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The assessment of trapezius muscle symptoms of piano players by the use of infrared thermography

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The aim of this study is to understand the correlation of trapezius muscle symptoms in piano players during their performance. The association of piano practice and the general health of a pianist, especially concerning the musculoskeletal system, and head posture has been studied in relation to orofacial anatomic zones and is presumed to have an influence on the biomechanical behavior of the cranio-cervico-mandibular complex (CCMC). Previous research has found that the act of playing piano involves a complex neuromuscular activity with hyperactivity of the masticatory muscles and the postural muscle trapezius. Thermal image assessment was made to the pianist's CCMC while the piano player was playing his/her piece.

Keywords: thermography; pianists; cranio-cervical-mandibular complex

The relationship of the postural muscles, like the trapezius and the symptoms affecting the neck of piano players, can be related to their practice by studying their head and cervical posture. An eventual altered head and cervical posture will produce specific symptoms from the cervical spine, such as tenderness of the neck and shoulder muscles. This can actually develop myofascial pain, which can be activated by chronic overload of muscles, especially in pianists, who make repetitive movements that demand precision. The trapezius is probably the muscle that most often experiences myofascial trigger points (highly sensitive muscle areas painful to palpation and produce referred pain) and is frequently overlooked as a source of temporal and cervicogenic head-

aches (Simons *et al.* 1999). These temporal headaches are often misdiagnosed with temporomandibular disorders (TMD) that include several clinical problems and involve the masticatory musculature and/or the temporomandibular joint (TMJ) and associated structures. It is, therefore, important to assess the symptoms of the trapezius muscle in piano players and recognize objective signs, perhaps even before they become symptomatic. The proposal of our research is in fact to evaluate the trapezius muscles of pianists by the use of an infrared thermography that measures the body's infrared radiation. The thermal images will give information on the physiopathology of pain in the CCMC of pianists during their performance. Thermal images with a difference of 0.36ºC or greater, left versus right side, are indicative of potentially clinically significant pathology, once it is possible to correlate with the anatomical distribution of pain (Gratt *et al.* 1996).

METHOD

Participants

The experiment was conducted with 7 pianists (3 female and 4 male), ranging from 18 to 27 years old, with classical piano training.

Materials

The thermography was conducted using the camera Flir® A 325. Thermal image assessment was made with a software analysis system (ThermaCAM Researcher Professional) where thermograms were being carried out for further interpretation (Figure 1).

Procedure

The pianists from the Superior School of Music, Porto, were recruited and gave informed consent. The pianists entered the piano classroom for a 15-minute period of acclimatization before capturing the thermal images, and they were given a questionnaire as a screening process for any kind of discomfort or pain regarding the CCMC. The thermal camera was mounted on a tripod and the thermograms were obtained at a dorsal view, anterior view, and lateral left and right view. The musicians also had thermograms made at the rest position before they started playing piano. Regarding the main complaints of the musicians that participated in our study, dorsal and lateral thermograms were made while playing piano in order to infer information on their symptoms in the postural muscles (Figure 1), as a response to a variety of stimuli, during the mechanical task of playing piano. Special attention was

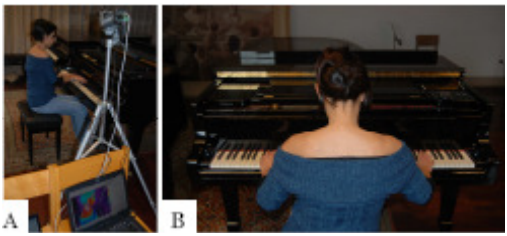

Figure 1. (A) Infrared termography with camera Flir® A 325. (B) Pianist performance.

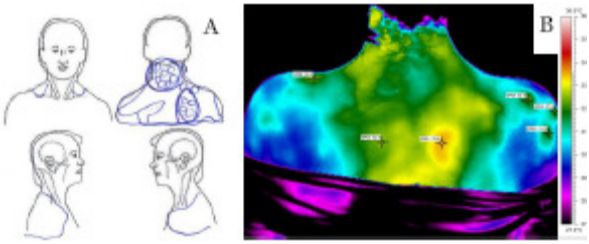

Figure 2. (A) Drawing of a pianist with trapezius muscle related pain. (B) Corresponding thermogram showing increased temperature on symptomatic upper dorsal right side. (See full color versions at www.performancescience.org.)

taken regarding the pianists clothes; the male participants played without their shirts while female participants were asked to play with a sleeveless shirt and their hair tied up. At the end, final thermograms were made to compare quantitative changes of the body temperature, corresponding to certain anatomic structures of the orofacial region.

RESULTS

Infrared thermography was demonstrated to be a reliable diagnostic tool in the study of these pianists. An asymmetric thermal pattern was found regarding the trapezius muscle, which was detected with a higher temperature in the sites where pianists had reported neck and shoulder pain. The five case reports in which the thermograms were made showed coinciding results with the presence of symptomatology of pain (Figure 2), even when the pianists had absence of complaints (Figure 3). A participant reported that “pain in the cervical region on the left side, after one hour of practice,” which drew attention to ergonomics during piano performance (Figure 4).

The implementation of well being programs and micro-breaks can eventually reduce the neck and cervical pain on the right side of the pianist in Fig-

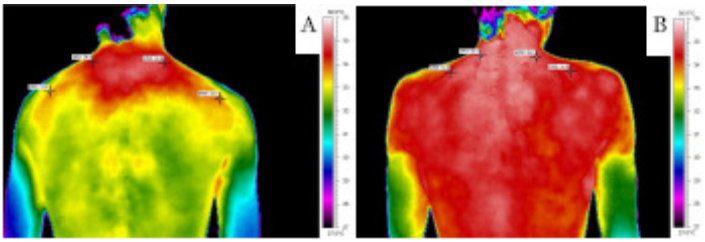

Figure 3. Thermograms of two pianists without pain. Note symmetric thermal patterns.

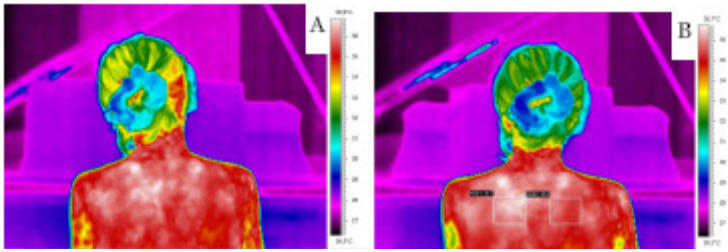

Figure 4. (A) Pianist during musical performance reading her piece. (B) The thermogram shows increased temperature on the symptomatic trapezius left side. (See full color versions at www.performancescience.org.)

ure 5. The perpetuation of pain is common in people who demonstrate symptoms of psychological distress, so it is important to associate and investigate the presence of parafunctional habits, like a pianist who clenches his/her teeth while playing. Oral parafunction was present in this pianist, since it was possible to observe that the initial temperature of the orbicular oris was of 32.4°C right side and 33.3°C left side, and after playing a classical piece, the temperature rose 1.8°C and 1.2°C, respectively (Figure 6). Understanding these factors when studying cervical and orofacial pain is of vital importance since it is consistent with a biopsychosocial model. Piano players, apart from physical requirements with muscle tension, can have stress with changes of emotions regarding the application of a job, where perfection is the limit. Social, cognitive, and behavioral factors can be present in a pianist who studies at a high level international school of arts, with work strain and hours of continuous practice (Figure 7).

It is possible to compare the thermal images of a pianist with reported muscular trapezius discomfort with the asymptomatic side. The implementation of exercise programs with the intention of improving craniocervical mus-

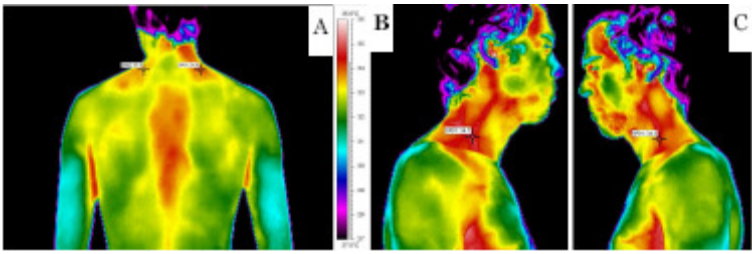

Figure 5. (A) Dorsal view highest temperature on symptomatic trapezius right (34.0°C) compared with trapezius left (33.5°C). (B) Thermal pattern shows that the right sternocleidomastoid muscle presents higher temperature which is coincident with the piano player's pain symptoms. (C) Left view.

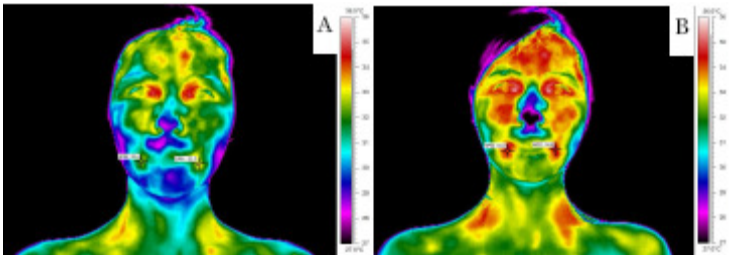

Figure 6. (A) Orofacial thermogram of pianist at rest position. (B) Pianist after playing shows higher temperature values of the orbicular oris muscle, masticatory muscles, and the sternocleidomastoid muscle.

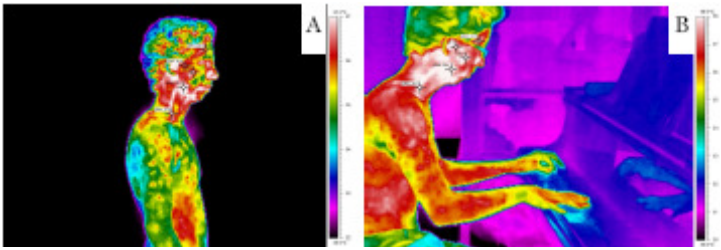

Figure 7. (A) Right lateral view at rest position with masseter muscle (37.2°C), sternocleidomastoid muscle (37.2°C), temporalis anterior muscle (35.9°C). (B) Right lateral view during performance with masseter muscle (38.4°C), sternocleidomastoid muscle (38.2°C), temporalis anterior muscle (37.7°C). (See full color versions at www.performancescience.org.)

cular equilibrium and a correct focus on warm-up techniques should be considered as important factors regarding the general health of a pianist.

DISCUSSION

Thermography can be effective in diagnosing muscular pain, providing a relatively inexpensive and non-invasive imaging diagnostic tool. Future studies should be made with a larger sample, where thermography can be an aid in warm-up techniques, by monitoring the body surface temperature of pianists through time.

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