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The Open Sports Sciences Journal, 2017, *10*, (Suppl-2, M2) 223-228 223

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The Open Sports Sciences Journal

Content list available at: www.benthamopen.com/TOSSJ/

DOI: 10.2174/1875399X01710010223

RESEARCH ARTICLE

Osgood-schlatter Disease Diagnosis by Algometry and Infrared Thermography

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Received: May 09, 2016 Revised: March 16, 2017 Accepted: July 20, 2017

Abstract:

Background:

The diagnosis of Osgood-Schlatter Disease (OSD) is based on clinical signs and symptoms. However, more objective parameters, like thermal images, have been researched to determine, along algometry, valid parameters.

Objective:

The aim of this study was to analyze the thermal differences and the painful sensibility between the knees (with SOS and contralateral) of young soccer players.

Methods:

6 young men, aged between 12 and 15, members of football schools, composed the sample. Images were taken from an anterior view of both knees, with the volunteer in a seated position, the knees flexed at 90º degrees and both feet flat on the floor. After the thermal image capture, the patients were submitted to an evaluation with the pressure algometer.

Results:

According to the results, it was found that the knee affected by the OSD showed temperatures significantly higher than the contralateral ($p = 0.027$) and also greater sensitivity to the pressure algometry ($p = 0.027$).

Conclusion:

it can be concluded that the inflammatory process, during OS Syndrome, promotes a local thermal hyper-radiation, identified with the high sensitive thermographic infrared image, producing a significant difference in local temperature between the knees of a single individual. Moreover, this process also increases the pain sensibility, accessed by pressure algometry.

Keywords: Osgood-Schlatter, Thermography, Thermal imaging, Pressure algometry, Inflammatory process, Painful sensibility.

1. INTRODUCTION

Robert Carl Bayley Osgood and Carl Schlatter described the diagnosis of Osgood-Schatter Disease (OSD), a pain

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syndrome in the tibial tubercle region, based on clinical symptoms as: Pain, increase in local temperature, edema and tibial tuberosity prominence [1].

This syndrome usually occurs in adolescent athletes aged between 12 and 15 years. The SOS incidence is more common in males than females, by a ratio 3:1, possibly because of the larger strength, muscle mass and the higher involvement in a sport practice [2]. This disease results from repetitive micro-injuries and the avulsion of osteotendinous junction, where the patellar tendon is inserted in the secondary center of tibial tuberosity ossification. This appearance during the early adolescence coincides with the development of the ossification center, which constitutes a weak link with the quadriceps muscle contraction [3].

The diagnosis is based on clinical signs and symptoms. However, more objective parameters has been researched for determining diagnosis along algometry, like thermal images [4 - 6]. The pressure algometry quantifies the pain perception through the determination of pain threshold by pressure [7]. Examination by nuclear magnetic resonance imaging is useful in revealing the initial lesions and progressive SOS [5]. Its is already possible to use ultrasound in order to access pathological findings: pretibial swelling, the center of ossification fragmentation in the patellar tendon insertion thickening, so also has been considered a valid test for the diagnosis [6].

Thermography can be accepted as an option of diagnostic tools for low-cost image, which detects the infrared radiation emitted by the skin. Several studies have demonstrated the successful use of thermal imaging for diagnosis of the dysfunctions that leads to ischemia or local inflammation as: identification of edema [8]; identification of Muscule Damage [9]; complex regional pain syndrome and Stroke [10]; and Osgood-Schlatter Disease [4].

While there are some studies that indicate the possibility of using algometry and thermography as complementary tests in the diagnosis of SOS, new studies may refute or consolidate this indication. This study aimed to analyze the thermal differences and the painful sensibility between the knees (with SOS and contralateral) of young soccer players.

2. MATERIALS AND METHODS

The sample was composed of six young men, aged 12 and 15, members of football schools. To obtain the sample, the researcher visited football schools in the *Vale do Taquari* region, where recruited athletes with a diagnosis of Osgood-Schlatter disease, after parental permission, were willing to participate. The research project was approved by the Ethics in Research involving human beings of UNIVATES University Center, under No. 141 764.

The patients evaluated met the inclusion criteria: Clinical diagnoses of Osgood-Schlatter disease signed by a doctor; and have the permission of their legal guardians signed (Term of Free and Informed). As exclusion criteria, the individuals could not present any other disease in the lower limbs, such as traumatic and orthopedic injuries or couldn't be in the postoperative period for last 12 months, besides that could not suffer any type of burn in the lower limbs.

Analyses were performed in a room acclimatized to 23 ° C, with relative humidity between 50% and 60% [11]. The volunteers remained in a rest period for 20 minutes before the exam. Initially a questionnaire was applied to collect the patient's identification data. After that, Images were taken of both knees of the volunteer, in a seated position, the knees flexed at 90º degrees and the feet flat on the floor [4]. The i7 model of FLIR® thermographers was the equipment used to take the thermal images, which was positioned at 1,50 meters away from the volunteer [12].

After the capture of the thermal images, the patient was submitted to an evaluation with the pressure algometer. To perform the algometry, it was used the algometer of the Wagner Instruments®. The researcher had the insertion of the patellar tendon on the tibial tuberosity as anatomical reference. The same evaluator performed all tests. The patient was instructed to sit with the knees at 90 ° degrees and the muscles relaxed. The pressure with the equipment was applied perpendicular to the region to be assessed, and the value was recorded in kilogram per square centimeter (Kg / cm^2).

Volunteers were asked to report the time when the pressure becomes pain. The threshold of pain caused by pressure is defined as the minimum force required to cause sensitivity.

Data analysis was performed using descriptive (mean and standard deviation) and inferential statistics. The Shapiro-Wilk test was used to test the distribution of variables and the Wilcoxon Signed Ranks Test was used to check for differences in temperature and pressure sensitivity between the knee affected by the OSD and the contralateral. The Spearman correlation coefficient was used to assess the strength of the correlation between thermal asymmetry and the pain asymmetry. The statistical analyses were carried out with software *Statistical Package for Social Sciences* (*IBM SPSS, version 21.0*). The statistical significance level was defined as $p < 0.05$.

3. RESULTS

The sample was composed by six young men, aged between 12-15 years (13.33 ± 1.03), soccer players and with a clinical diagnosis of Osgood-Schlatter disease. Table (**1**) shows the relevant information relative to age and exercise practice time.

Table 1. Age and sport practice time of the volunteers.

–	Athlete 1	Athlete 2	Athlete 3	Athlete 4	Athlete 5	Athlete 6
Age (years)	14	12	13	13	15	13
Tempo de prática esportiva (months)	84	50	60	60	90	70

Table (**2**) shows the values of the comparison between the thermal differences and the painful sensitivity, in the two knees (with SOS and contralateral) of the assessed adolescents. For algometry values, the lower the pressure, the greater the tenderness of the subject. In the thermal analysis, for this syndrome, the hottest region was considered as the region affected by the condition.

Table 2. Comparison between thermal and painful the sensitivity differencies in the knees (with SOS and contralateral) of adolescents soccer players (n = 6) using the Wilcoxon Signed Ranks Test.

Variables	Mean	Standard Deviation	p value
Knee Temperature OS (ºC)	34,03	1,07	0,027
Knee Temperature contralateral (ºC)	32,98	1,53	
Algometry of the Knee with OS (Kg/cm^2)	35,83	14,76	0,027
Algometry of the Knee contralateral (Kg/cm^2)	97,00	61,41	

According to the results shown in Table (**2**), it was seen that the knee affected by the OSD displays had significantly higher temperature than the contralateral (p = 0.027) and also greater sensitivity to the pressure algometry (p = 0.027). Fig. (**1**) illustrates a representative picture of the subjects in this study.

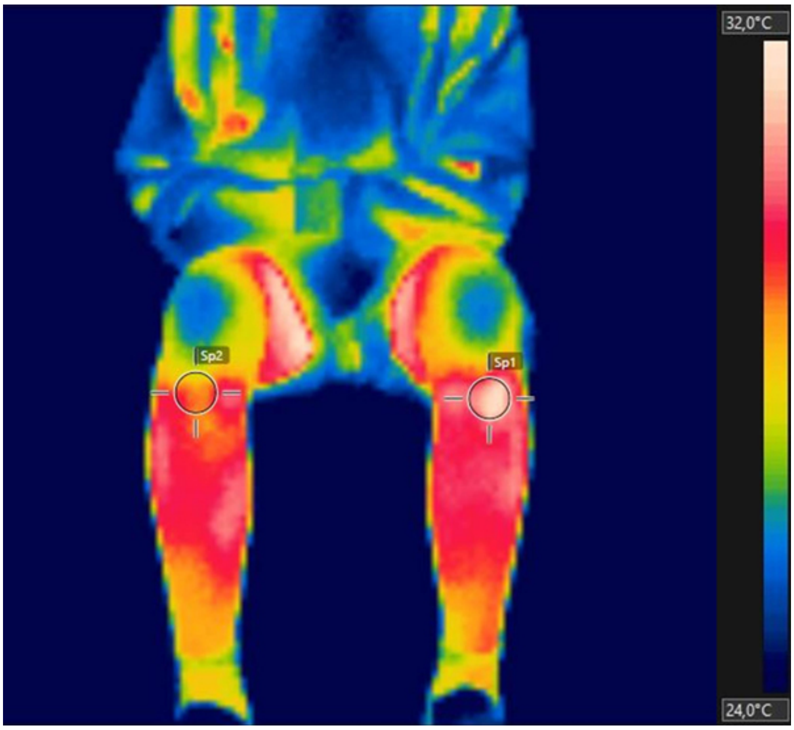

Fig. (1). Image of the knee anterior view accessed by infrared thermography showing most hyper-radiation in the tibial tuberosity region earlier in his left knee compared to the right.

Regarding the association between the variables, asymmetry pain sensitivity (algometry pressure) and thermal asymmetry, a low correlation was observed (rho = 0.232) by the Spearman test, with no statistically significant (p = 0.658).

4. DISCUSSION

Adolescence is a critical period for the acquisition of bone mass and the exercise has major role in this function [13]. However, in adolescents that practice regular physical activity, the peak of bone mass can be increased during the phase of growth spurt, due to the mechanical stress on the bones resulted from physical exercises, therefore at this stage is common that osteomuscular pathologies can occur, including the O.S [4]. This relationship was proven by a study of a representative sample of 956 subjects aged 12-15 years, of both sexes, concluding that the practice of regular sports activities is an associated factor to the syndrome OS [2].

Radiographic exams are usually unchanged in OS Syndrome, and only in severe cases can be observed the intratendinose ossicle, but this clinical sign is not unique to OS [14]. The nuclear magnetic resonance imaging (MR) was proven useful to reveal the initial lesions and the progressive lesions of OS syndrome [5], However, the disadvantages of MR are still the high cost of the exam, and the consuming time that implicates [15]. Thermography has advantages like the speed of data collection, the image evaluation in real time, the radiation is not harmful, and does not require contact with the part inspected during the collection [16].

The present study examined the thermal difference and algic sensitivity of soccer players knees with OSD and the results showed a significantly higher thermal temperature in the knees with OSD compared to the contralateral knee (p = 0.027).

These findings corroborate with those related by Freitas *et al.* [4] that also studied 10 patients with OSD and 10 patients without the OSD, which served as a control group (CG), and found significantly higher temperatures in the knees with the OSD (p = 0.008) compared to the CG. Other studies [14] and [1] also studied children and adolescents with the OSD, however we can not compare with the present study because it was used radiography to assess the degree of injury, as well as the prevalence of OSD by age and gender, concluding that the male gender, aged 12-15 years were the most affected by the OSD.

Temperature is one of the five signs that the inflammation process can show, and the only one that can be objectively and accurately measured by thermal analysis, which enables the relation of intensity of the symptoms in the temperature area affected by inflammatory process, that could lead to a positive correlation between pain intensity and the local temperature in the same individual. This relationship between temperature and pain, may be used as an auxiliary method in the diagnosis and treatment of pathologies which cause pain and disability [17].

The results of the present study did not show a significant statistically correlation between pain and the temperature variation in the tibial tuberosity (p = 0.658). A study with 18 patients treated for ontogenesis distraction for bone lengthening with external fixator reported significant statistically correlations 0.925 ($p < 0.01$) and 0.724 ($p < 0.05$) between the bone regeneration and thermal indices for the tibia and femur, respectively [18]. Another study [19] with a sample of 53 patients with coccygeal pain condition who were submitted to a different therapeutic modalities for eight weeks reported significant correlation between pain relief and decreased temperature (r = 0,67, p <0,01). The difference between the results of this study and others found in the literature may be related to the place of study and the small sample size used in this study. Thus, we highlight the sample size as one of the limitations of this study.

CONCLUSION

It can be concluded that the inflammatory process, during OS Syndrome, promotes a local thermal hyper-radiation, sensitive to thermographic infrared capture, producing a significant difference in local temperature between the knees of a single individual. Moreover, this process increases the pain sensibility, accessed by pressure algometry. It was also observed a weak correlation of pain intensity with the local temperature in the studied population, although not statistically significant for the sample. It is suggested to carry out other studies with larger samples and to investigate new tools for analysis of OS syndrome

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research project was approved by the Ethics in Research involving human beings of UNIVATES University Center, under No. 141 764.

HUMAN AND ANIMAL RIGHTS

No Animals/Humans were used for studies that are base of this research.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

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