

## Chapter 46

# Infrared Thermography as a Means of Monitoring and Preventing Sports Injuries

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### ABSTRACT

*Sports injuries are one of the most important problems in sports. Moreover, professional sports injuries lead to a difficult recovery process for the athletes, reduced athletic performance, and large economic costs. Infrared thermography (IRT) is a safe, non-invasive and low-cost technique that allows for the rapid and non-contact recording of Skin Temperature (Tsk). Recent research results have demonstrated new applications for this technique; among them, the monitoring and prevention of sports injuries appears to be one of the most interesting applications. Although IRT is not as objective as other methods, it may be sufficiently accurate and reliable as a complementary tool considering the theory that musculoskeletal structures should be in thermal equilibrium when in a healthy state. Therefore, the main contribution of IRT is to help identify an injury before it occurs, providing an opportunity for preventative action.*

### INTRODUCTION

Infrared Thermography (IRT) is a safe, non-invasive and low-cost technique that allows for the rapid and non-contact recording of the irradiated energy that is released from the body (E. Akimov & Son'kin, 2011; J. T. Costello, McInerney, Bleakley, Selfe, & Donnelly, 2012; Hildebrandt, Raschner, & Ammer, 2010; Merla, 2005; Ng, 2009).

DOI: 10.4018/978-1-7998-7707-3.ch046

Although IRT is not as objective as other methods, it may be sufficiently accurate and reliable as a complementary tool considering the theory that musculoskeletal structures should be in thermal equilibrium when in a healthy state. Regarding the practical application of thermography, thermal asymmetry in body areas can aid in the early detection of overload and skeletal muscle fatigue and may therefore help prevent injuries in individuals who practice sports.

Comparing real life with cars, sports practice maybe considered as the “Formula 1” of physical activity. Athletes are exposed to a higher injury risk because the intensity and volume of the physical activity demanded by hard training seasons (and competitions) are much higher than a normal physical activity, with the injury risk proportional to the competition level.

All the research performed on athletes, which is mainly oriented toward improving the athletes’ performance, can be easily transferred to “real-life” when the physiological and psychological differences between athletes and sedentary people are considered. Consequently, when we use the term “sport” in this chapter, the term “physical activity” could also be applied in many of the contexts.

The objectives of this chapter are:

1. To review the evolution of applied thermography in the field of physical activity and sports.
2. To analyze the current applications of thermography in that field, mainly as a tool for monitoring and preventing injuries and
3. To identify the main controversies and problems of thermography application as a means to prevent sports injuries
4. To propose solutions to those issues and suggest some future research lines and approaches to improve the utility of thermography as a tool to assist in the prevention and monitoring of sports injuries.

## **INFRARED THERMOGRAPHY IN PHYSICAL ACTIVITY AND SPORTS**

### **Evolution of Sports Thermography**

Apart from medical research and applications, the existing studies in the field of physical activity and sports are quite scarce. The first investigations regarding thermography and high-performance sports were performed in the 1970s by a small number of research groups. Some prominent groups are the Clinical Research Centre from Middlesex UK (Clark, Goff, & Mullan, 1977; Clark, Mullan, & Pugh, 1974; Clark, Mullan, & Pugh, 1977), the University of California (Veghte, Adams, & Bernauer, 1979; Wade & Veghte, 1977), the Universitätsklinik Orthopädische München Germany (Keyl & Lenhart, 1975) and in the 1980s the research group from Addenbrooke’s Hospital took over from Cambridge (Binder, Parr, Thomas, & Hazleman, 1983; Devereaux, Parr, Lachmann, Page-Thomas, & Hazleman, 1986; Devereaux, Parr, Lachmann, Page-Thomas, & Hazleman, 1984).

In addition to those primary studies, Rochcongar and Schmitt (1979) published an interesting report describing the effects of different injuries on Tsk and highlighted the potential of IRT to indicate the degree of the lesion and control its evolution. Some years later, Ring (1990) detailed the basic skin responses after an injury as identified by Rochcongar and Schmitt: normothermic, hyperthermic and hypothermic patterns, i.e., increased and decreased temperatures.

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