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The challenge of shoulder pain.

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ABSTRACT

Shoulder pain (SP) constitutes a major medical, social, and economic challenge. 20% of the general population will suffer SP at least once in their lifetime. Many therapeutic techniques and modalities are used to treat SP. Rehabilitation practice should utilize a problem-oriented approach to direct treatment. However numerous factors make this difficult. Consequently the patient tends to return to the clinical practice complaining about persisting symptomatology. A review of the literature has revealed lack of evidence based work for the treatment of SP. This project has been conducted to address the issue of treating non-specific SP with the use of a new modality the HILT. 31 subjects suffering non-specific SP have taken part to this project. The participants have been treated with the HILT (Nd:YAG laser Hiro 3.0) device with the standard hand piece for the pain therapy, according to a specific protocol. The Visual Analogue Scale (VAS) pain score (climax of 10) was used to evaluate the subjective pain symptomatology prior and after the treatment application. The satisfaction index has also been evaluated at the end of the therapy. The mean values \pm SD have been used for the statistical analysis. The results revealed a great reduction of the subjective pain to all individuals. The level of satisfaction was also measured very high at the end of the treatment. The study has confirmed that the Hilterapia[®] has shown good results

regarding the improvement of SP and the level of patient satisfaction, when applied at individuals with non-specific SP.

INTRODUCTION

Shoulder pain (S.P.) constitutes a major medical, social, and economic challenge. S.P. is frequent in the general population and is the reason why many people are seeking medical care every year. It is second only to low back pain in patients attending the clinical practice for musculoskeletal (MSK) complaints in the primary care setting [1, 2, 3, 4].

S.P. is affecting 16%-21% of the population. The 1/5 of all disability payments for MSK disorders are for patients suffering shoulder dysfunctions [5]. An estimate of 20% of the general population will suffer S.P. at least once in their lifetime [6], when about 50% of the population has at least one episode of S.P. yearly. Its incidence may be estimated at about 70-260‰ in the general population [7, 8] A Norwegian survey revealed that 46% of the population had at least one episode within the year [9]. Another Norwegian survey resulted that the weekly or more frequent prevalence of shoulder-neck pain was 13% for men and 25% for women [10].

Regarding its prevalence, S.P. and impairment may influence self dependence.

Normal shoulder function requires an integrated motion created by the interaction of almost 30 muscles. The joint complex controlled by this musculature is comprised by three joints: the glenohumeral, the

scapulothoracic, and the acromioclavicular. Long outer muscles such as the deltoid move the upper extremity. The glenoid joint is stabilized by passive structures and the rotator cuff muscles. The later short muscles are the supra- and the infra-spinatus, teres minor and subscapularis, whose tendon comprises the rotator cuff. The subacromial bursa is located between the cuff, the coracoacromial ligament and the acromion [2, 11].

Compared with the hip joint, the cavity of the glenoid gives little support. The motion of the shoulder complex is greater than any other joint in human body [2].

The basic aetiologies for S.P. are ischaemia, degeneration, and acromial morphology. Pain may be caused by numerous factors:

- Degeneration of the Rotator Cuff due to tension overload and overuse (intrinsic impingement) [2],
- Encroachment of the subacromial contents (extrinsic impingement) [2],
- The potential mechanisms causing structural compression include dysfunctional glenohumeral and scapulothoracic kinematics, degeneration and inflammation of tendons and bursa, acromial morphology (flat, curved, hooked), postural dysfunctions of the upper quarter, weak or dysfunctional rotator cuff and scapular musculature, and capsular laxity or tightness. These mechanisms may occur individually or in combination [2, 3, 4, 5, 11].
- Work activities that entail using the arms overhead or working with hand loads, increase the risk of developing S.P. [2, 4, 5, 11, 12].

Pain may be elicited from different tissues such as tendon bursa, ligament and muscle. Shoulder function may be altered by pain, structural abnormality or by fear of pain. Free nerve endings containing substance "P" and calcitonin-gene-related peptides and mechanoreceptors, have been identified in subacromial bursa and are being blamed as source of subacromial pain [2, 3, 4]. Disorders are classified by pathological process (tendonitis, tendinosis, rapture),

by anatomical localization (rotator cuff disease, subacromial pain syndrome), by mechanism (impingement syndrome) and by aetiology (work related shoulder pain, repetitive strain syndrome) [1, 2, 3].

In the literature there have been identified numerous diagnoses to justify shoulder pain: adhesive capsulitis, sympathetic dystrophy or shoulder-hand syndrome, osteoarthritis, glenohumeral arthritis, subacromial pain (impingement syndrome), acute tendonitis / bursitis, tendinosis / chronic subacromial pain, rotator cuff tears, instability, S.P. after stroke, Thoracic outlet syndrome, and non-specific shoulder pain, are only a few among the existing diagnoses to explain S.P. and pathology [2, 3].

Many diagnostic tools have been developed to lead to the most precise diagnosis for S.Ds. MRI, X-Ray, 3D CT scan, physical examination; thorough history and symptoms assessment are commonly used in the clinical practice.

Shoulder pain causes disability, complaints, lower quality of life, absenteeism and sickleave, and a major factor of money-loss for the healthcare system, the employer and the patient. It also has psychological effects, causing cognitive and behavioral dysfunction.

Many therapeutic techniques and numerous modalities are used to treat S.P.. These include: therapeutic exercise, manual therapy, mobilization, manipulation, thermotherapy, massage, electrical stimulation, shockwave therapy, therapeutic U/S, mechanical traction, electrotherapy, low level laser and acupuncture, regarding the physiotherapeutic management. Other approaches consist of the use of NSAIDs and steroid injections. Of course there are also invasive surgical interventions that are usually used to fix the cause of the disorder or to alleviate pain symptoms and restore joint ROM [13].

Rehabilitation practice should utilize a problem-oriented approach to direct treatment. That is, specific problems should be identified for each patient individually and the treatment should be developed to address these problems.

However numerous factors make it difficult if not impossible to utilize a problem-oriented approach:

- Generalized treatments are often applied universally to patients with various problems. This may confound the ability to determine treatment efficacy.
- Furthermore, it is often not clear if the interventions studied are evidence-based themselves.
- Also confounding is the fact that there exist many different operational definitions to describe a certain condition, which may mislead the rehabilitation professional.
- The lack of consistent terminology may also reflect the uncertain relationship between S.P., radiological and histopathological findings.
- Most of the times, the diagnosis is rather conflicting and consequently the therapeutic modalities are unable to focus on the core of the problem to resolve pain symptoms [2, 4].

Consequently the patient tends to return to the clinical practice complaining about its persisting symptomatology. At the basis of this argument, this paper has been conducted as a descriptive observational study, to discuss the problem of patients experiencing S.P., who tend to visit several different rehabilitation practices complaining about non-alleviated S.P. These patients have often used every diagnostic assessment tool and have been treated with every available modality; however they seem to experience persistent S.P. They usually appear to the clinical practice experiencing pain, stiffness, reduced ROM, but also psychological problems and distress. The pain problem has been identified as a multifactor issue and as that it is going to be addressed.

A review of the literature has revealed a lack of evidence based work for the treatment of S.P. [14]. However it seems that there is a ray of light coming from a new modality, the High Intensity Laser Therapy (HILT). The Low Level Laser Therapy (LLLT) is already known. Theoretically laser energy

is transmitted to induce cell proliferation. Although current evidence is conflicting, it appears LLLT is beneficial regarding pain and disability when applied as a single intervention for patients with S.P. Current studies support that LLLT was effective in pain relief and improvement of functional ability among patients with shoulder-neck pain [15].

Basford et al. [16] have also concluded that the modality had also shown effectiveness regarding the perception benefit and level of function in patients suffering MSK back pain.

It has also been highlighted that Laser improves topical blood circulation which seems to be an issue regarding shoulder pain. Two different studies [17, 18] have addressed the issue of the changes in blood flow and EMG in chronic shoulder-neck pain due to trapezius myalgia. They both concluded that MSK pain increases the transmitter activity of neuropeptides causing impairment of the blood flow in the muscle.

Recently it has been shown that overhead static use of the shoulder especially with the hand loaded with up to two Kg of weight, alters the EMG activity of upper trapezius and anterior deltoid shoulder muscles, leading to impairment of the blood flow and resulting in pain and chronic MSK complaints around the shoulder area [12]. Little research has been conducted to address the issue of treating MSK S.P. and dysfunction with the use of HILT. What makes HILT a promising modality is the ability of the higher energy luminous radiation to be transferred to the deepest layers of the tissue without releasing too much energy to the superficial musculature. Another positive is that the light is transmitted through pulses instead of a continuous way. There is some scientific evidence showing that on a cellular level the bio-stimulating effect activates some enzymes, increasing the production of nucleic acids and proteins, but also the metabolic exchanges, potentially leading to reduction of inflammation fluids, edema

and pain. Much work has been published to address the issue of impaired blood flow of the painful shoulder. The HILT through its photothermal effect, causes a controlled increase of the tissue temperature, activates circulation stimulation and a correlated increase of oxygen supply to the suffering structures [19].

MATERIALS AND METHODS

Patients

31 subjects suffering non-specific shoulder pain have taken part to this project. The sample used was constituted by 15 male and 16 female participants, aged between 25 and 65 (mean age 49 years). All patients have suffered shoulder pain for at least one year, and have taken no specific diagnosis, however the clinical or radiological testing. They all have visited at least one physician or special physical therapist in the past year without alleviating results. All the patients attended the clinical practice of the diagnostic and therapeutic centre of Athens "Hygeia" because of their problem and have been asked to participate to this project by the leading head of the department. The later, Dr. of physical medicine and rehabilitation obtained an informed consent by each individual participating to the project, prior to its initiating. It should also be mentioned that all participants were Caucasian. Before the project initiated the physician of the department has taken a thorough history and has completed a clinical examination of every individual. The hall project and data collection have taken place at the "Hygeia" hospital during a 12 months period between October 2007 and October 2008.

Exclusion Criteria

A potential participant would be excluded if they had a tumor, or any neoplastic disease diagnosed in the past. They would also not be allowed to participate if they were under NSAIDs or heavy analgesic treatment for the past 2 weeks. Non compliant patient

(cognitive and behavioral impairment), patients with psychiatric history, and patients with a very recent unhealed fracture, individuals with rheumatic or other inflammatory diseases, were also considered as reasons for exclusion from the project.

with the standard hand piece for the pain therapy. The protocol used was selected by the physician and the physical therapist that was conducting the study and was modified according to the painful symptoms of each patient. This protocol is being described at the following table.

PHASE	SUBPHASE	FLUENCE mJ\cm ²	FREQUENCY	MODE	TOTAL ENERGY
Initial	Step 1: 500J Step 2: 500J Step 3: 500J	810 970 1070	Level 10 Level 9 Level 8	Fast Fast Fast	1500 J
Intermediate	Step 1 Step 2 Step 3 Step 4 {The points were selected according to each patient's painful areas}	810 970 1070 810	Level 4 Level 4 Level 3 Level 5	Static	Depended on the points treated at each step
Final	Step 1: 500J Step 2: 500J Step 3: 500J	810 910 1070	Level 11 Level 10 Level 9	Slow Slow Slow	1500 J

Table I: HILTERAPIA® PROTOCOL. The parameters used to treat shoulder pain (J: Joule, MJ: Millijoule, CM: centimeter).

Treatment

All patients have undergone a specific rehabilitation program aimed at alleviating their pain symptoms and restore their movement. The participants have been treated with the HILT according to a specific protocol, and have also participated to an individualized kinesitherapeutic program aimed at restoring the joint range of movement (ROM) and muscular strength.

Measurement Tools

The Visual Analogue Scale (VAS) pain score (climax of 10) was used to evaluate the subjective pain symptomatology prior and after the treatment application. The satisfaction index has also been evaluated at the end of the therapy. All patients have been asked to subjectively evaluate their level of satisfaction (very satisfied, satisfied, little satisfied, or not satisfied) after the application of the therapeutic program.

Methodology

In the present study each patient has been treated using the Hilterapia® pulsed Nd:YAG laser Hiro 3.0 device (ASA S.r.l., Vicenza, Italy) (peak power 3000W)

Because this project has been conducted as a descriptive observational study, a randomization of the participants to more than a single group of therapy has not taken place. Instead, there was a single group of patients, undergone the same therapeutic program. Before each therapeutic session all participants were being asked to complete the VAS. After the last session the individuals answered the subjective level of satisfaction test. Treatments were administered every day for the first week and every second day for the following 2 weeks for a total of 10 sessions. The kinesiotherapeutic protocol included active and passive mobilization exercises of the shoulder girdle, kinesthetic exercises of the shoulder, light resistance exercises of the arm, ROM exercises and proprioceptive exercises for 15 minutes. All 31 patients who have been found to fulfill the inclusion criteria to participate to the study have finished all the 10 physiotherapy sessions without any dropouts.

Data Analysis

The data obtained have been analyzed using Office 2007 Excel software (Microsoft Windows®). The mean values ±SD have been used for the statistical analysis rather than another more complicated statistical test, as this project purported to show any difference from the use of a new modality. The level of significance for the data obtained has not been identified.

RESULTS

After treating all the 31 patients, with 10 sessions of HILT the following results were found:

The mean values by which the individuals described their pain through the VAS before and after the treatment were as follows: before the treatment the mean value of pain was 8.1 ±0.96 and after the treatment application that was formed at 3.9 ±1.07; the average variation was of 4.2 (figure 1).

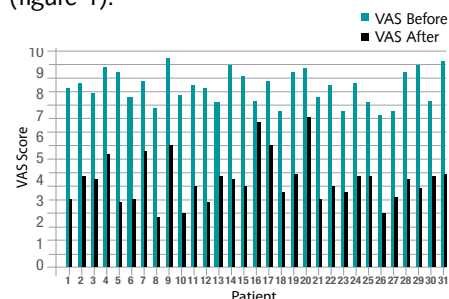


FIGURE 1: Pain Level, in each patient, before and after the entire treatment with the Hilterapia®.

The Mean VAS scores for all participants before and after the application of the hall treatment program have shown an

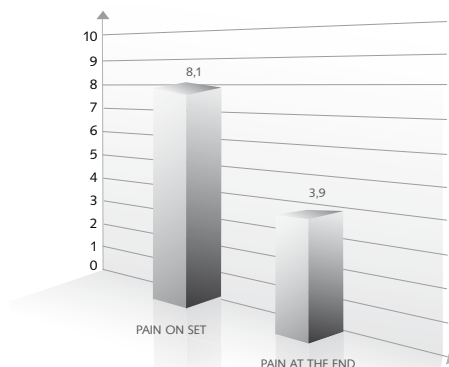


FIGURE 2: VAS score mean values before and after the treatment application

average decrease of 4.2 points on the 10 points climax of the VAS regarding pain perception. This can be easier understood by studying Figure 2 which is exposed below.

The level of satisfaction as a subjective measure of how did the patients evaluated their treatment was as follows: the 68% (21 patients) answered that they were very satisfied with the results of the treatment regarding pain levels. The 26% (8 patients) answered that they were satisfied with the results. Only the 6% of the individuals (2 patients) answered that they were little satisfied by the application of the treatment modality. 0% answered that they were not satisfied by the treatment (Figure 3).

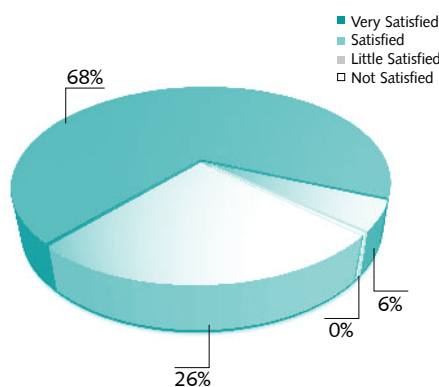


FIGURE 3: The satisfaction index at the end of the treatment.

DISCUSSION

This project has been conducted to address the issue of treating non-specific shoulder pain with the use of a new modality, the HILT. To the authors' knowledge and according to an extensive literature review, there have been no other scientific works conducted around this knowledge area. That makes this study the first to approach this specific issue which seems to be relevant regarding the everyday clinical practice.

According to previous research, the HILT seems to have good effects on pain, inflammation and edema regarding many musculoskeletal disorders [19, 20, 21, 22]. It seems that the high intensity pulsed light has an effect on the microcirculation of the region to which it is applied. The impairment of the microcirculation seems

to be an issue regarding the painful shoulder as has been demonstrated by recent studies [12, 17, 18]. Its topical thermal effects and the concentration of blood supplies seem to improve the healing processes. This fact also helps to decrease the inflammation fluids that tend to take part in a painful process at the shoulder area. The ability of the higher energy luminous radiation to be transferred to the deepest layers of the tissue without releasing too much energy to the superficial muscles seems to be another good effect regarding the painful shoulder, as that is covered by several muscle layers [19].

At this study the authors have tried to reveal any effects of the HILT on the shoulder area of individuals with non-specified, multi-diagnosed shoulder pain. As that consists a preliminary descriptive study, the writers should recognize that the statistics were not the most suitable to reveal any statistically significant effect by the use of the modality on the results of the measurement tools on the individuals' perception of pain and satisfaction. However, that could form the basis for more research to be conducted on that field of science. We also recognize that more appropriate tools could be used to obtain more measures about the healing processes taking part at the shoulder area when applying the HILT. However, that project took place as an observational procedure during everyday clinical practice, in order to form a preliminary idea of how that modality may or may not work on patients. We should not forget to mention that we were referring to patients that have been treated in the past with all available techniques and modalities and have not reached pain relief. That makes the results of this preliminary observational study rather important.

All in all, the results of this project showed an improvement regarding pain and level of satisfaction of all 31 patients that have been treated with the HILT. It is assumed that a larger sample of patients and also a follow up procedure would be more appropriate to scientifically research this specific issue.

CONCLUSIONS

This preliminary observational study has confirmed that the Hilterapia® has shown good results regarding the improvement of shoulder pain when applied at individuals with non-specific SP. It has also shown good results regarding the objective perception of the level of patient satisfaction, regarding patients that have used all other kinds of treatment without improvement. Although it appears that there are issues that lower the external validity and reliability of our results, it seems that this study could form the basis for more research to be conducted on this challenging scientific domain.

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