

GUIDANCE TOPIC

DIAGNOSIS AND THERAPY OF MYOFASCIAL PAIN SYNDROME WITH FOCUSED SHOCK WAVES (ESWT)

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Zusammenfassung

Myofasziale Triggerpunkte (MTrP) der Skelettmuskulatur sind eine häufig unterschätzte Ursache von akuten und chronischen Schmerzen des Bewegungsapparates. Die Muskulatur ist neuerdings ein Behandlungsgebiet für den Einsatz von radialen Druckwellen und der fokussierten Stoßwelle (ESWT) zusätzlich zu den bisher etablierten Diagnosen (Fasziitis plantaris, Tendinosis calcarea, etc.). Im Gegensatz zu oberflächlich wirksamen radialen Druckwellen ist mittels der fokussierten Stoßwelle eine direkte MTrP-Behandlung möglich. Die wichtigen MTrP-spezifischen Diagnosekriterien "Wiedererkennung des Schmerzes" und "Übertragungsschmerz" werden durch die punktgenaue am biologischen Feedback orientierte fokussierte ESWT-Ankoppelung ausgelöst, und eine exakte MTrP-Therapie erzielt. In der vorliegenden Arbeit wird eine prospektive Pilotstudie vorgestellt, in der der Effekt der fokussierten ESWT sowohl hinsichtlich der Bestätigung der diagnostischen Kriterien als auch des Therapieerfolges (Schmerzreduktion) untersucht wurde. Die Schmerzreduktion wurde mittels der VAS vor und 3 Monate nach der Behandlung gemessen. In 95% der Fälle konnten die o.g. Diagnosekriterien durch punktgenaue Applikation der fokussierten ESWT festgestellt werden. Die Untersuchung ergab, dass der Einsatz der fokussierten ESWT die Diagnostik von myofaszialen Triggerpunkten deutlich verbessert und einen sehr guten Behandlungserfolg erzielt.

Schlüsselwörter

Triggerpunkte, Myofasziale Schmerzen, fokussierte Stoßwelle, ESWT.

Summary

Myofascial Trigger Points (MTrP) in skeletal muscle are often an underestimated reason for acute and chronic pain in the musculo-skeletal system. The musculature is a relatively new field for the use of radial pressure waves and focused extracorporeal shock waves (ESWT) in addition to the established diagnosis of Plantar Fasciitis, calcified Tendonitis, etc. With radial pressure waves only superficial tissue can be reached whereas with focused ESWT direct treatment of MTrPs in the deeper tissue is possible.

The important and specific MTrP's diagnostic criteria "recognition" and "referred pain" are elicited by the accurate application of focused ESWT which is orientated on biological feedback and in this way an exact MTrP treatment is achieved. In this paper a prospective pilot trial is presented, that shows the effect of focused ESWT and the success of treatment (reduction of pain) as well as the confirmation of the diagnostic criteria. Pain reduction was measured by VAS before treatment and 3 months after the start of the treatment. In 95% cases the above mentioned diagnostic criteria were observed. This study confirmed that focused ESWT improves the diagnosis of MTrP at a high success rate.

Keywords

trigger point, myofascial pain, focused shock wave, ESWT.

Introduction

Focused shock waves have become established in orthopaedics as a standard procedure in the treatment of many conditions such as epicondylopathy, tendinosis calcarea, achillodynia, plantar fasciitis etc. (1-6). In recent years, it has become apparent that the effects of ESWT take place less at a physical-mechanical level and more at the molecular-biological and cellular level (7-12). Basic studies have demonstrated various effects in tissue treated with ESWT: These include neovascularisation, specific stimulation of bone growth, resorption of calcific deposits, alleviation of pain among other things due to the permanent suppression of the production of substance P, to name but a few (13-16).

In the early years of ESWT in orthopaedic disease, therapy was performed mainly in the region of bone and the bony tendon attachments as well as in the treatment of calcific structures (17-20). More recent publications indicate a tendency towards orientation on the point of pain based on biological feedback from the patient both in terms of the localisation and the point of maximum sensitivity (21-22). An expansion of the indications for focused shock waves is the treatment of the musculature and this has become a major area of interest particularly with regard to the therapy of myofascial trigger points or MTrPs (23).

Principles of Shock Wave Generation

Focused shock waves of the ESWT devices generate shock waves according to three different principles. The oldest method is the electrohydraulic spark gap principle with which the first extracorporeal stone fragmentation was achieved. Later, electromagnetic and piezoelectric methods of shock wave generation were developed. The focused shock wave of ESWT is a special acoustic pressure wave characterised by a high positive amplitude with an abrupt rise and a short pulse duration. Using shock waves generated extracorporeally allows non-invasive coupling of therapeuti-

cally effective energy into the body over a large surface area of the skin. This is then focused accurately in the precisely delineated therapy focus (therapy zone) in deeper lying tissue without any detrimental effects to the surface of the skin or surface tissue. No unwanted side-effects have yet been observed when using low-energy ESWT (24).

periented examiner can identify MTrPs clinically with certainty (29-31). MTrPs are a muscular dysfunction at the level of the motor end-plate and the sarcoplasmic reticula that, in turn, cause a local contraction with ischaemia-induced hypoxia. Along with the hypoxia, the resulting energy crisis leads to a sensiti-

Table 1: Diagnostic criteria of myofascial pain syndrome acc. to TRAVELL / SIMONS

1. Taut band
2. Tender nodule on the taut band with increased pain on pressure
3. Pain recognition
4. Referred pain
5. Local twitch

In contrast to the focused shock wave, the ballistic pressure wave (also known as a radial shock wave) produces its effects due to the impact pulse of a projectile propelled by compressed air against an applicator applied directly to the skin. A coupling medium, usually ultrasound gel, helps to propagate the pressure wave divergently (unfocused) in the tissue. The highest pressure and energy values are achieved at the point of application on the skin. The energy density and the pressure reduce quickly with the cube of the depth of penetration so that even at a depth of 5-10 millimetres within the tissue it is practically undetectable (25, 26).

Myofascial Trigger Point (MTrP) Therapy According to TRAVELL / SIMONS

MTrPs can imitate all types of neurological and orthopaedic conditions as well as symptoms of joint dysfunction (27). Myofascial pain syndrome can be accurately diagnosed based on the diagnostic criteria listed in Table 1 (28). The ex-

periented examiner can identify MTrPs clinically with certainty (29-31). MTrPs are a muscular dysfunction at the level of the motor end-plate and the sarcoplasmic reticula that, in turn, cause a local contraction with ischaemia-induced hypoxia. Along with the hypoxia, the resulting energy crisis leads to a sensitisation of the surrounding nociceptors (32). A suitable therapeutic procedure for the treatment of MTrPs must break this vicious circle by stopping the contraction and eliminating the energy crisis (32, 33). According to the principles of myofascial trigger points introduced by Travell / Simons more than 50 years ago and the definition of myofascial pain syndrome, precise and specific procedures are necessary in both diagnostics and treatment (28). In particular, the diagnostic criteria referred pain and pain recognition are signposts both for the classification of MTrPs in the mechanism of pain as well as for their precise treatment. Accurate treatment has proved to be the most effective method with chronic myofascial pain (34-35). Put simply, the therapeutic procedures used up to now in the treatment of myofascial pain syndrome were based on releasing the MTrPs using reflex techniques or mechanical release (23, 28).

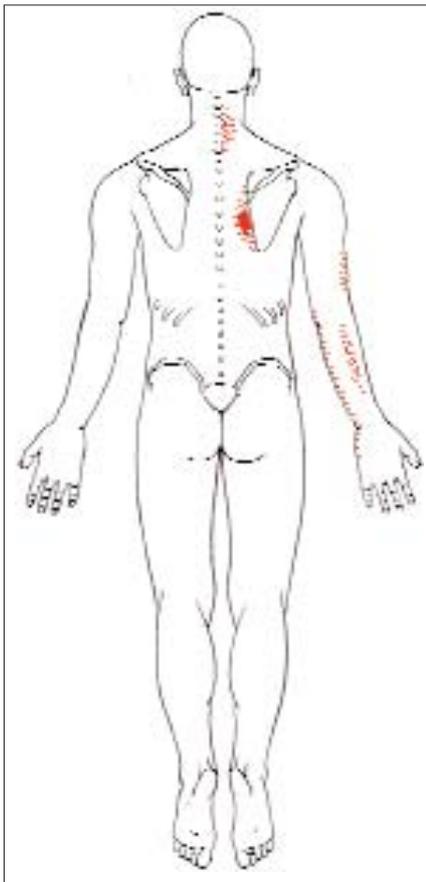


Figure 1: Referred pain region - rhomboid muscles (from "Triggerpunkt-Therapie", Verlag Hans Huber)

Clinical Application of Focused ESWT on MTrPs

Following thorough anamnesis and a preliminary palpatory trigger point examination, the myofascial trigger point (MTrP) in the muscle structure is brought into focus precisely by selecting the required height of the coupling membrane (MTrP). Precise localisation of the depth is possible only with deep palpation and this should first be learned in special courses.

Following the principle of biological feedback, the extremely accurate pulse of the focused ESWT is used to treat the MTrP precisely based on the diagnostic criteria of pain recognition and referred pain. This confirms the clinical diagnosis and expands it with a reproducible procedure using technical apparatus.

Clinical experience confirms the theoretical concept that MTrPs represent extremely small sensitive structures in the musculature that must be targeted precisely with the accurate application of energy. Whenever necessary, the trigger point is readjusted during treatment based on the feedback from the patient. In such applications of ESWT, the energy density (ED) always remains within the low energy range (ED: 0.0 - 0.28 mJ/mm²). In the low energy range, piezoelectric systems allow high repetition accuracy and good dosability (7). This is a great advantage for precise therapy of MTrPs because treatment is possible only in the low to very low energy ranges due to the increased sensitivity.

Focused ESWT in Orthopaedic Conditions - Results of a Prospective Pilot Study

Patients

During the period from November 2004 to January 2005, 30 patients with a variety of orthopaedic conditions and myofascial pain components (trigger points) were treated with focused ESWT targeting diagnosed MTrPs. Based on differential diagnostics, serious diseases (malignancies, infectious inflammation, nerve compression syndrome etc.) were excluded. The sex ratio (f:m) was 21:9, the average age was 53.1 years (range: 17-78). The degree of chronicity was established according to the categories used by Gerbershagen (Table 2). Interruption of treatment after less than 2 treatment sessions (for example, therapeutic success after one session or non-appearance of the patient for follow-up treatment) was specified as an exclusion criterion. Most of the diagnoses made by physicians treating the patient prior to ourselves are listed in Table 3, multiple diagnoses were possible.

Method

Focused shock wave therapy was performed with the PiezoSon 100 plus piezoelectric device from Wolf, Knittlingen, Germany. The focus depth was set using a suitable sized coupling membrane following trigger point palpation by an experienced physician (trigger point therapist IMTT®). After applying ultrasound gel, treatment of the MTrPs was performed with focused ESWT based on biological feedback oriented constantly on the recognition of the pain and the referred pain. The information

from the patient is used both to readjust (to target the MTrP exactly) as well as to find the maximum tolerable intensity of the energy density. The energy density used was

Table 2: Stages of chronicity according to Gerbershagen

Stage I	n = 1
Stage II	n = 24
Stage III	n = 5

Table 3: Diagnoses

Cervical spine syndrome	13
Lumber spine syndrome	11
Hypomobility of the sacrum / sacro-iliac joint	7
Impingement syndrome	8
Fasciitisplantaris	4
Coxarthrosis	3
Gonarthrosis	2
Epicondylitis radialis humeri	2
Intercostal neuralgia	1
CTS	1

in the low energy range between the 5 levels below 0.04 mJ/mm² to a maximum 0.26 mJ/mm² (maximum value once in one session with one patient). The ability to use the piezoelectric device with great accuracy at lower energy levels proved to be an advantage particularly at the beginning of the treatment when the MTrPs are very sensitive during focused ESWT application. Therapy was performed at a pulserate of 800-1000/MTrP and a pulse frequency of 6 Hz. On average, 7.3 therapeutic sessions (range 2 -16, mean 7) were necessary, once or twice a week. Ear and head acupuncture was used as adjuvant therapy. As a dependent variable, the pain was



Figure 2 (top left): Focused ESWT on TrP in biceps muscle

Figure 3 (top right): Focused ESWT on TrP in rhomboid muscle

measured according to the visual analog scale (VAS) prior to therapy and 3 months after commencement of therapy (Figure 1). In addition to this, the pain recognition and referred pain diagnostic criteria indicated by the patients as being triggered by the focused ESWT were recorded and evaluated statistically (Figures 2 and 3). To test the statistical differences between measurement prior to therapy and 3 months after therapy, we performed the t test. The significance level was specified as $p < .05$.

Results

All 30 patients were reexamined following treatment. The pain

level at rest dropped from an average initial value of VAS 3.6 prior to therapy to 1.7 after 3 months. During activity, the mean patient VAS of 7.4 prior to commencement of therapy and 3.4 after 3 months was recorded. The difference between the results prior to therapy and after 3 months were highly significant both at rest and during activity ($p < .001$). The MTrP diagnostic criteria of recognition of pain and referred pain could be established by focused ESWT in 95% of patients. In one patient, no recognition and in another patient no referred pain could be established.

Discussion

The previous technological methods of diagnosis available in every day clinical practice were not adequately suited to detect MTrPs (36). This prospective study showed that focused ESWT as a technological diagnostic procedure was able to establish the diagnostic criteria of recognition of pain and referred pain relevant for myofascial trigger points in 95% of patients with MTrPs. Focused ESWT confirms the clinical diagnosis and expands it with a reproducible procedure using technical apparatus. The exact mechanisms involved in ESWT have been the subject of basic research in recent

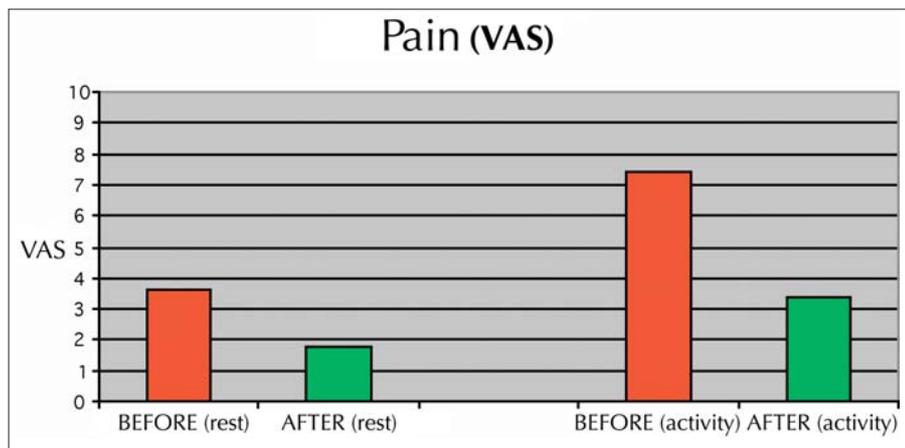


Figure 4: Pain prior to therapy and 3 months after therapy

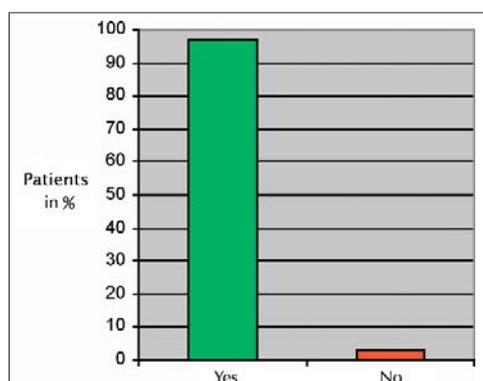


Figure 5: Recognition of pain

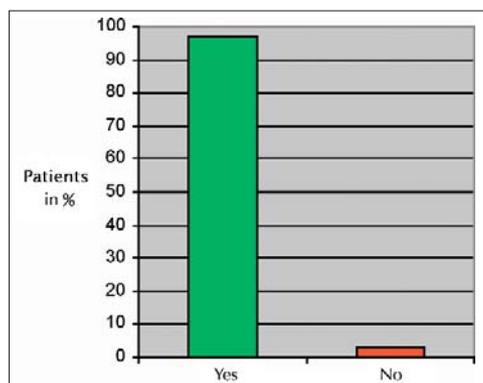


Figure 6: Referred pain

years. Apart from the effects of the mechanical pulse, the therapeutic effects that arise following the ESWT applications are the main benefits described in the discussions of focused shock waves (10-12). We do not have any data available on the specific effects on muscle tissue, it can, however, be assumed that the effects are simi-

lar to those in the types of tissue that have been examined up to now. Here, the effects of pain reduction and neovascularisation, in particular, must be mentioned since there are direct parallels with the pathogenetic mechanisms of MTrPs. In this respect, it can be assumed that the vicious circle of local contraction, ischaemia and pain is broken by precisely focused ESWT (16, 33). A reduction of non-myelinated nerve fibres as found by Maier et al. cannot be expected at the low to very low energy levels (16). A positive effect of ESWT in the sense of a reorganisation of pain memory has also been discussed (9). Apart from the surface effects, there are no descriptions of the effects of the radial pressure wave. An unspecific stimulation similar to that of a good massage is conceivable by reaching the upper skin layers and achieving a reflex effect. David G. Simons coined the term "surgeons of muscles" and meant the systematic and precise use of specific and accurate therapeutic procedures to diagnose and treat myofascial pain syndrome. With focused ESWT, we have a technological

procedure available with which MTrPs can be diagnosed and treated accurately and specifically.

Conclusions

- Focused ESWT is well suited for the diagnosis and treatment of myofascial pain in orthopaedic conditions.
- Basic studies researching the use of the effects of ESWT in muscle tissue and especially on MTrPs are necessary.
- Further controlled clinical studies that integrate myofascial trigger point therapy in the treatment concept of orthopaedic disease are necessary.

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