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ORIGINAL ARTICLE

Observation using thermography of post-operative reaction after fascial manipulation®

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Abstract

Introduction and objective. Fascia Manipulation® is one of the methods focusing on the deep fascia. The assumption is that fascial manipulation is carried out on precisely determined points – coordination centres (cc), and on a limited area so as the friction occurring during manipulation would cause a local rise in temperature due to the inflammatory reaction. Rise in temperature influences modification in consistency of elementary matter in the manipulated area, and by the same token causing a decrease in the negative effects of fascia densification which stems from accumulation of hyaluronic acid. The purpose of the research is to prove the thesis that fascial manipulation causes local rise in temperature due to inflammatory reaction.

Materials and method. For the research, 25 individuals with densification in lower limb area were qualified. They were exposed to a single, 3-minute facial manipulation®. By means of a thermal-imaging camera, changes in the temperature of the body in the examined area were evaluated. The body's temperature evaluation was carried out 8 times: before the treatment, 5 minutes after the treatment, and, next, 6, 12, 18, 24, 36, 48 hours after the treatment.

Results. The average surface temperature of the treated area before mobilization was 33.4 °C. A statistically relevant increase in temperature was already observed 5 minutes after the treatment (increase of 0.5 °C; $p<0.001$). However, the highest temperature was observed 24 hours after mobilization (increase of 2.4 °C). The difference between the first and 7 other measurements was statistically relevant ($p<0.001$).

Conclusion. The statistically relevant increase in temperature under the influence of fascial manipulation® in the treatment area can confirm the occurrence of inflammatory reaction.

Key words

fascial manipulation, thermography, inflammation

INTRODUCTION

Since the beginning of the 21st century, the interest and knowledge of scientists about fascia has grown considerably. Fascia is no longer treated as solely a connective-tissue package for important organs, and currently it is believed to have an important mechanic role connected with carrying tension [1, 2], as well as a receptive function connected with carrying information to the central nervous system [3, 4, 5, 6, 7].

Many conceptions and therapeutic methods concerning work with fascia have arisen. One of these methods is the Luigi Stecco Fascia Manipulation® method in which the deep fascia are the foundation. Luigi Stecco has divided a body into 14 segments in which movement is coordinated by 6 main muscle-fascia units (mf units) constructed of muscle fibre, their fascia and joints moving a particular body segment in one direction. In the area of each segment there are located coordination centres (cc) accordingly for each muscle-fascia unit. In the coordination centres, vectors of the forces taper causing tension of the fascia in consequence of muscle cramp of the mandril after impulsation of gamma motor neuron [8, 9, 10].

Over-burdening, injuries, and metabolic disturbances may be the cause of fascia densification [11], connected with hyaluronic acid density [12, 13, 14]. Additionally, multiplication of collagen fibrous and change in their orientation can be involved [8, 15]. The densificated coordination centre (cc) loses the capacity to adjust to the tension of muscle cramp, which, in turn, causes only a part of the muscle fibra of muscle-fascia unit to shrivel and, consequently, the direction of the forces affecting the joint are changed which causes pain. The site of the pain is not, however, the densificated cc but the perception centre located in the joint capsule. The perception centre receives non-physiological tension of the tissues in consequence of common neuration with skeletal muscles [8, 9, 10].

Fascia manipulation is conducted at strictly defined fascia points. After movement and palpatory verification,

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receiving the most active points of cc (coordination centre) of the common plane, and balancing it with the points of the antagonistic plane, takes place [8, 9]. Fascia manipulation causes shift of friction into heat and creates inflammation in the manipulated site and this, in consequence, leads to modification of the consistency of the primary substance [8, 11, 16].

Non-contact computer thermographyis the best thermal-imaging method which has been in use since the 1950s in various branches of medicine. Thermal-imaging enables visualization of infrared radiation invisible to the human eye, and can therefore be used to obtain information about the physiological and pathological processes in the human body which reflect local and global changes in temperature.

OBJECTIVE

The aim of the research was observation with the use of thermography of postoperative reaction after fascial manipulation® to prove the thesis that fascial manipulation causes a local rise in temperature resulting from inflammatory reaction.

MATERIALS AND METHOD

The research was conducted at the turn of June – July in 2018. For the research, 25 individuals with densification in the lower limb area (gemo segment), without pain in the lower limb, were qualified. Three subjects were excluded from the study due to the lack of dentistification in the knee. The participating individuals were exposed to a single, 3-minute manipulation according to Luigi Stecco's conception [8, 17]. The manipulation was carried out by a certified therapist in the fascia manipulation method® (J. F-W). The Bioethics Committee approved the research (KE – 0254/170/2018), all participants provided informed consent to take part in the research.

By means of thermal-imaging camera model E60, changes in body temperature of the examined area were evaluated. Body temperature evaluation was carried out 8 times: before the treatment, 5 minutes after the treatment, and, next, 6, 12, 18, 24, 36, 48 hours after the treatment – that is, after the introduction, middle, and final hour of every phase of the treatment method for postoperative reaction (Tab. 1). In connection with the observed lack of decrease in temperature in the treatment area in relation to temperature before the manipulation, observation of 6 patients was extended to an additional survey 60 hours after the original treatment.

Thermal-imaging measurement was conducted while taking into consideration the repeatability of the climate of the evaluation. The room in which the research was conducted was air-conditioned, the temperature oscillated between 22–24 °C and air humidity between 50–55%. All external sources of heat were separated and excessive air circulation was eliminated. During registration of the thermal-imaging photographs, the camera was located 1 metre from the individual perpendicularly. Slin temperature of each individual was read from the thermogram, with a thermal-imaging camera using a software programme suitable for computer analysis of thermal-imaging images. The software enables analysing the researched surface using reading options, such as: measurement point, measurement line, measurement rectangular and measurement ellipse. On the basis of a trial reading series, in which all the software options were used, it was decided that for the research measurement, an ellipse would be the best option available in the thermal-imaging camera.

The obtained results were statistically analysed. To compare two dependant groups, the Wilcoxon pair sequence test was used. For more than two depended groups, ANOVA Friedman test and *post-hoc* test were used. A five-percent deduction error was assumed and connected with it, a $p<0.05$ level of weightiness indicating statistically relevant differences or relations. Statistic analyses were conducted using Statistica v. 13.0 computer software (StatSoft, Poland).

RESULTS

Study participants included 11 women and 14 men with an average age of 28, the majority of whom were urban dwellers.

The average temperature of the treated area before the manipulation was 33.4 °C. A significant increase in temperature was observed as soon as 5 min. after the start of treatment (+0.5 °C; $p=0.00001$), and consecutively increased, reaching its peak 24 hours after manipulation (+2.4 °C). In the next 24 hours, a slow decline in the temperature was observed. The difference in the temperature in the treated area between the moment before the manipulation and every subsequent observation was statistically relevant ($p=0.00001$). Additional thermal-imaging measurement after 60 hours following the treatment showed that after 12 hours the temperature was still statistically high (+0.3 °C; $p=0.02$) (Tab. 2).

It was observed that significantly the highest increase in the temperature value was between hour 6 and hour 12 of observation (Fig. 1).

Based on the analysis of thermograms between 24 and 60 hours after manipulation, it was concluded that a significant

Table 1. Phases of post-treatment reaction and protocol of the conducted research

Phases	Time	Description of the phase	No. of the research	Hour
I	0–15 min	Beginning of inflammation phase	I observation – before treatment	07.00 h
			II observation – 5 min after treatment	07.05 h
II	15 min – 12 h	Increase in symptoms of inflammation: pain, oedema, loss of functions	III observation – 6 h after manipulation	13.00 h
			IV observation – 12 h after manipulation	19.00 h
III	12 h –24 h	Peak of inflammtion	V observation – 18 h after manipulation	01.00 h
			VI observation – 24 h after manipulation	07.00h
IV	24h –48h	End of inflammation	VII observation – 36 h after manipulation	19.00 h
			VIII observation – 48 h after manipultion	07.00 h

Table 2. Values of temperature of treatment area after 60 hours

Temperature of treatment area (°C)	Measurement	Thermo gram No.	M	SD	Statistical Analysis
	Before treatment	I	33.4	0.69	
	5min after	II	+0.5	0.42	Chi^2_{ANOVA}=42.45 p<0.00001 I vs II: Z=4.37 p=0.00001 I vs III: Z=4.37 p=0.00001 I vs IV Z=4.37 p=0.00001 I vs V Z=4.37 p=0.00001 I vs VI: Z=4.37 p=0.00001 I vs VII: Z=4.37 p=0.00001 I vs VIII: Z=4.37 p=0.00001 I vs IX: Z=2.20 p=0.02 III vs IV: Z=4.29 p=0.00001
	6h after	III	+1.0	0.33	
	12h after	IV	+1.7	0.37	
	18h after	V	+2.1	0.29	
	24h after	VI	+2.4	0.26	
	36h after	VII	+1.6	0.66	
	48h after	VIII	+1.0	0.70	
	60h after	IX	+0.3	0.62	

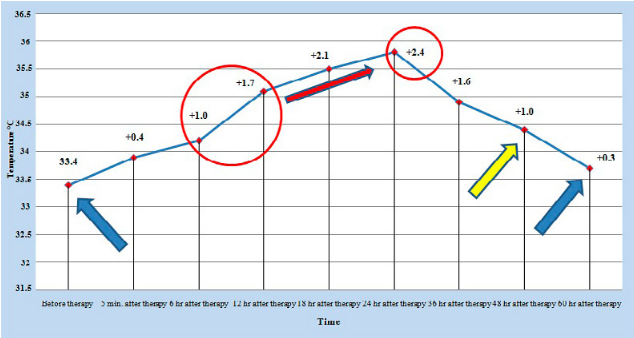

Figure 1. ?

decrease in the temperature had occurred (p<0.00001) (Tab. 3).

Table 3. Values of temperature of manipulation area during observation between 24 – 60 hour after treatment

Temperatue of treatment ares miejsca zabiegowego (°C)	Measurement	Thermo gram No.	M	SD	Statistical Analysis
	24h after	VI	35.8	0.60	
	36h after	VII	-0.8	0.54	Chi^2_{ANOVA}=49.52 p<0.00001 VI vs VII: Z=4.37 p=0.00001 VI vs VIII: Z=4.37 p=0.00001 VI vs IX Z=2.20 p=0.02
	48h after	VIII	-1.4	0.56	
	60h after	IX	-2.1	0.50	

DISCUSSION

Immobilization, overuse and injures can lead to an increase in the concentration of HA within and between the muscular and fascial compartments. Increase in the concentration of HA can increase the fluid viscosity, and decrease the gliding between the layers of collagen fibres [11, 18]. Over time, there are also changes in the arrangement of collagen fibrils in the endomysium. Changes in the turnover of HA and in the properties of extracellular matrix may lead to structural and functional changes in the muscles, which has a significant impact on the movement [17, 19]. Alteration of HA could also modify the activation of the receptors, producing non-specific musculoskeletal pain [11, 17, 20].

Fascia manipulation is conducted at strictly defined points in a specific area, so that the friction during manipulation would cause an increase in the temperature of the fascia tissue [9, 10]. This leads to the destruction van der Waals and hydrophobic forces which hold together the hyalurnian chains [16]. The increase of the temperature in tissues causes decrease in hyalurnian viscosity [12, 21] and an increase its ability to slide [14, 22]. A less viscous, loose connective tissue allows fibroblasts to discern the lines of tensions of the fascial layers, and may therefore cause remodelling of their dense connective tissue, with a deposition of collagen fibres along the correct lines of force [23].

Thermal-imaging can be applied as an objective and non-invasive tool to evaluate the inflammation response [24]. Thermal-imaging is currently applied in almost every branch of medicine. In laryngology, it is used to evaluate the function of the nasal sinus (lack of air in relation to the inflammation which may be a result of the lower temperature of the surrounding tissues) [25]. In dentistry, it was applied in the analysis of the state of paradentium and temple-mandible joints. The available research shows that every case of symptoms of severe and chronic inflammation joint sinus, a change in the temperature of the area, compared to the other half of the body, occurred of about 1.2 °C [26]. Evaluation of the inflammatory reaction using thermal-imaging is also used in ophthalmology. Kawali concluded that patients with sclera inflammation and post-operative choroid inflammation suffered from higher temperature of the eye, compared to a healthy eye [27]

Thermal-imaging is also used to evaluate the function of the musculoskeletal system. A significant change in the temperature occurring during healing of the distal part of radial bone, enables application of thermal-imaging in traumatology as a method of control of the process of healing [28]. Additionally, in rheumatology, thermograpy can be applied as an innovative, credible and non-invasive research tool to evaluate joint inflammation [29]. The research also confirms high sensitivity (85.7% and 71.4%) and specificity (80.0% and 93.3%) of thermal-imaging check, comparable to ultrasound survey, as well as in the diagnosis of patients suffering from juvenile idiopathic arthritis [30].

Despite numerous examples of thermal-imaging application in medical science, the described method is not a standard diagnostic tool. In available research, there is a lack of publications describing the use of a thermal-imaging camera as a tool to evaluate the temperature of the surface of the body under fascia manipulation, according to L.Stecco. In own research, there was a significantly higher temperature in the area under fascia manipulation during observation after 60 hours after the treatment, compared to the temperature after the treatment. A significantly highest temperature of the treated area was observed 24 hours after the manipulation. It was also the turning point of the observation because since that moment, the surface temperature of the manipulated area became significantly lower. It was also noticed that significantly the biggest rise in the temperature of the surveyed part of the body occurred between hour 6 and hour 12.

The above observation confirms that as a result of the fascia manipulation according to L.Stecco, a higher temperature of the manipulated surface occurs, which may be related to the consequent temporal and territorial inflammation.

Taking into consideration the fact that the conducted survey is pioneer, conducted in a small group of individuals, the surveys should be continued and, additionally, enhanced by using other diagnostic tools. The obtained results should be additionally confirmed in the future.

CONCLUSION

A statistically significant rise in the temperature under fascia manipulation® in a treated area can confirm the occurrence of inflammation.

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