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Using thermal imaging to monitor the treatment of latent myofascial trigger points in the upper trapezius

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Abstract

Clinically, latent myofascial trigger points are characterized as hyperirritable points located within taut bands of skeletal muscles or fascia. These points may cause referred pain, local tenderness and autonomic changes when manually stimulated. Dry needling is one of the treatment options but evidence of its results is scarce. This paper experimentally investigates the potential use of thermal imaging to assess the effect of dry needling on the skin temperature in patients with latent myofascial trigger points. No significant differences were found between the mean skin temperature and pain before and after the treatment, evidencing the agreement between the outcome measures.

1. Introduction

Myofascial trigger points are a very prevalent source of musculoskeletal pain. Trigger points are hyperirritable nodules localized within taut bands of skeletal muscles and fascia that when stimulated induce local tenderness and referred pain. Clinically, two types of trigger points can be identified, active and latent trigger points, the later being far more common [1] but less investigated. Latent trigger points, although physically present, are not associated with spontaneous symptoms but will produce local or referred pain when mechanically stimulated [2, 3]. Latent trigger points affect the functional capacity of individuals as both can be associated with muscle dysfunction, muscle weakness and limited range of motion [3]. Latent trigger points are often found in pain-free muscles and can become active trigger points by continuous harmful stimuli, but also by prolonged or non habitual exercise and acute trauma [4] increasing the relevance of appropriate diagnosis and management in the clinical setting. There are several interventions currently adopted to treat trigger points [5] and dry needling is one of the most popular. It is a minimally invasive technique with documented benefits within the physiopathology of trigger points [6]. However, its use in the treatment of latent myofascial trigger points needs further investigation.

Several studies have addressed the effects of dry needling application in patients with myofascial trigger points with inconclusive results but few have investigated its application in latent myofascial trigger points [7-10]. Regardless of the number of studies, the methodological variability makes it difficult to conclude on the effectiveness of dry needling, specially in latent myofascial trigger points.

Infrared thermography is a useful tool to objectively quantify functional abnormalities leading to skin temperature changes and is a noncontact and non-invasive method however, to our knowledge, only two studies have used this methodology [11, 12] and none to assess the effect of a treatment technique. Both studies have used thermal imaging as an outcome measure to the occurrence of sympathetic vasoconstrictor response following nociceptive stimulation of latent myofascial trigger points. Pressure pain threshold is also a common outcome measure in the assessment of latent myofascial trigger points [4]. Using an algometer it is possible to quantify the pressure required to induce pain in a given area and evaluate the success of a treatment procedure. Several studies have used this instrument to assess local pain as an outcome in patients with latent trigger points [e.g. 13].

Therefore, taking in account the research demand in the area of latent trigger point assessment and therapy, the aim of this study is to analyse the potential use of thermal imaging to assess the effect of dry needling on the skin temperature in patients with latent myofascial trigger points.

2. Methodology

2.1. Subjects

Five subjects with clinically identified latent myofascial trigger points (23.40±1.52 years; 22.42±1.86 Kg/m^2) volunteered to participate, in a single testing session. The protocol was previously approved by the local ethic committee and the rules of the declaration of Helsinki were followed. All participants were informed about the experimental procedure, the potential risks and benefits and gave written consent in order to participate in the study. Since the amount of fat tissue is one of the factors influencing skin temperature measurements [14], subscapular skinfold was controlled to identify possible outliers regarding this parameter (15.86±7.50 mm).

2.2. Experimental procedures

Thermograms were obtained with a thermographic camera (FLIR A325), properly calibrated and positioned 1 meter away from the subjects. Thermograms capture and analysis were made using the software FLIR ThermaCAM Researcher Pro 2.10®. Using the previously indicated software, mean skin temperature of defined regions of interest were obtained for further analysis. Pain was assessed using a digital algometer (Wagner Model FDIX) to quantify the pressure pain threshold in the upper trapezius.

A cross sectional study was planned in order to assess skin temperature of the upper trapezius before, immediately after, 5 minutes after and 10 minutes after the treatment of latent myofascial trigger points with Dry Needling. The recommendations of previously published literature regarding the capture of thermal images were followed [15]. The camera was switched on 40 minutes prior to the beginning of the data collection. The emissivity was set to 0.98 and the temperature scale from 25ºC to 35ºC.

All tests were conducted with controlled room temperature (22±1ºC), humidity (less than 50%) and no airflow after a 15 minute acclimatization period. The selected regions of interest for analysis were located in the area of both upper trapezius muscles, treated and untreated (figure 1).

The presence of latent myofascial trigger points was confirmed through clinical history and the presence of pain when using the algometer in the area of the trigger point. Three pressure pain threshold measures (Kg/cm^2) were recorded and the mean value of the three readings was computed. The measurements were recorded before the treatment, 15 minutes after the treatment and in the following day of treatment. Pressure pain threshold was measured bilaterally and the location of symptoms guided the decision on the upper trapezius to be treated. If the subject referred bilateral symptoms the chosen upper trapezius was the one evidencing lower pressure pain threshold. Measurements were made in a time interval of 30-60 seconds by the same researcher to avoid methodological bias.

Sterile acupuncture needles with 0.3 mm wide and 50 mm length were used in this study. The dry needling technique consisted in needle insertion in the trigger point and stimulation moving up and down with vertical motions at 1Hz for 10 seconds [16].

2.3. Statistical Analysis

All statistical analysis was conducted with Statistical Program for the Social Sciences (SPPS) for Windows, version 22. Descriptive statistics (mean and standard deviation) were used to summarize the results. Shapiro-Wilk test was used to analyse the normality of the variable distribution and according to the results Friedman's Two-way Analysis of Variance by Ranks test was selected to analyse skin temperature and pressure pain threshold variations between the assessments. The significance level set to 0.05.

3. Results

Figure 1 illustrates the analysed regions of interest in the upper trapezius muscles, treated and non treated, before and 10 minutes after the intervention. In the example the left side was treated with the Dry Needling technique.

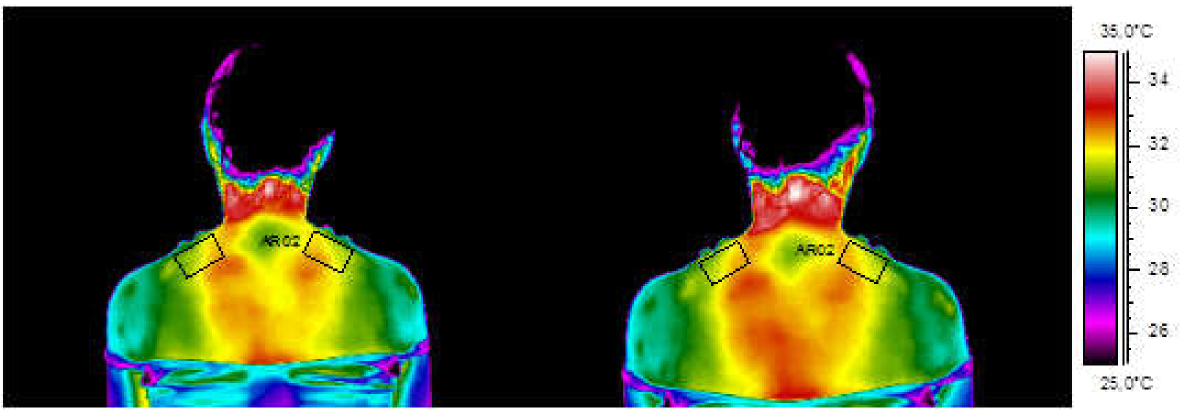

Fig. 1. *Example thermograms showing the analysed regions of interest before the treatment with dry needling and 10 minutes after the treatment.*

Skin temperature evolution was distinct in the treated and non treated upper trapezius as shown in figure 2 (treated upper trapezius) and figure 3 (non treated upper trapezius). In the treated upper trapezius, the trend was a decrease in skin temperature immediately after the treatment and 10 minutes after the treatment while in the non treated upper trapezius the trend was a n increase in skin temperature immediately after and 5 minutes after the technique and a decrease 10 minutes after the technique application.

In table 1 the values of mean skin temperature in each of the assessment periods are shown with the result of the statistical analysis comparing the evolution of skin temperature. The variations in skin temperature in both upper trapezius are not statistically significant (p>0.05).

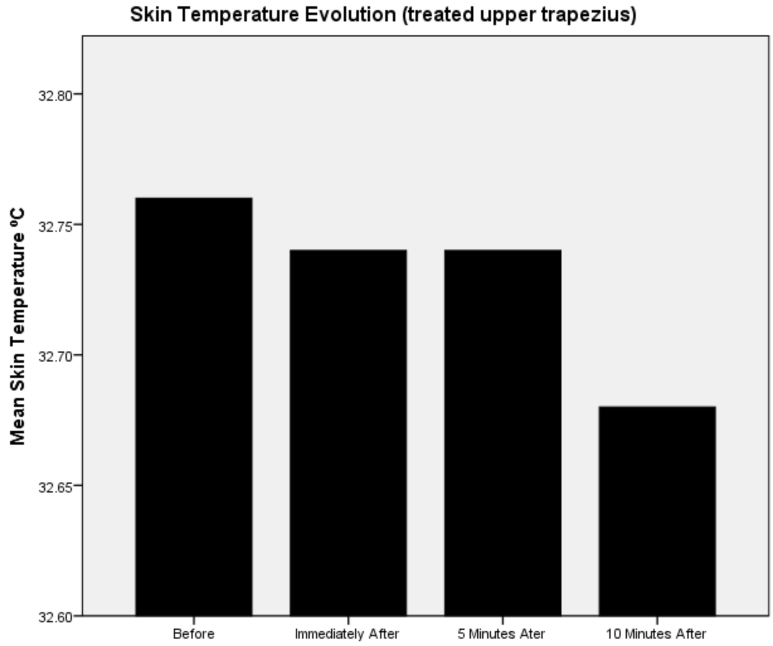

Fig. 2. *Skin temperature evolution in the upper trapezius treated with the Dry Needling technique.*

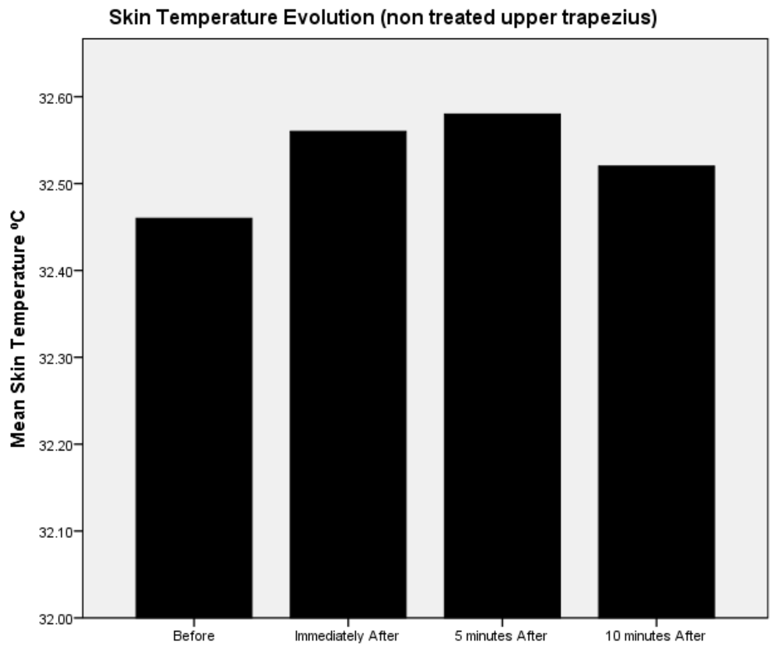

Fig. 3. *Skin temperature evolution in the contralateral upper trapezius.*

The trend for skin temperature evolution was different in the treated and non treated sides. In the treated side skin temperature decreased across measurements but in the non treated side skin temperature increased until 5 minutes after the application of the technique and started 10 minutes after the application skin temperature had decreased was higher than baseline.

Table 1. *Friedman test results comparing mean skin temperature (ºC) values before, immediately after, 5 minutes after and 10 minutes after dry needling in subjects with latent myofascial trigger points in both treated and non treated upper trapezius.*

Upper Trapezius	Before	Immediately After	5 minutes after	10 minutes after	*p*
Treated	32.76 ± 0.83	32.74 ± 0.79	32.74 ± 0.99	32.68 ± 1.04	0.532
Non treated	32.46 ± 0.81	32.56 ± 0.85	32.58 ± 1.00	32.52 ± 1.04	0.781

In table 2 the values of pressure pain threshold before, 15 minutes after and 24 hours after are shown. The observed values increased across experimental measurements before, 15 minutes after and 24 hours after the treatment with dry needling but no significant differences are found.

Table 2. *Friedman test results comparing pressure pain threshold (Kg/cm^2) values before, 15 minutes after and 24 hours after dry needling in subjects with latent myofascial trigger points.*

	Before	15 minutes after	24 hours after	*p*
Pressure Pain Threshold	2.66 ± 1.20	2.74 ± 0.83	2.84 ± 0.63	0.819

Thermal symmetry values before, 15 minutes after and 24 hours after are presented in table 3. No significant differences were found between the assessment periods.

Table 3. *Friedman test results comparing Thermal Symmetry values (ºC) values before, 15 minutes after and 24 hours after dry needling in subjects with latent myofascial trigger points.*

	Before	Immediately After	5 minutes after	10 minutes after	*p*
Thermal Symmetry	0.3 ± 0.4	0.2 ± 0.1	0.2 ± 0.2	0.2 ± 0.2	0.896

4. Discussion

In this sample, no significant differences were found in skin temperature and pressure pain threshold after the treatment of latent myofascial trigger points, both outcome measures were in agreement.

Regarding latent myofascial trigger points research, thermal imaging has not been used extensively in the assessment of rehabilitation effects. A previous study [12] has assessed skin temperature before, during and after painful stimulation with wet needling (glutamate injection). The technique was applied in latent myofascial trigger points or in regions without pathology in the left and right brachioradialis muscles. The authors found that the wet needling technique had positive effects, decreasing pain and pressure pain threshold in latent myofascial trigger points, comparing to regions without pathology. Blood flow to the injection site was also measured and a decrease in blood flow was found in the trigger points location. Although laser doppler flowmetry evidenced changes in blood flow, no significant changes in skin temperature, assessed with thermal imaging, were found. This finding is in line with our results, however we should point that in our study we assessed the effects of a dry needling technique and not a wet needling technique and the intervention was in the upper trapezius and not in the brachioradialis muscle.

Zhang and colleagues suggested that the needling stimulation could have activated a sympathetic vasoconstriction mechanism, leading to lower values of blood flow in the location of latent trigger points after needling stimulation. This mechanism has been further explored and confirmed [11] and changes in blood flow after wet needling were reported. In our study we assessed skin temperature changes in the treated upper trapezius and in the non treated upper trapezius.

Although no significant differences were found, a different pattern was found in the treated and non treated sides. In the treated side, skin temperature decreased immediately after the treatment with dry needling and further decreased until 10 minutes after the technique application. This pattern was not found in the non treated side, where skin temperature was higher than baseline immediately after the technique application and 5 minutes after the technique, decreasing at 10 minutes but with higher skin temperature values than baseline. This results may be related with the sympathetic vasoconstrictor response described before [11, 12] that could explain our results regarding the decrease in skin temperature.

Some research has been published on the efficacy of rehabilitation techniques in myofascial trigger points, however, most of the studies are in active myofascial trigger points. The results of this research has shown that dry needling, with manipulation – needle insertion and needle stimulation – or without – needle insertion alone – may or not be beneficial in pain reduction [7-10]. The differences across protocols, enrolled patients, outcome selection and measurement techniques do not allow to formulate a definite position on the efficacy of the technique in trigger point rehabilitation.

Our findings are in agreement with the study of Ilbuldu and collaborators [8] that concluded that dry needling was not better than placebo to treat patients with myofascial pain syndrome with active myofascial trigger points. In our study we have also found that dry needling was not successful in decreasing pain in patients with myofascial trigger points.

A recent study [9] investigated the effects of three different treatment protocols in patients with latent myofascial trigger points. Three groups of patients were treated with dry needling, muscle energy techniques and a combination of both techniques. All groups had positive results regarding pain reduction but the combination of techniques had the most positive results. The differences between the results of this study and our own may be explained by several methodological differences, for instance the sample size and dry needling technique, that was different from the one used in our study.

5. Conclusion

Although no significant differences were found in skin temperature after the application of a dry needling technique we should point that thermal imaging proved to be an accurate outcome measure to monitor the treatment results in patients with latent myofascial trigger points. Both outcome measures – thermal imaging and algometry – were in agreement, the dry needling technique was not effective in reducing pressure pain threshold and no skin temperature changes were found, in this sample.

Further studies are required, with bigger sample sizes, in order to strengthen the evidence on the topic of latent trigger point rehabilitation with dry needling and on the use of thermal imaging to assess the dynamics of skin temperature during and after the rehabilitation techniques. Studies comparing the effects of dry needling technique with needle manipulation and without needling manipulation or against a placebo are also welcome to understand the physiological effects of needle insertion alone. The effects of different dry needling techniques in terms of duration and frequency of needle manipulation remain to be compared.

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