All these variables except number 3 determine the amount and rate of transfer of energy through the skin to the thermal receptors. The standardisation of this energy transfer is a basic prerequisite for techniques of thermal threshold measurement. Their failure to control these variables invalidates any conclusions on the reliability or otherwise of a single component, namely the psychophysical aspect, of the techniques.

In addition to the technical difficulty the authors choice of subjects further compounds the problem. In diabetic patients thermal thresholds and other parameters of nerve function vary with blood glucose levels,¹⁰ introducing another variable.

Their definition of "static" and "dynamic" methods of application of thermal stimulation is misconceived; dynamic stimuli are applied in both techniques (for example, in the Sensortek method, the temperature of the thermal receptors will alter with time when a thermode of different temperature is applied to the skin surface). The authors' statement, in the discussion, that differences between these two techniques are due to the nature of the stimulus (static versus dynamic) has no conceptual or rational basis.

In conclusion, the authors have not assessed the merit of the two psychophysical procedures, rather they have compared two techniques for thermal threshold testing, which incorporate among many other variables, two different psychophysical procedures. Their conclusion as to the efficiency or otherwise of the psychophysical aspect of the two techniques is invalid.

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- 1 Levy D, Abraham R, Reid G. A comparison of two methods for measuring thermal thresholds in diabetic neuropathy. *J Neurol Neurosurg Psych* 1989;52:1072-7.
- 2 Lele PP. Relationship between cutaneous thermal thresholds, skin temperature and cross sectional area of the stimulus. *J Physiol (London)* 1954;126:191-205.
- 3 Kenshalo DR. Psychophysical studies of temperature sensitivity. In: Neff WD ed. *Contributions to sensory physiology*. Vol 4. New York, London: Academic Press, 1970:19-74.
- 4 Molinari HH, Greenspan JD, Kenshalo DR. The effects of rate of temperature change and adapting temperature on thermal sensitivity. *Sens Processes* 1977;1:354-62.
- 5 Hensel H. *Thermal sensations and thermoreceptors in man*. Illinois, Springfield: Thomas, 1982.
- 6 Jamal GA, Hansen S, Weir AI, Ballantyne JP. Reproducibility of thermal sensation threshold measurements. *J Clin Physiol Physiol Measurement* 1986;7:391-2.
- 7 Jamal GA. A quantitative study of thermal sensation in man. PhD thesis, University of Glasgow 1986.
- 8 Cohen ML. Measurement of the thermal properties of human skin. A review. *J Invest Dermatol* 1977;69:333-8.
- 9 Stoll AM. Thermal properties of human skin related to nondestructive measurement of epidermal thickness. *J Invest Dermatol* 1977;69:328-32.
- 10 Delaney C, Westerman RA, Horowitz M, Pratt A, Kent P. Effects of blood glucose on small nerve fibre function in diabetes mellitus. *Proc Aust Physiol Pharmacol Society* 1989; 20(1):11.

Levy et al reply:

Dr Jamal and his colleagues argue that we are unable to comment on the relative advantages

of the two algorithms used for testing thermal sensation as we did not control for a number of confounding variables that influence the rate of heat transfer through skin. This was not the aim of our study; we set out to compare, in a routine clinical setting, two commercially available methods. The algorithms used were one of many differences between the two methods. We simply made the point that in screening studies the choice of a suitable apparatus need not be determined by the psychophysical basis of the test; this is evident from the similar coefficients of variation of all comparable methods.

Dr Jamal's long excursion into the factors influencing transfer of thermal energy is irrelevant since control of stimulus-related factors other than skin temperature and site would have materially altered the methods from those which are commercially available, and does not affect our proposition that precision and reproducibility are related neither to the choice of apparatus nor to the algorithm used. It is our contention that the high variability of all clinical psychophysical methods owes more to "central processing" than to the standardised presentation of the stimulus.¹ Our experience with the Glasgow thermal testing method (as used in the Medelec instrument) showed that it was no more reproducible than three other methods, a finding which is at variance with Dr Jamal's claim of "negligible" intraindividual variability.²

Some of the technical points raised by Dr Jamal apply equally to both methods, so we are unclear how they would affect a comparative study (for example, the surface skin temperature, the lack of calibration of heat transfer at the thermode, the thermode application pressure, and the fact that both methods involve application of uncontrolled tactile stimuli). As to the question of thermal neutrality, Kenshalo³ found that it could be achieved over a wide range of temperatures, 29-37°C; Dr Jamal's advocacy of the use of a basal temperature of 35°C is therefore arbitrary and in addition quite impractical and time-consuming to achieve in diabetic patients, many of whom have peripheral small- and large-vessel disease. The criticism of our use of diabetic patients on the basis of the known effects of ambient blood glucose levels on nerve function is misplaced in a paper devoted specifically to a clinical study of diabetic patients. In addition, in a large group comparison, the effects of blood glucose variation can also be discounted.

A study comparing algorithms alone with control of all stimulus-related factors has yet to be done and remains a formidable challenge. We are yet to be convinced that strict attention to details of presentation of the thermal stimulus is relevant to the testing of thermal sensation in untrained subjects in clinical settings.

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- 1 Fagius J, Wahren LK. Variability of sensory threshold determination in clinic use. *J Neurol Sci* 1981;51:11-27.
- 2 Levy DM, Abraham RR, Abraham RM. A comparison of four methods for measuring thermal thresholds in diabetes. *Diabetic Med* 1987;4:591A.
- 3 Kenshalo DR. Psychophysical studies of temperature sensitivity. In: Neff WD, ed. *Contributions to sensory physiology*. Vol 4. New York, London: Academic Press, 1970:19-74.

Responses to temperature in primary hypothyroidism

Using standard neurophysiological criteria Beghi *et al*¹ made a definite diagnosis of polyneuropathy in 72% of 39 consecutive outpatients with primary hypothyroidism. They took care to maintain skin temperature at 32-34°C throughout these studies, but do not comment upon core temperatures.

It is well recognised that hypothyroid patients may be hypothermic.² In 1983 we found similar abnormalities in peripheral nerve conduction in hypothyroid patients.³ We also corrected skin temperature in these studies. Central conduction velocity in the visual pathways, represented by latency of the visual evoked potential, was also slow. These abnormalities were reversed by thyroxine. However, we also demonstrated that correction of hypothermia by central warming led to a rapid improvement of both of these neurophysiological parameters in untreated patients.

Beghi *et al* state that using physiological criteria the prevalence of polyneuropathy in hypothyroidism is 718 cases per 1000. Our data suggest, however, that these abnormal conduction velocities are, in many cases, appropriate physiological responses to a reduced core temperature rather than due to pathology of the peripheral nerves.

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- 1 Beghi E, Delodovici M, Boglium G, *et al*. *J Neurol Neurosurg and Psychiatry* 1989;52: 1420-3.
- 2 O'Malley BP, Davies TJ, Rosenthal FD. TSH responses to temperature in primary hypothyroidism. *Clinical Endocrinology* 1980;13: 87-94.
- 3 Abbott RJ, O'Malley BP, Barnett DB, Timson L, Rosenthal FD. Central and peripheral nerve conduction in thyroid dysfunction: the influence of L thyroxine therapy compared with warming upon the conduction abnormalities of primary hypothyroidism. *Clinical Science* 1983;64:617-22.

Management of intraventricular haemorrhage secondary to ruptured arteriovenous malformation in a child with von Willebrand's disease

The recent report by Osenbach *et al*¹ about a 13 year old girl with von Willebrand's disease and an intracranial arteriovenous malformation raises some important issues.

Their patient developed intraventricular and subarachnoid haemorrhage following minor trauma. Although a bleeding diathesis was diagnosed, a structural vascular lesion was suspected and subsequently confirmed by angiography. The occurrence of an arteriovenous malformation in a patient with von Willebrand's disease is of interest in view of the possible association of this bleeding disorder with various cardiovascular abnormalities, including mitral valve prolapse,² arterial aneurysms,³ gastrointestinal angiodysplasias,⁴ and telangiectasias.⁵

It has been suggested that this association represents an underlying mesenchymal disorder of von Willebrand's disease, resembling the heritable connective tissue disorders.^{2,4} Abnormalities of the mesenchym derived extracellular matrix may be the common ground of, among others, von Willebrand's disease, Ehlers-Danlos syndrome, polycystic