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THERMO GRAPHICAL METHODS IN HIGHLIGHTING THE MUSCLE STRAIN OF DENTISTS DURING DENTAL TREATMENTS UNDER THE MICROSCOPE

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Abstract: *Thermo graphical knowledge and equipment are very useful in demonstrating the physical overstraining of the dentist`s body. The aim of this study is to show that because of the working position when using the microscope, some areas of the body (especially the shoulders and the back) experience reduced blood flow (isometric muscular contractions), which in time, lead to muscular fatigue, contractions and musculoskeletal disorders. This study relies on thermo graphic techniques to bring evidence of the affected muscles of the dentist`s body , using the FLIR B200 camera, which records the cold and warm areas of the body by detecting infrared radiation that reacts to the blood flow in that particular territory. The red coloured areas on the thermo graphic pictures represent the most overstressed body regions: neck, shoulders, upper back. With the help of thermo graphical knowledge and equipment, the physical overstraining of the dentist`s body can be easily pointed out.*
Key words: *thermo graph, ergonomics, microscope, musculoskeletal disorders.*

1. INTRODUCTION

Musculoskeletal disorders reflect the suffering of the muscles, tendons, joints, inter vertebral discs, peripheral nerves and the vascular system. They represent the effect that occupational activities and medical issues have on the dentist´s body (Alexopoulos et al. 2004), (Andrews & Vigoren, 2002). Up until the present, significant research regarding ergonomic postures while using a dental microscope has been done (Hokwerda et al., 2007), (Rucker & Boyd, 1998). Therefore, the ISO 11226 Standard has been set and it represents a milestone in ergonomic dentistry all over the world. In this study we used thermo graphical methods to evidence the strain that appears on the dentist´s body after some long hours of work behind the microscope.

The results show the importance of adopting healthy ergonomic postures and the significance of movements during the working day (stretching), and the ill-fated consequences of bad working positions.

2. AIM

The aim of this study is to show the areas of the body which experience reduced blood flow (isometric muscular contractions) using thermo graphical data because of the working position behind the microscope, leading to musculoskeletal disorders in time.

This study brings important data which can be used in ergonomic design of the dental equipment, and also in improving the prevention of the musculoskeletal disorders by using ergonomics (mechatronic devices, adequate working posture and sport).

3. METHODS

The notion of thermo graph refers to the measurement of the regional body temperature by detecting infrared radiation.

The temperature recorder (thermograph) is an important tool for medical diagnosis because science has managed to prove that all diseases cause temperature changes in a suffering organ. Some types of disorders lower the temperature in that particular organ, others raise it.

The infrared camera we used was FLIR B200 which is based on settings that sense and record on tape the cold and warm areas of the human body by detecting infrared radiations which react to blood flow. The FLIR B200 camera measures temperature values between -20ºC and +120ºC. The incorporated digital camera (1.3 Mpixels) offers the possibility to easily observe and evaluate the picture (flirb200.com.2010).

With the help of the infrared camera we took a set of pictures which give the possibility to analyze the body temperature distribution and at the same time the increase of muscle contraction.

This study underwent three shooting sessions of the same doctor (male). He was sitting in an ergonomically correct position while using the dental microscope. The patient was positioned horizontally. The three treatment sessions lasted each approximately two hours, during which the dentist maintained his posture unchanged. Near the end of the two hours of treatment, the dentist performed stretching exercises for one minute. After that, he returned in the ergonomic working posture and finished the dental procedures on the patient.

The infrared pictures were taken every 10 minutes from the beginning of the treatment until the end.

The conditions that had to be fulfilled to assure the accuracy of the study were the following:

- Low surrounding temperature, to avoid errors in measuring the real body temperature (the air was renewed, the air conditioner was turned on and the lights were turned off).
- The dentist´s position was maintained for a longer period of time
- The dentist posed shirtless so that the body temperature could be most accurate.

4. RESULTS

The pictures were taken in the correct sitting posture at the microscope and they reflect precisely the muscle areas that undergo stress and strain during the dental procedures.

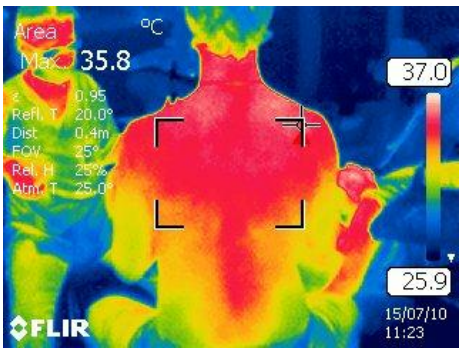

Fig. 1. Working in an erroneous posture

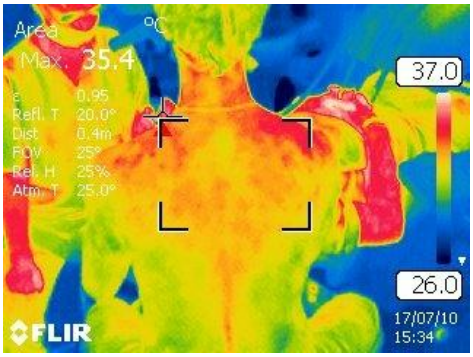

Fig. 2. Working in an ergonomic posture after one minute of stretching exercises

The intense red-coloured surfaces represent high temperatures, where the muscles are contracted, and the surfaces coloured in yellow, green, blue, show the cold parts of the body.

The three shooting sessions brought into light the fact that after only 5 minutes of work, the muscles in the neck area become fatigued. After half an hour the whole shoulder area and the upper back are very strained. After 90 minutes the lower back is also affected by overload.

It is very well demonstrated that after one minute of stretching exercises in the upper body areas, the muscles are relaxed and the blood flow is renewed. The intense red colour vanishes and is replaced with the yellow colour which stands as evidence for rested, relaxed muscles.

5. CONCLUSION

With the help of thermo graphical knowledge and equipment, the physical overstraining of the dentist´s body can be easily proven.

- The thermo graphical method is an objective way of showing the overstressed body areas during the working hours of dentists while using the microscope.
- The occupational factors play a very important role in the activity of dentists. The dentist is subjected to a great variety of both physical and psychological issues which are caused or worsened by the profile of their activity.
- Adopting an ergonomically correct working posture and embracing mild gymnastic movements stand as evidence for a long, healthy professional life.
- An erroneous working position and the lack of exercising on a regular basis lead to overload, muscle contraction and musculoskeletal disorders.
- The avoidance of muscle strain by using ergonomic postures brings a great deal of benefits: increase in productivity and treatment quality, decrease of fatigue and prevention of musculoskeletal disorders.

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