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Effectiveness of Cold–heat Contrast and Local Compression Therapy Device in Physiotherapy for the Patients with Latent Myofascial Trigger Points

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Introduction

Myofascial trigger points (TPs) are forming in the tired (usually skeletal) muscles triggering discomfort and pain [1] and represent a major cause of sustained pain, as well as muscular, nervous system, and soft tissue dysfunction. Extensive research and experimental results show that all chronic pain conditions produce trigger points. They are extremely common and become a distressing part of nearly everyone's life at some time. Latent TPs, which may cause some stiffness and restricted range of motion, are far more common than the active TPs. In general myofascial trigger points represent small areas of tightness within muscles, creating tight bands and "knots" or tiny bumps from the contracted muscle fibers. It's a sensitive spot in a taut band of a skeletal muscle that is painful on compression and/or stretch and that can give rise to a typical referred pain pattern. The most effective methods of treatment of trigger points involve local ischemic compression and cold or heat applications [2]. Application of separate heat and cold agents are widely discussed in scientific literature. The decrease of tissue temperature produced by cold agent may directly reduce the sensation of pain. Applying cold for 10 – 15 minutes one can control pain for 1 or more hours. Effects of cold involve initial decrease and later increase in blood flow, decrease nerve conductivity, increase pain threshold, alter muscle strength, decrease spasticity, facilitation of muscle contraction. Cold has been demonstrated to be effective in the treatment of myofascial pain [3]. Its analgesic effect is probably one of its greatest benefits with ability to reduce muscle spasm [4]. Within rehabilitation, heat is used primarily to control pain, increase soft tissue extensibility, increase circulation and accelerate healing. Heat has these therapeutic effects due to its influence on hemodynamic, neuromuscular, and metabolic processes [5]. Local superficial heating is recommended in subacute conditions for reducing pain and inflammation through analgesic effects. Superficial heating produces lower tissue temperatures in the site of the pathology relative to the higher temperatures in the superficial tissues, resulting analgesia. Heat dilates blood vessels, causing the patient capillaries to open up and increase circulation [4]. The rate of metabolism of tissues depends partly on temperature. The metabolic rate was found to be increased approximately 13% for each 1ºC increase in temperature [6]. A lot of devices are used in physiotherapy in order to treat tender points in the muscles and to reestablish normal muscle function. Acupuncture, dry needling and injection into trigger points, laser and magnetic treatment, micro-currents, ultrasound and hydrotherapy devices are available on the market. A unique device (patent number A61F 7/00) [7], originally constructed in Kaunas University of Technology, Institute of Physical Electronics includes the main physical agents (compression and cold and heat) needed for the treatment of trigger points. The main task of the current research is to assess effectiveness of the cold-heat contrast and local compression therapy device in the treatment of latent myofascial trigger points.

Technical details of the cold – heat contrast and local compression therapy device

The device used in this research consists of a controller and thermoelectric module with integrated force measurement module (TEFM) (Fig. 1).

The basis of controller is a microprocessor pic 16f628 with a program. According to written control protocols and in association with the data input device („rotary encoder"), LCD indicator and analogue – code converter controls the thermoelectric and compression force measurement module (TEFM) (Fig. 2).

Fig. 1. View of the cold – heat contrast and local compression therapy device

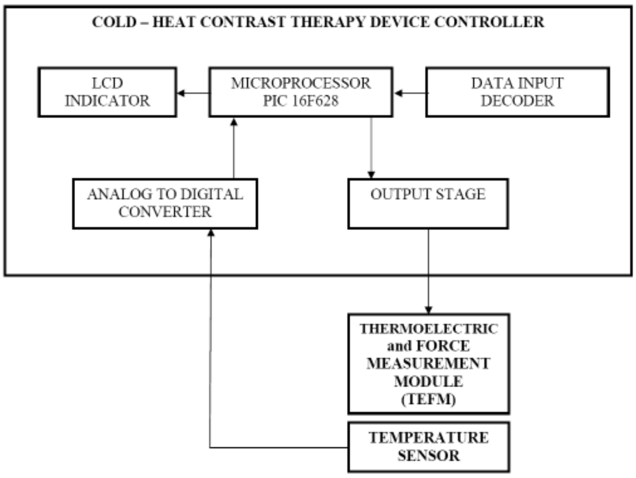

Fig. 2. The principle scheme of the cold – heat contrast and local compression therapy device [8]

Depending on the direction of the current flow, the thermoelectric and force measurement module (TEFM) will either absorb or release the heat. Depending on the difference of the current and temperature of the thermoelectric module to be reached, voltage of the necessary direction and value for the thermoelectric module are selected. The contact surface of the thermoelectric module is a 10 mm diameter rounded edged copper „finger", which can be cooled down to -20 ºC and can be heated up to +50ºC. The resolution of temperature is 0.5 °C, maximum temperature ramp rate is 40 °C/min. It is in contact with a Peltier element and transmits heat directly to the skin. The integrated compression force measurement unit consists of 3 tensoresistive sensors placed on the metal frame. Applied manual pressure force is deforming the frame with tensoresistive sensors. The produced voltage from the tensoresistive sensors goes to the microprocessor, which calculates magnitude of the force and displays it on the LCD indicator. Range of force measurement is between 9.8 and 98 N. The compression force measurement provides a feedback about the applied force to the human body and allows one to quantify this therapeutic agent. The local compression with a copper "finger" and cold-heat contrast can be used simultaneously for the maximum effectiveness of the treatment.

Patients and treatment methods

The volunteers (N = 37) were recruited for this research. The age of selected subjects varied from 21 to 63 years (mean 33.4 years, SD = 4.0, M = 13, F = 24) Including criterion for the current research was more than 4 hours per day spent working on a computer and felt pain and/or discomfort in the neck and shoulder area. Research was done in February – April of 2007. The average amount of hours per day spent on the computer was 6.5 ± 09. The felt pain and/or discomfort were assessed by asking persons to point or circle the pain area in the pain drawing of the picture of human in the anatomic position [9]. The patients were asked to mark pain intensity in the VAS (visual analogue scale) in the questionnaire. Part of the Functional Rating Index (FRI) questionnaire was used for measuring influence of pain on sleeping, traveling (driving etc.), working, recreation and frequency of pain [10]. The painful points (myofascial trigger points) were assessed by the Wagner instruments Pain Test algometer FPN - 100 - the diagnostic tool for measuring pain caused by pressure. Each point was pressed with the 50 N/cm^2 force and the patient was asked to evaluate felt pain in 10 score system (0 stands for "no pain", 10 – "severe pain"in visual analogue scale (VAS)). The most common, standard locations of the trigger points in the upper part of the body were tested according to the Travell and Simons' topographical charts [3]. After the initial investigation, the patients were divided into 3 groups: 15 patients were asked to do stretching exercises individually 3 times per day for 6 weeks according to the given exercise program; 10 patients had 10 procedures of the cold-heat contrast and local compression therapy and 12 patients were in a control group (recommendations were given after the experiment). The procedures of cold-heat contrast and local compression therapy were given simultaneously with the intermittent compression for 70 s at -10 ºC (cooling stage) and for 90 s of +45.2ºC (heating stage) of each trigger point. After 6 weeks of the application of stretching exercises and cold-heat contrast and local compression therapy we have reevaluated the state of patients. The control group was reevaluated after 6 weeks too.

Results

Measurement of pain

The mean of the initial pain in myofascial trigger points in all 3 groups was similar (no significant difference) and varied from 1.8 to 8.4 score. We can state that the groups were homogeneous according to the baseline of suffered pain. The changes of myofascial trigger point's pain before and after the application of stretching exercises, cold-heat contrast and local compression therapy and in the control group are presented in Fig. 3.

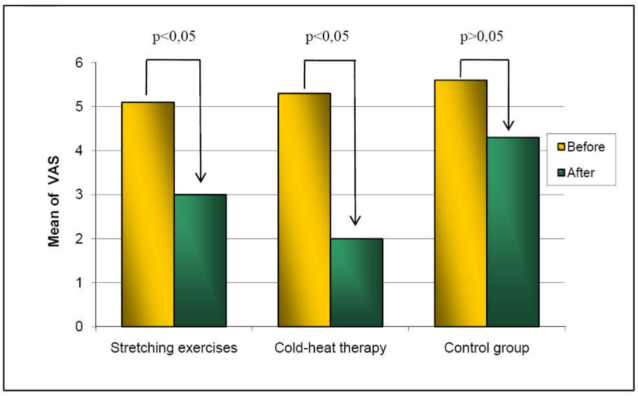

Fig. 3. The total changes of myofascial trigger point's pain (VAS) before and after the application of stretching exercises, cold-heat contrast and local compression therapy and in the control group

Effects of the stretching exercises

After 6 weeks of individually done stretching exercises for head and shoulder muscles 28.6% of patients reported absence of pain, 50% had less pain, in 14.3% pain stayed at the same level and 7.1% reported increased pain. The main reason of increased pain was sustained work on the computer and not enough frequent done stretching exercises. In 31.3% of found myofascial trigger points, the pain was statistically significant decreased ($p<0.05$) (Fig. 4)

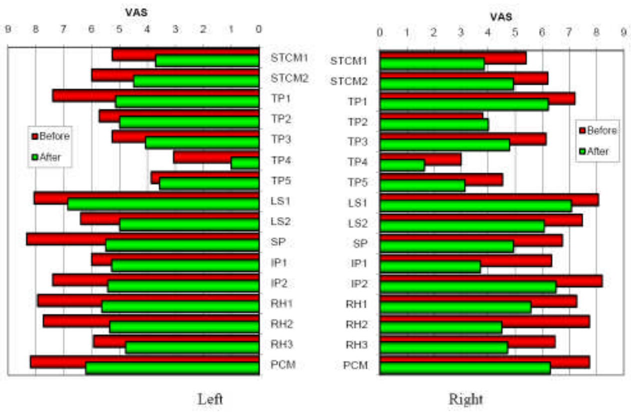

Fig. 4. The level of myofascial trigger points pain (VAS) before and after the application of stretching exercises

Effects of the cold-heat contrast and local compression therapy

After the session of 10 procedures during 6 weeks, 25% of patients reported absence of pain and 75% claimed that pain was significantly reduced by the cold-heat contrast and local compression therapy. Self reported pain, measured in VAS (visual analogue scale) in the initial testing varied from 4 to 8 score, while after the cold-heat contrast and local compression therapy the score was from 0 to 4. The most noticeable effect of therapy was observed in reducing measured pain of myofascial trigger points. Reduced pain was observed in 81.3% of trigger points ($p<0.05$) (Fig. 5).

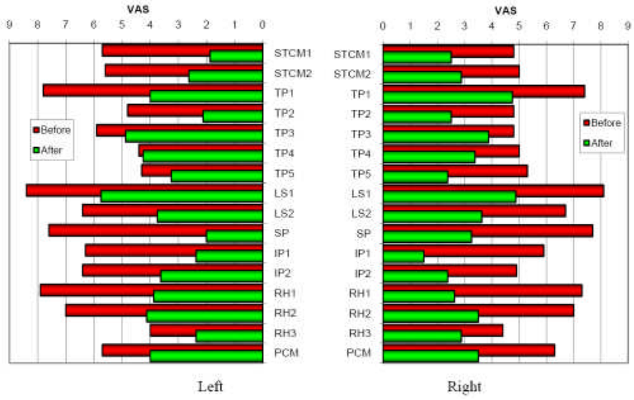

Fig. 5. The level of myofascial trigger points pain before and after the application of cold-heat contrast and local compression therapy

Control group

70% of patients in the control group reported the same level of pain in trigger points after 6 weeks. For 20% of patients the pain increased and in for 10% - decreased. The main reason of decreased pain was a start of doing physical exercises individually. The measured pain of myofascial trigger points increased after 6 weeks period (21.9% statistically significant, ($p<0.05$)) (Fig. 6).

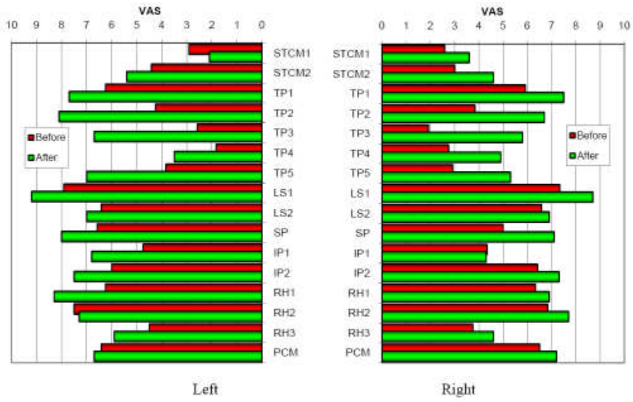

Fig. 6. The level of myofascial trigger points pain before and after 6 weeks in the control group

Conclusions

The stretching exercises and cold – heat contrast and local compression therapy statistically significantly ($p<0.05$) reduced pain in the neck and shoulders. The stretching exercises reduced self reported pain duration and frequency and had effect on daily life activities, meanwhile cold-heat contrast and local compression therapy statistically significantly ($p<0.05$) reduced most (83%) of the found myofascial trigger points. In the control group was no change for 70% of patients and 20% of them had intensified pain in the neck and shoulder area. The control group also had pain intensifying of myofascial trigger points, 22% of them – statistically significantly ($p<0.05$). In conclusion, the best effect on the neck and shoulder muscles and discomfort/pain in this area had the cold-heat contrast and local compression therapy. Many scientific papers proof effectiveness of the complex use of intermittent ischemic compression, stretching, heat, cold in the treatment of myofascial trigger points. This research showed clear indications for trigger point's treatment: acute pain – cold-heat contrast and local compression therapy, chronic pain – stretching exercises for treatment and prevention of the muscle pain.

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Aim of the study was to assess effectiveness of cold – heat contrast and local compression therapy device in physiotherapy for the patients with latent myofascial trigger points effects. Device (patent number A61F 7/00) originally constructed in Kaunas University of Technology, Institute of Physical Electronics used in this research consists of a controller and thermoelectric module with integrated force measurement module. 37 computer users with pain and discomfort symptoms in the muscles of neck and shoulder area were recruited for this research. Used stretching exercises and cold-heat contrast and local compression therapy reduced pain in the muscles of neck and shoulder area ($p<0,05$). The best effect in the treatment of myofascial trigger points had cold – heat contrast and local compression therapy. Ill. 6, bibl. 10 (in English; summaries in English, Russian and Lithuanian).

Л. Шюпшинскас, С.Тамулевичюс, Р. Гудайтис, В. Завецкас, А. Вайнорас. Эффективность прибора для терапии контрастом жара и холода для пациентов с хроническими миогенными тригерными точками // Электроника и электротехника. – Каунас: Технология, 2008. – № 6(86). – Р. 43–46.

Цель эксперимента была определить эффективность прибора для терапии контрастом жара и холода вместе с локальной компрессией для пациентов с хроническими миогенными тригернами точками. Прибор (номер патента A61F 7/00), первоначально построен в Институте физической электроники Каунасского технологического университета был использован в этом исследовании. Были исследованы 37 потребителей компьютера с симптомами боли и дискомфорта в зоне шеи и плеча. Были использованы упражнения разтяжки и терапия контрастом жара и холода вместе с локальной компрессией, которые уменьшили боль в зоне шеи и плеча ($p<0,05$). Таким образом самое лучшее влияние в лечении хронических миогенных тригерных точек имело терапия контрастом жара и холода вместе с локальной компрессией. Ил. 6, библ. 10 (на английском языке; рефераты на английском, русском и литовском яз.).

L. Šiupšinskas, S. Tamulevičius, R. Gudaitis, V. Zaveckas, A. Vainoras. Šaldymo bei šildymo kontrasto ir lokaliosios kompresijos prietaiso efektyvumas fizioterapijoje, kai pacientams yra diagnozuoti latentiniai trigeriniai taškai // Elektronika ir elektrotechnika. – Kaunas: Technologija, 2008. – Nr. 6(86). – P. 43–46.

Eksperimento tikslas – įvertinti šaldymo bei šildymo ir lokaliosios kompresijos prietaiso efektyvumą fizioterapijoje, kai pacientams yra diagnozuoti latentiniai trigeriniai taškai. Buvo ištirti 37 darbingo amžiaus žmonės, dirbantys kompiuteriu ir jaučiantys skausmą ar diskomfortą kaklo bei pečių srityje. Po ištyrimo jie suskirstyti į tris grupes: 1) 15 tiriamųjų 6 savaites buvo taikyti tempimo pratimai, skirti kaklo bei peties srities raumenims. Tiriamieji pratimus atliko savarankiškai, prieš tai išėję mokymus bei gavę specialų lankstinuką; 2) 12 tiriamųjų buvo taikyta šaldymo ir šildymo terapija, skirta miofascijiniams trigeriniams taškams gydyti, naudojant originalų KTU Fizikinės elektronikos instituto sukurtą šaldymo ir šildymo įrenginį; 3) 10 tiriamųjų sudarė kontrolinę grupę ir jiems rekomendacijos bei tempimo pratimai buvo pateikti tyrimo pabaigoje (po 6 savaičių). Įvertinus taikytų gydymo priemonių efektyvumą nustatyta, kad didžiausią įtaką kaklo ir peties srities raumenims bei jaučiamam skausmui ar diskomfortui turėjo šaldymo ir šildymo ir lokaliosios kompresijos terapija, naudojant KTU FEI sukonstruotą prietaisą. Il. 6, bibl. 10 (anglų kalba; santraukos anglų, rusų ir lietuvių k.).