Thermography and orofacial pain

by J. M. MUMFORD and J. B. MILES

University of Liverpool and Centre for Pain Relief, Regional Centre for Medical and Surgical Neurology, Liverpool (U.K.)

SUMMARY. Thermographic investigation of orofacial pain is of some diagnostic value in certain cases including anaesthesia dolorosa and ice-cream headache. It may also be significant for unravelling the aetiology of anaesthesia dolorosa. At this stage it seems unlikely to be useful for intraoral conditions.

Key words: anaesthesia dolorosa; causalgia; orofacial pain; thermography.

INTRODUCTION

Although the face is readily **available for** diagnostic procedures, and the mouth only a little less so, there are still problems in diagnosing where thermography might be helpful. The Philips Medical Thermograph (Thermoscan) has been used in a preliminary investigation of these. The equipment is specially designed for medical application and is safe, painless and non-invasive[2]. It also fits well into a dental surgery. The mobile camera has both pan and tilt, and these facilities arc supplemented by the various movements and adjustments that are possible with the dental chair. In addition, the patient can be made comfortable, is well supported and stays still. Gautherie et al.[1] have drawn attention to the need for accurate repositioning of patients during intermittent investigations, and the dental chair facilitates this. Also, since the face is exposed, there is not the same problem of the tissues having to reach the ambient temperature after clothes have been removed as, for example, in mammography.

The equipment provides a visual display on an oscilloscope as well as photographs on Polaroid film. These arc in colour or black and white, and can be taken either separately or simultaneously. In this research, the cold areas were represented as black; the hot areas as white; but an inverted image is also obtainable as an alternative if this is preferred. It is also possible to add a line to the oscilloscope display and the temperature along this line is displayed as a thermal profile. A technical snag is that the thermal profile cannot always be brought clear of the picture, as shown in the following cast.

FRONTAL SINUS HEADACHE

This patient had a left frontal sinus headache of several days duration and the area did seem slightly colder as judged by the colour (Fig. 1), but the thermal profile is the same on both sides of the midline (Fig. 2). The small amount of colour change shown here is presumably unreliable. The thermal profile trace is superimposed on the picture in Fig. 2, so it would be helpful if a mechanism were available to move this trace independently.

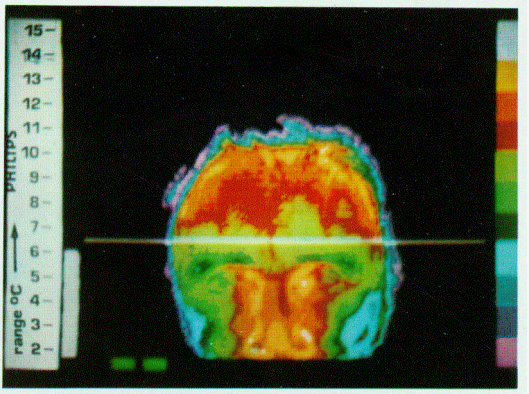

Fig. 1. Left frontal sinus headache with a questionably lower temperature.

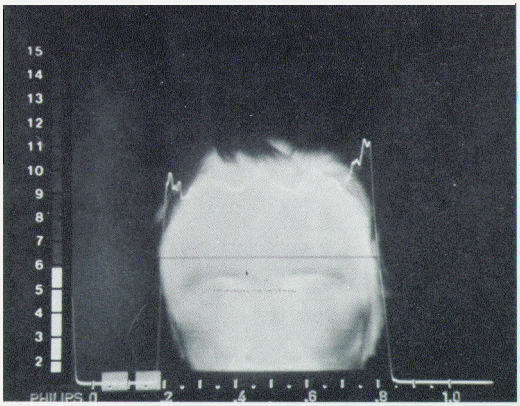

Fig. 2. Same case as Fig. 1. The thermal profile is the same on both sides of the midline.

ICE CREAM HEADACHE

When some people eat cold ice cream or drink iced drinks they develop a pain in the forehead. Thermography seems very suitable for investrgating this as seen in Figs. 3A and B. The black area over the patient's mouth in Fig. 3A is a block of ice cream. He developed a pain in the middle of his forehead and the temperature fall can be clearly seen by comparing the two figures. Using the thermal profile facility the black and white photographs also showed this fall in temperature. Further research is proceeding on the problem of ice cream headache.

MASTICATORY DYSFUNCTION SYNDROME

Extraction of teeth and irregular arrangement of teeth are factors in this condition but it is now accepted that the most important feature is muscle tension associated with stress. Pain occurs over the temple, masseter muscle and the angle of the jaw, but is most pronounced about a cm in front of the temporomandibular joint [7]. Radiography does not help much and thermography seemed worth trying.

A comparison of the two sides is possible (Fig. 4) and is greatly assisted by the facility for obtaining a thermal profile. The female patient shown in Fig. 4 was able to provoke the pain but the thermal profile retained its bilateral symmetry (Fig. 4B).

It is obvious that the two areas concerned, the right and left temporomandibular joints, are badly placed to be scanned simultaneously so the problem arises of positioning the patient to obtain comparable scans of the right and left sides. Figs. 5A and B arc very similar, but it is not possible to draw any conclusion about the small differences over the right and left joints.

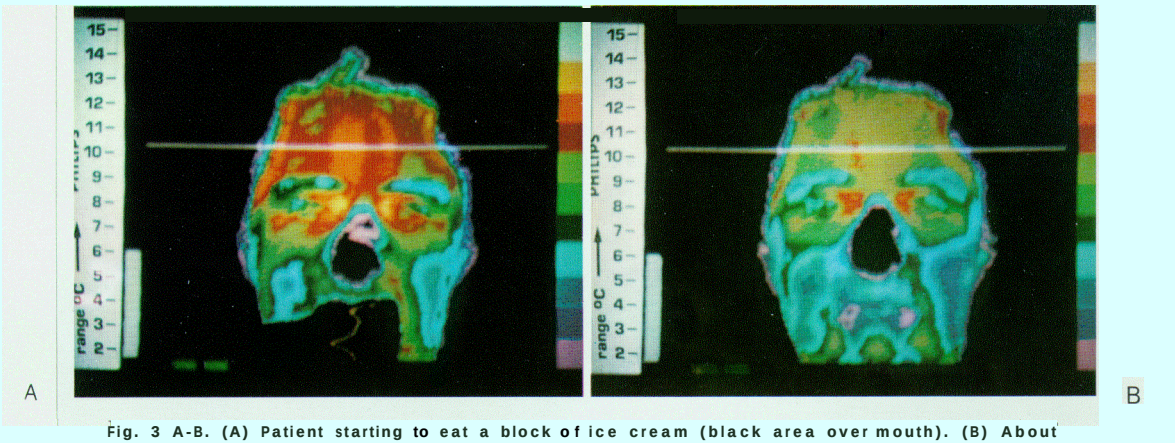

Fig. 3 A-B. (A) Patient starting to eat a block of ice cream (black area over mouth). (B) About hall a minute later. The patient reported pain in the middle of the forehead and the thermogram taken at that time shows that the area has cooled through approximately 1°C.

VASCULAR CHANGES

To find if changes in vascular pressure would have any effect, the facial artery was

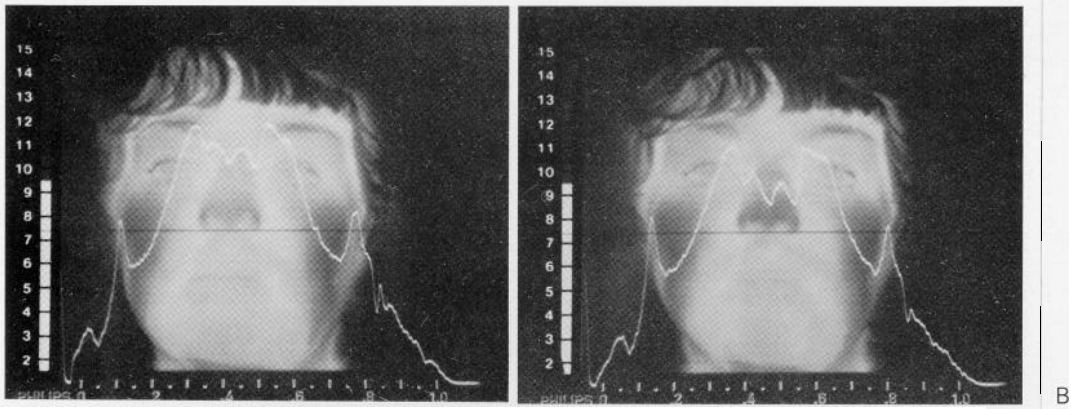

Fig. 4 A-B. (A) Female patient suffering from masticatory dysfunction pain in the face about 1 cm in front of the right temporomandibular joint. (A) Before pain. (B) After she provoked the pain. In each case the thermal profile was the same on each side of the midline.

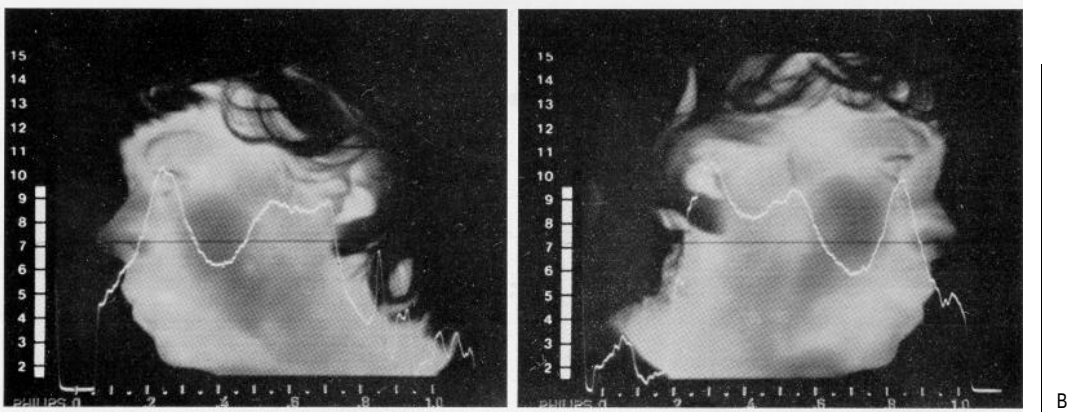

Fig. 5 A-B. Same case as Fig. 4. The profile is somewhat different on the two sides but it is not possible to draw a conclusion.

compressed by the thumb at the lower border of the mandible for one minute. The considerable effect is shown in Fig. 6. The thumb is seen in place in the left thermogram. On removing it, the rise in temperature is obvious. Thermographic equipment should be readily available for helping to diagnose suspected cases of facial migraine. Migraine has been investigated by Lance et al.[3, 4, 5].

IDIOPATHIC TRIGEMINAL NEURALGIA

No success has been found with several patients suffering from this condition, including two who were able and willing to provoke pain. Thermograms of these were no different before and immediately after the pain. This lack of success was expected.

ANAESTHESIA DOLOROSA

This patient had suffered from symptomatic trigeminal neuralgia 18 years earlier; it was treated by surgery which failed to remove the pain or totally anaesthetise the face. Alcohol injections were then given and these succeeded in removing the original pain but were soon followed by the development of anaesthesia

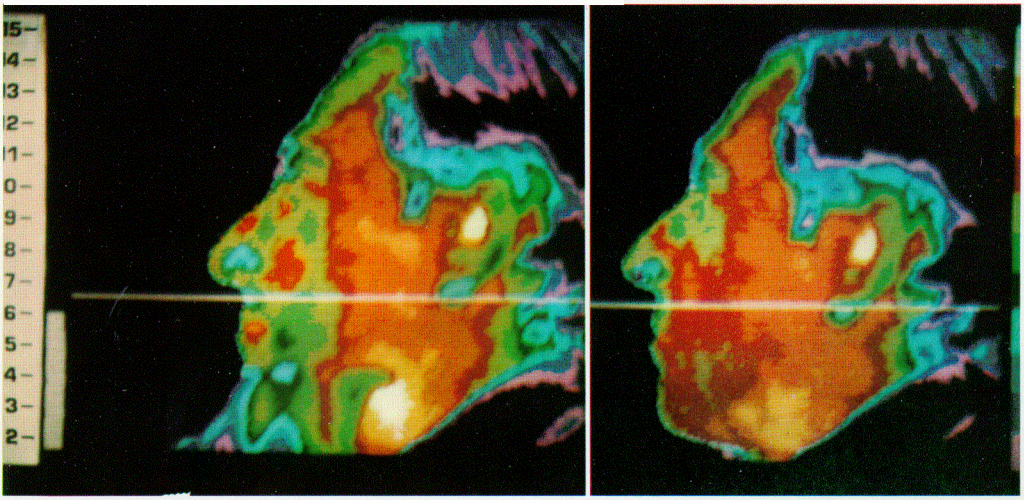

Fig. 6 A-B. (A) Pressure on the facial artery as it crosses the lower border of the mandible caused the temperature to fall. (B) Releasing the thumb allowed the temperature to return to normal.

dolorosa. This was a burning pain involving the left half of the forehead and left eyelids. At the time these thermograms were taken she had suffered the burning pain constantly for 2 ½ years with severe exacerbations lasting for a whole day. She described these as so intense that she contemplated suicide. The colour photograph (Fig. 7) shows the raised temperature in exactly- the area indicated by the patient. The colour scale indicates a raised temperature of approximately l.l°C. Note that she still had some sensation in the mandibular division on the left side.

The black and white photograph thermal

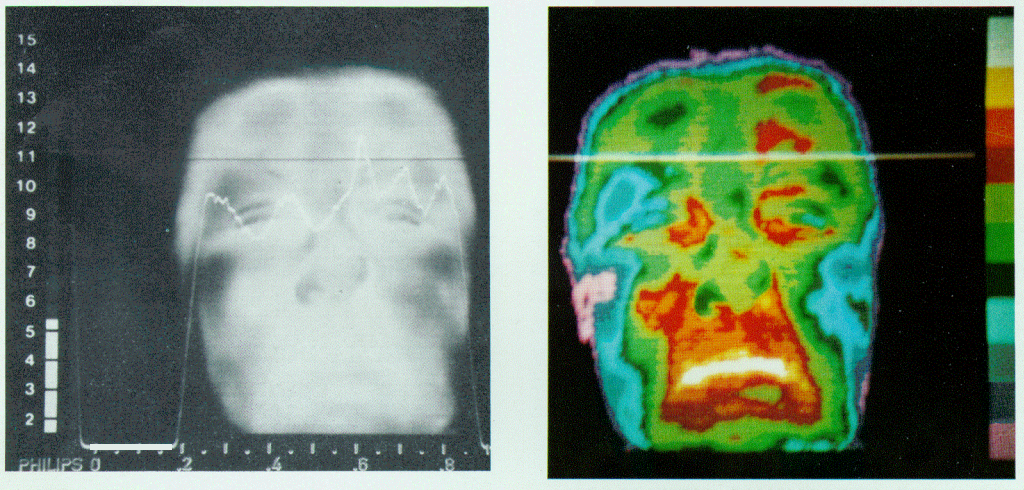

Fig. 7 A-B. Anaesthesia dolorosa affected the left orbit and forehead. The thermal profile (A) and colour arrangement (B) both indicate that the area affected has a temperature about 1.1 °C higher than the opposite side of the midline.

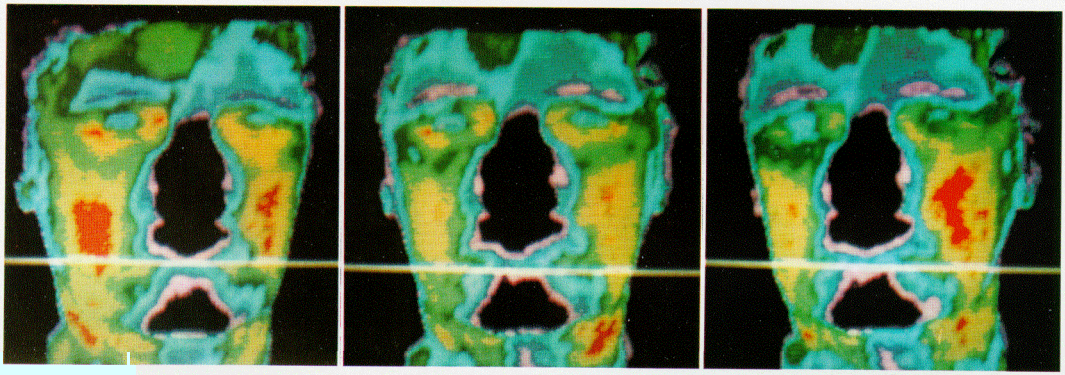

Fig. 8. Artifactual colour changes related to the head being in three slightly different positions.

trace (Fig. 7) shows a raised temperature similar to that on the colour thermogram.

The above results were obtained irrespective of the head positioning. This is important because it is possible to obtain false results by small movements of the head (Fig. 8). The viewing angle and emissivity of curved anatomical surfaces are important in thermographic analysis and have been considered by Martin and Watmough [6].

Anaesthesia dolorosa is worth further investigation, and it is appropriate to speculate that part of the patient's distress in this condition might be alleviated if thermographic investigation could be used to demonstrate to him (her) a raised temperature as a partial explanation of the problem. The therapeutic potential of induced cooling must also be considered and investigated.

INTRAORAL PROBLEMS

The mouth is largely shielded by the lips and cheeks, and the tongue is very mobile. Also, the area involved is often small so that it would be necessary to focus onto a small area. The equipment used in this investigation could only focus down to the area shown in Fig. 3, and distortion is produced by the investigator's hands. The method does not seem suitable for intraoral use in its present form, but attempts are being made to investigate intraoral tumours in Japan [8].

For investigating intraoral conditions via the face, the face itself would obscure any underlying temperature changes. A male patient had a retained molar root with an acute abscess at the upper border of the alveolar ridge (Fig. 10) but there was no noticeable change in the thermogram (Fig. 11).

This pattent was also used to illustrate an artifactual effect. So many patients handle or touch their faces that it is essential to say, « Do not touch your face when you show me where the pain is ». Fig. 12 shows the effect in black and white and in colour of the patient handling the face to indicate the site of pain some minutes prior to thermography. However, there is not always a discernible effect.

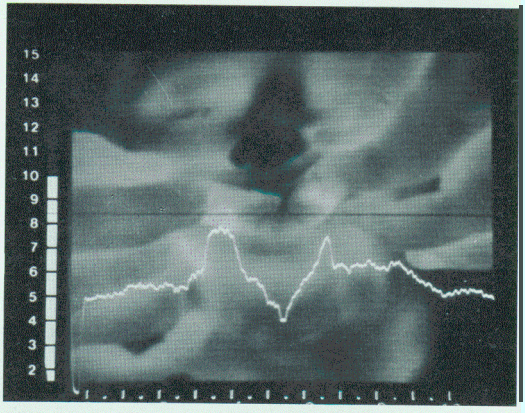

Fig. 9. Intraoral thermogram seems of little value.

AETIOLOGICAL IMPLICATIONS

There are many obscure and even dubiously organic pain syndromes to be found about the head and neck. There is no doubt that the recognition of abnormality in inve-

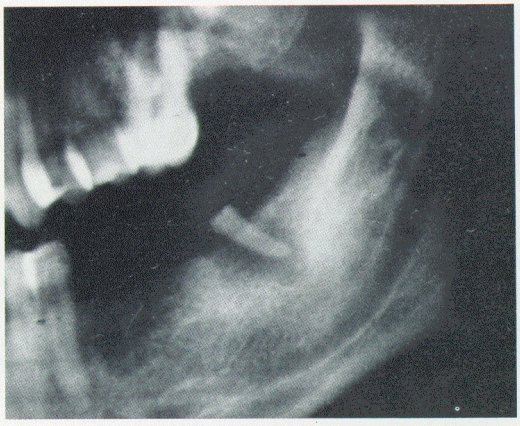

Fig. 10. Radiograph of a patient with an acute abscess in the lower jaw associated with a retained tooth root.

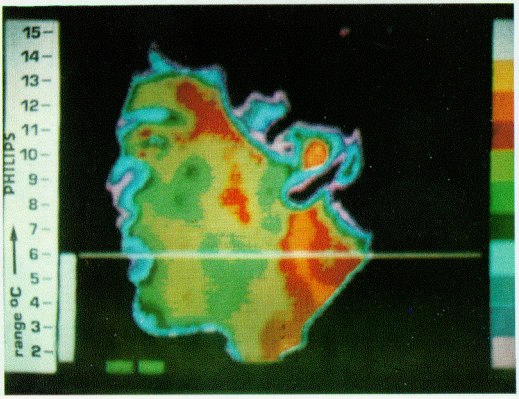

Fig. 11. Same case as Fig. 10, showing no recognisablc effect on the facial thermogram.

stigation of such a syndrome provides in itself a value in persuading the clinician of its likely organic nature.

In the extremely refractory condition of anaesthesia dolorosa, any aid to the elucidation of a cause must be welcomed. It is difficult to avoid acknowledging the relevance of such a temperature change at the site of pain as has been described. The pain seems to be a consequence of physical injury to the trigeminal system and does not occur spontaneously. It has occurred after injury to the peripheral nerve ganglion or sensory root destruction.

In the context of a possible relationship between anaesthesia dolorosa and skin temperature change, we have been particularly interested in the blushing phenomenon seen during trigeminal sensory root electrical stimulation. This is undertaken immediately prior to root destruction by radiofrequency coagulation [9] and is often so specific a phenomenon as to guide the destruction to the limits of the particular division in which the pain is felt. An explanation for this apparently antidromic response has been that sympathetic fibres to the vessels of the skin travel with the trigeminal nerve along the whole of its path. Could it be that anaesthesia dolorosa is a result of trigeminal sympathetic discharge or over-activity? Could it in fact be a causalgia-

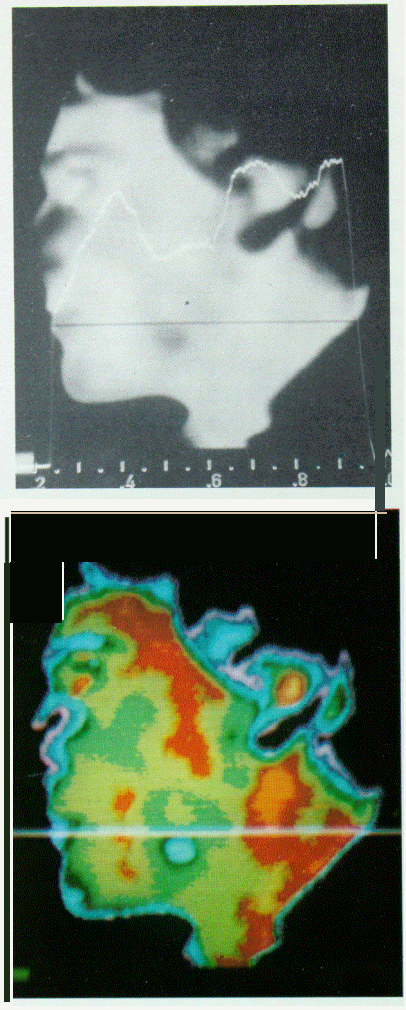

Fig. 12. Same case used to demonstrate artifact due to patient handling his face.

like syndrome affecting the face? Clearly further investigation of these possibilities would be of interest and might also prove clinically helpful.

The strength of the correlation between temperature change and the site of pain needs to be estabiished by further study. Then the value of various means of modifying this temperature, such as by simply cooling, or even perhaps by the oral ingestion of ice cream or by temporary sympatholisis, can be assessed. A further practical use for facial thermography occurs to us. One of the remaining problems of radiofrequency coagulation of the trigeminal sensory roots is that during stimulation the patient is awake but anaesthetised during coagulation. For further testing and stimulation the patient is again awakened and this pattern is repeated many times with a definite tendency for confusion due to accumulation of anaesthetic before the end of the procedure. It could be that if thermography during stimulation proved to be sufficiently accurate then there might not be need for the patient to be repeatedly awakened.

Acknowledgement

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