

Thermography as an aid in the prevention of injuries in soccer: Presentation of a possible curricular component in imaging courses

Robson Carlos Coimbra¹, Cristiane Carla Muniz², Juliana Silva de Oliveira³, Alexandre dos Santos Gomes⁴.

ABSTRACT

Thermography is a non-invasive method that records body thermal gradients and patterns by measuring the thermal radiation emitted by the body. It can be used to diagnose sports injuries, as it captures the infrared radiation emitted by the individual himself, without emitting external radiation. The lesions trigger inflammatory processes that generate heat, detectable by thermography before clinical signs appear, allowing for preventive intervention. This technique makes it possible to measure temperatures and form thermal images, precisely locating injury points. Thus, it is possible to monitor the evolution of the inflammatory condition and prevent aggravation, even when the lesion is not yet clinically noticeable.

Keywords: Thermography, Sports injuries, Early diagnosis.

INTRODUCTION

Thermography is a non-invasive method used to record body thermal gradients and patterns in images, and is used to measure the thermal radiation (heat) emitted by the body or parts of it, and can therefore be used to diagnose injuries caused by sports training. In thermography there is no emission of radiation. On the contrary, the system captures the infrared radiation emitted by the individual studied. There is no contraindication. Lesions trigger inflammatory processes and inflammation generates heat as a result of increased local metabolism. The inflammatory level can be assessed by means of temperature gradients: thermographic images show the early onset of an inflammatory process, which has not yet presented classic signs and symptoms, acting preventively. The sensing technique enables the measurement of temperatures and the formation of thermal images of the athlete's body, allowing a more precise action of the point of injury, whether in the initial or evolutionary stage, it is possible to detect the critical places to be treated. When there is an inflammatory process, the affected region becomes hotter and through the device it is possible to monitor the evolution of this inflammatory condition. Usually the injury is already in the athlete's body, but at that moment it is imperceptible, which will only change when

¹ Unigranrio University – RJ

² Unigranrio University – RJ

³ Bezerra de Araújo College (FABA) – RJ

⁴ Unigranrio University – RJ

Bezerra de Araújo College (FABA) – RJ

the athlete increases the load, aggravating the problem. With thermography it is possible to prevent this condition.

OBJECTIVE

To disseminate scientific information to peers in the area of Radiology Technology regarding how thermography can help athletes to prevent injuries generated by great muscle wear, following the physical wear and tear of athletes in high-performance sports, such as soccer.

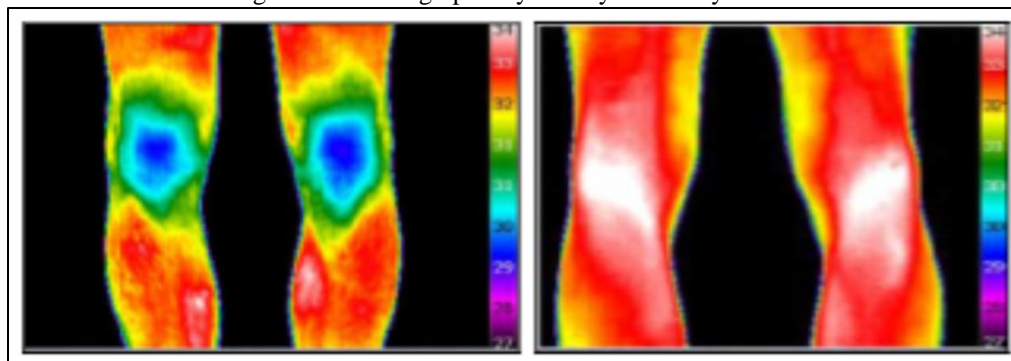
METHODOLOGY

A search was conducted in books, magazines and scientific articles with databases from Sicelo, Pubmed and Google Scholar. The preferred languages selected were: Portuguese and English, the words chosen were: thermography, sports thermography. Works that were not within the scope of the article, i.e., that did not have a context with the sports area, were excluded. Then, a technical visit was made to Botafogo de Futebol e Regatas, more specifically in its arena, the Nilton Santos Stadium, where the understanding of the use of technology was witnessed and solidified.

FINAL THOUGHTS

It is hoped that this document can facilitate the elaboration of the article by the authors, as well as the review by the reviewers. (Demonstrate whether the proposed objectives have been achieved, and the final considerations of your research). To determine whether a thermogram is normal, research from the University of Glamorgan created a database of thermal images of different parts of the body of healthy individuals. Symmetry between the limbs is essential in the evaluation of the normality of the thermogram. (Figure 1)

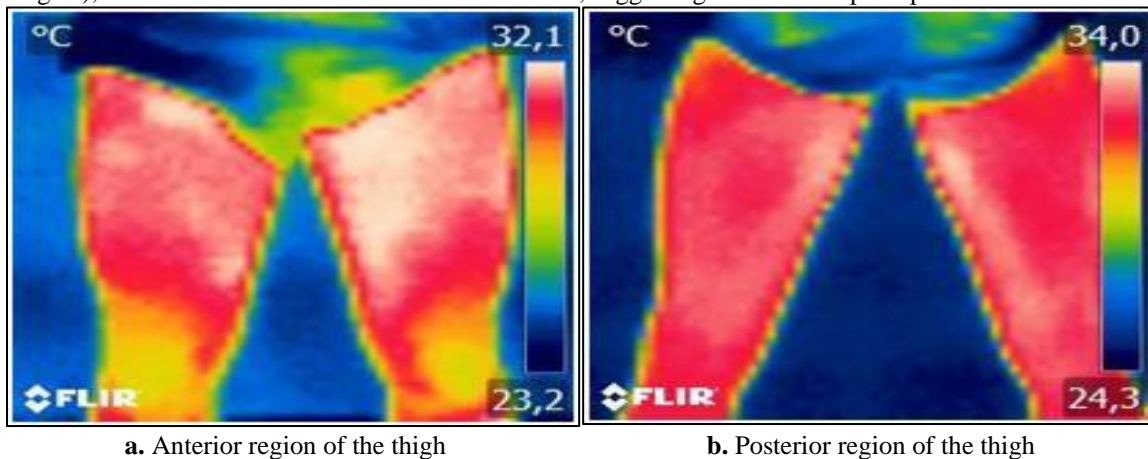
Figure 1: Thermographic symmetry in healthy knees.



A. Anterior Region of the Knee

B. Posterior Region of the Knee

Figure 2: A visible temperature difference can be observed, suggesting some abnormal adaptive process (Image a). On the other hand, in (image b), a balance is observed between the two limbs, suggesting a normal adaptive process.



The literature has shown that a difference greater than 1 degree centigrade between the sides of the body may indicate a physiological duck process. (Selfe, 2008) (Table 1).

Table 1: Thermography analysis.

Assimetria	Nível de Atenção
< 0,4° C	Normal
0,5° – 0,7° C	Acompanhamento
0,8° - 1°C	Prevenção
1,1° - 1,5°C	Alarme
> 1,6°C	Grave

Therefore, from the performance of weekly and/or daily thermographic evaluations, it is possible to create a thermographic profile of each individual and from this, verify if the athlete is in a process of greater physical wear or even injured. The exam can also be used as a tool in the recovery process of muscle and tendon injuries, serving as a beacon for advancement in the recovery phases of an injury.

Table 2: Clubs that use thermography in Brazil.

Estado	Clube	Clube	Clube	Clube
Rio de Janeiro	de Botafogo	Flamengo	Fluminense	Vasco
São Paulo	Corinthians	Santos	São Paulo	Palmeiras
Minas Gerais	Atlético M.	Cruzeiro		
Rio G. do Sul	Grêmio	Internacional		
Paraná	Atlético P.	Coritiba		
Recife	Sport	Santa Cruz	Náutico	
Goiás	Goiás			
Pará	Paysandu			



Table 3: Comparison of muscle injuries in 2016, 2017 and 2018 of Botafogo F.R.

Ano	Competições	Jogos	Lesões M.
2016	Carioca, Copa do Brasil, Brasileiro.	64	36
2017	Carioca, Libertadores, Brasileiro, C. do Brasil.	72	25
2018	Carioca, Copa do Brasil, Sul-Americana, Brasileiro.	29	11

In a period where any and all injuries can bring losses to Brazilian football clubs, efficient alternatives are more than valid. Thermography has been shown to be successful, which we were able to determine on the subject, suggests that the use of thermography, together with physiological markers, allows us to determine the intensity and location of muscle injuries in a safe and non-invasive way.

One of its advantages is that it can detect the anatomical location of muscle injury, it can be said that thermography has a great potential to support the diagnosis of muscle injuries in athletes of various modalities. The professional who works with thermography must have knowledge in anatomy, physiology, biomechanics and understand well about the equipment software.

In short, the training of athletes for performance sports is a huge financial investment and also a time investment. For this, financial investments are necessary and that aim at good sporting results and consequently generate future economic benefits to the clubs that hold their rights, thermography has an excellent cost-benefit ratio, and with it these investments gain a new protection.



REFERENCES

- Kitchem, S., & Young, S. (1998). Princípios eletrofísicos. In S. Kitchem & S. Bazim (Eds.), *Eletroterapia de Clayton* (pp. 46-58). São Paulo: Manole.
- Brioschi, M. L., Yeng, L. T., Pastor, E. M. H., & Teixeira, M. J. (2007). Utilização da imagem infravermelha em reumatologia. *Revista Brasileira de Reumatologia*, 47, 42-51.
- Machado, M., Antunes, W. D., Tany, A. L. M., Azevedo, P. G., Barreto, J. G., & Hackney, A. C. (2009). Effect of a single dose of caffeine supplementation and intermittent-interval exercise on muscle damage markers in soccer players. *Journal of Exercise Science & Fitness*, 2, 91-97.
- Tan, J. H., Ng, E. Y. K., Acharya, U. R., & Chee, C. (2009). Infrared thermography on ocular surface temperature: A review. *Infrared Physics & Technology*, 52, 97-108.
- Arena, S. S., & Mancini, R. U. (2003). Lesões esportivas, fatores de risco e exames de pré-participação para jovens atletas. *Revista de Educação Física da Cidade de São Paulo*, 3(1), 21-29.
- Maost, L. (2009). Efeitos da crioterapia na recuperação das alterações na performance física e de indicadores de lesão muscular induzida por um único jogo de futebol. Dissertação de Mestrado, Faculdade de Desporto, Universidade do Porto, Porto, Portugal.
- Arnaiz, J., et al. (2014). Aplicación práctica de la termografía infrarroja en el fútbol profesional. *Revista de Preparación Física en el Fútbol*, 6-15. ISSN: 1889-505.
- Bouzas Marins, J. C., et al. (2014). Thermographic profile of soccer players' lower limbs. *Revista Andaluza de Medicina del Deporte*, 7(1), 1-6.
- Ramos, S. (2016). Termografia no futebol brasileiro. *Fisiologistas*. Available at: <https://fisiologistas.wordpress.com/2016/11/25/termografia-no-futebol/>. Accessed February 10, 2018.
- Silva, M. G., & Andrade, G. (2014). Porque a termografia deve ser utilizada no tratamento de lesões em jogadores de futebol de campo? *EFDeportes*. Available at: <http://www.efdeportes.com/efd190/a-termografia-no-tratamento-de-lesoes.htm>. Accessed February 15, 2018.
- Meira, L. F., et al. (2012). Termografia na área biomédica. *Pan American Journal of Medical Thermology*. Available at: <http://abraterm.com.br/revista/index.php/PAJTM/article/view/12/11>. Accessed February 15, 2018.
- Bandeira, F., et al. (2012). Pode a termografia auxiliar no diagnóstico de lesões musculares em atletas de futebol? *Revista Brasileira de Medicina do Esporte*. Available at: http://www.scielo.br/scielo.php?pid=S1517-86922012000400006&script=sci_arttext&tlng=pt. Accessed February 18, 2018.
- Bandeira, F., et al. (2014). A termografia no apoio ao diagnóstico de lesão muscular no esporte. *Revista Brasileira de Medicina do Esporte*, 20(1), 59-64. Available at: <http://www.scielo.br/pdf/rbme/v20n1/1517-8692-rbme-20-01-00059.pdf>. Accessed February 18, 2018.