Vibration Sensation in Leprosy Patches

TO THE EDITOR:

Demonstration of impaired sensation in a skin patch is a crucial step in the diagnosis of leprosy. In clinical practice, this normally relies on testing of light touch, pain, and possibly temperature sensations, usually in a qualitative manner. Efforts have been made to develop a more quantitative or objective method of assessment using tests of pressure sensation, temperature sensation, and autonomic function ([1, 6, 9]), but these are not in widespread clinical use. Vibration sense is thought to contain components from superficial and deep sense organs ([2]). Quantitative assessment of vibration sense in leprosy using a biothesiometer has demonstrated that it is lost in parallel with touch sensation as determined by Semmes-Weinstein monofilaments (Hammond, C. and Klenerman, P., unpublished data). It was therefore postulated that it might be possible to record, in a quantitative manner, small changes in sensory function in leprosy patches. This study was designed to test this hypothesis.

METHODS

Eighteen subjects with leprosy were selected from patients at the Dr. Bandorawalla and Sassoon Hospitals, Pune, India. The biothesiometer (The Figure) was used to assess vibration sensory thresholds in three places: a) the patch itself, b) a portion of adjacent normal skin, and c) an identical unaffected point on the opposite side of the body. Testing was done by resting the probe of the instrument gently on the skin and increasing the amplitude of vibration until the patient first felt sensation. The process was repeated twice and the mean of the three values recorded. Ten patches (and their adjacent and contralateral uninvolved areas) on patients with skin diseases other than leprosy (e.g., psoriasis, eczema, vasculitis) were assessed in a similar manner to act as controls.

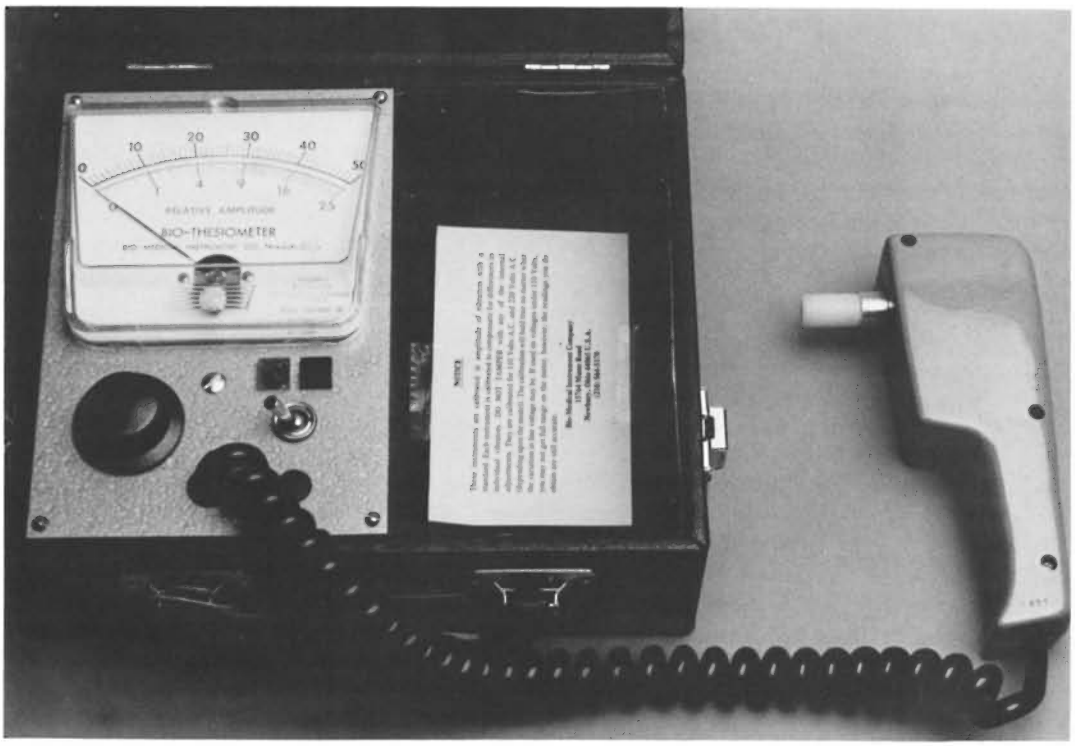
RESULTS

Forty-two patches were measured on 18 patients (15 males, 3 females; average duration of disease, 4 years); their sensation thresholds are shown in The Table. Use of the paired *t* test demonstrated a significant increase in the threshold of patch sensation compared to that in adjacent skin ($p < 0.001$). A significant difference between patch threshold and that on the opposite side of the body was also found ($p < 0.001$). There was no significant difference in sensation between uninvolved skin adjacent to the patch and that on the contralateral side.

Controls without leprosy showed no significant differences between patches and normal adjacent or contralateral skin (average threshold difference = 0.01 microns).

DISCUSSION

Vibration sensation in the skin arises from excitation of Pacinian and Meissner's corpuscles ([5]), although it is thought to comprise a deep component ([2]). It is impaired in a number of diseases, and in common clinical practice is assessed by the use of a low-frequency tuning fork. The biothesiometer was invented in 1932 by Gray ([3]) and is an instrument capable of delivering a vibratory stimulus of variable amplitude. (A similar device of variable frequency rather than amplitude had been used by Tilney 3 years earlier in the investigation of Helen Keller.) Gregg ([4]) demonstrated that the biothesiometer would allow relative mea-



THE FIGURE. Bio-thesiometer (Bio-Medical Instrument Co., Newbury, Ohio, U.S.A.) used in the study.

surement of vibration threshold within 1% and absolute determinations within 5%. It is estimated that the vibration of a tuning fork is equivalent to a stimulus of approximately 2 to 4 microns, while the biothesiometer can accurately deliver stimuli well below this value ([2]). (This has been confirmed by us in a small series of normal patients.) Thus, the machine not only provides a quantitative, reproducible measurement of vibration sensory threshold but, also, changes in that threshold which would be considered "subclinical," if using a standard tuning fork, may be noted.

This study demonstrates that significant threshold differences are present in the skin of leprosy patches compared to those of adjacent skin and skin on the other side of the body. The largest differences were found on the back, where thresholds are normally highest, with smaller differences on the upper and lower limbs. Two patches were tested on the face and these did not show reduced sensation in comparison to uninvolved areas. This is a common difficulty in sensory testing of this part of the body, and is thought to be due to the rich innervation of facial skin ([8]). In this experiment, transmission of vibration by bone may also complicate testing ([8]). Practical problems associated with the use of the biothesiometer have been highlighted recently by Williams and colleagues ([10]).

Our study was mainly restricted to patients who had already been diagnosed and treated for some time (average 2.5 years). Thus, it is possible that the loss of sensation

THE TABLE. *Patch sensory thresholds and those of control areas.*

Site	No. patches	Mean threshold (microns)		
		Patch	Adjacent	Opposite
Upper limb	14	1.36	0.82[a]	0.92[a]
Lower limb	12	2.35	1.05[a]	1.11[a]
Torso	14	3.15	1.66[a]	1.44[a]
Face	2	1.81	1.73	2.55
Total	42	2.26	1.21[b]	1.23[b]

[a] Significant difference from patch ($p < 0.025$) by paired t test.

[b] Significant difference from patch ($p < 0.001$) by paired t test.

detected by the biothesiometer might only be a relatively late change. However, differences in threshold were also noted on those patients who were either untreated or who had been treated for 2 months or less. It is suggested that to investigate this further, loss of vibration sense should be assessed in parallel with other nerve functions (preferably in a quantitative manner) in patients when they first present.

Studies have shown that up to 77% of clinically unaffected nerves in leprosy may show marked impairment of nerve conduction ([7]). Thus it is of obvious importance to attempt to improve clinical testing in order to assess more subtle levels of nerve damage. This is not only of value in diagnosis but also in follow-up, assessment of treatment and reactions.

We have shown elsewhere that the biothesiometer may be of value in the assessment of insensitive feet and their susceptibility to ulceration and tarsal disintegration (Hammond, C. and Klenerman, P., unpublished data and Klenerman, P., Hammond, C. J., and Kulkarni, V., submitted for publication). It is suggested on the basis of this study that it might also be of use in the diagnosis of the anesthetic patch.

—Paul Klenerman, B.A.
—Christopher Hammond, B.A.

Oxford University Medical School
Oxford, England

Acknowledgments. We would like to thank Dr. Jal Mehta (Hon. Pres.) and all of the staff at the Dr. Bandorawalla Leprosy Hospital, Pune; Dr. Sunil Tolat, Dermatology Department, Sassoon Hospital, Pune; and Dr. T. J. Ryan, The Slade Hospital, Oxford, for their help and support with this project. We would also like to thank Dr. Colin McDougall and Prof. L. Klenerman for providing us with ideas, equipment, and encouragement.

We are grateful for grants from LEPRA, the *Journal of Bone and Joint Surgery*, St. Francis Leprosy Guild, Medical Defence Union, Anglo-American (Zimbabwe) and the Oxford University Medical School.

REFERENCES

1. Chattopadhyay, S. P., Bonsa, P. C. and Rathore, B. S. Value of pilocarpine test in early diagnosis of leprosy. Indian J. Lepr. **56** (1984) 877–883.
2. Fox, J. C. and Klemperer, W. Vibratory sensibility; a quantitative study of its thresholds in nervous disorders. Arch. Neurol. Psychiat. **48** (1942) 622–645.
3. Gray, R. C. Quantitative study of vibration sense in normals and pernicious anemia cases. Minnesota Med. **15** (1932) 674. (Quoted in Ref. 4).
4. Gregg, E. C. Absolute measurement of vibratory threshold. Arch. Neurol. Psychiat. **66** (1951) 403–411.
5. Iggo, A. Cutaneous sensory mechanisms. In: *The Senses.* Barlow, H. D. and Mollon, J. D., eds. Cambridge: Cambridge University Press, 1982, pp. 389–408.
6. Jain, G. L., Pasricha, J. S. and Guha, S. K. Minimum temperature felt as hot (MTH)—a new concept for grading the loss of temperature sensation in leprosy patients. Int. J. Lepr. **53** (1985) 206–210.
7. McLeod, J. G., Hargrave, J. C., Walsh, J. C., Booth, G. C., Gye, R. S. and Barron, A. Nerve conduction studies in leprosy. Int. J. Lepr. **43** (1975) 21–31.
8. Pfaltzgraff, R. E. and Bryceson, A. Clinical leprosy. In: *Leprosy.* Hastings, R. C., ed. Edinburgh: Churchill Livingstone, 1985, pp. 134–176.
9. Weddell, A. G. M., Jamison, D. G. and Palmer, E. Recent investigations into the sensory and neurohistological changes in leprosy. In: *Leprosy in Theory and Practice.* Cochrane, R. G. and Davey, T. F., eds. Bristol: John Wright & Sons Ltd., 1964, pp. 205–220.
10. Williams, G., Gill, J. S., Aber, V. and Mather, H. M. Variability in vibration perception threshold among sites; a potential source of error in biothesiometry. Br. Med. J. **296** (1988) 233–235.