Preliminary data on VibraTip®, a new source of standardised vibration for bedside assessment of peripheral neuropathy

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Abstract

Testing vibration sense is a recognised component of neuropathy assessment. One hundred consecutive patients attending diabetic annual review and podiatry clinics were enrolled in a study to compare a 10 g Semmes–Weinstein monofilament and a 128Hz tuning fork with VibraTip®, a novel, key-fob-sized source of fixed amplitude vibration for the identification of peripheral neuropathy. Patients were tested sequentially with the three devices in random order on either the left or right foot. Of the 100 patients 55 felt both the vibrating tuning fork and VibraTip, the remaining 45 patients felt neither. Pressure from the 10 g monofilament was perceived by 53 patients of whom 51 also felt VibraTip®. VibraTip® proved a practical, hygienic, simple, rapid and very specific test of the integrity of vibration sense, easily controlled with a null stimulus, that appeared highly engaging for patients. As the utility of testing for neuropathy is no more or less than a strategy to persuade patients to change their behaviour, VibraTip® may be a useful addition to sensory nerve function testing at the clinical interface.


Key words: neuropathy, pallesthesia, vibration

Introduction

Loss of the ability to feel vibration is increasingly prevalent with advancing age and, together with paraesthesia and loss of proprioception, is also characteristic of large fibre neuropathy. The latter is significantly associated with risks of tissue damage and cardiovascular risk factors such as hypertension, dyslipidaemia, obesity, male sex and smoking.¹² While testing vibration sense is universally taught to medical undergraduates as an integral component of nervous system clinical examination, its principal utility in the diabetic clinic is as an educationally compelling demonstration to patients that they are at risk and may need to modify their behaviour accordingly. The concept that disordered sensory nerve function may continue to provide ‘feeling’ and even pain, but that these sensations no longer protect from tissue damage sustained by climbing into a bath that is too hot or wearing ill-fitting shoes, for example, is a difficult and complicated message to get across and rehearse often enough to make a difference.

Tuning forks applied directly to the skin have been used to test the integrity of vibration sense since the beginning of the 20th century³⁴ but there is little agreement about the optimal frequency of vibration⁶ or the method for making the tuning fork vibrate in the first place. Tuning forks are cold to the touch and require pressure to impart vibration, both of which incur variability and impair specificity, additionally their size makes them cumbersome to carry around and difficult to use without inappropriate cueing. Tuning forks left out on the wards have a
propensity to go missing. Once locked away, they are no longer available at the point of use.

More specialised equipment such as Reidel–Seiffer calibrated tuning forks, biothesiometers and neurothesiometers are generally confined to specialist and research settings and in use have specific requirements about application pressures that are rarely addressed. This lack of consistency is exacerbated by the irresistible urge to ‘hit the tuning fork harder and try again’ if the patient is unable to feel it in the first place. These factors increase the time required and reduce the overall utility of testing for pallesthesia in the clinical arena. Lastly there is no precedent for autoclaving tuning forks or wiping them between patients to address infection control imperatives.

The device
VibraTip® contains a micro-vibrating motor powered for many months of routine use in a clean, sealed, disposable unit (figure 1). It was designed to overcome many of the limitations of tuning forks by providing a constant source of gentle vibration activated by squeezing the casing firmly between finger and thumb (figure 2). By gently touching the patient’s skin twice with the rounded tip of the device, each time for about half a second, explaining that ‘this is touch one’ and ‘this is touch two’ while making either of the two stimuli vibrate, it provides a rapid and specific assessment of the integrity of vibration sense. In very quiet settings, any sound from the device audible over background noise can be effectively masked by only activating it while the explanations ‘this is touch one’ or ‘this is touch two’ are recited. The result is a specific vibration stimulus of arbitrary but reproducible amplitude with high face validity.

Study design
A cross-sectional study of 100 consecutive patients attending hospital-based diabetes annual review and podiatry clinics in

Results
For the non-vibrating presentation of VibraTip®, no patients thought they could feel vibration when no such vibration was
Irrespective of the above, the fundamental utility of neuropathy testing rests on whether the demonstration of nerve dysfunction will bring about changes in behaviour that reduce risk of tissue damage. Unless a device to test nerve function is to hand and an irrefutable result obtained, the demonstration may not be compelling enough to induce patients to modify their behaviour. Why wait until a neuropathic threshold has been exceeded before educating patients about protective footwear? By being given a device to keep on the bedside table (not necessarily to use) VibraTip® might remind a person with diabetes to put a hand in his or her shoe before putting a foot in it.

References


Discussion

In neuropathy testing by experienced and interested operators, Rydel-Seiffer graduated tuning forks have been shown to correlate well with thresholds obtained in diabetic patients with electromagnetic instruments such as a Bio-Thesiometer (Bio-Medical Instrument Company, Newbury, OH, USA). In practice, testing is often limited by the availability of appropriate instruments and lack of sufficient time to instruct the patient about what sensations to look out for and how to respond. Irrespective of the above, the fundamental utility of neuropathy testing rests on whether the demonstration of nerve dysfunction will bring about changes in behaviour that reduce risk of tissue damage. Unless a device to test nerve function is to hand and an irrefutable result obtained, the demonstration may not be compelling enough to induce patients to modify their behaviour. Why wait until a neuropathic threshold has been exceeded before educating patients about protective footwear? By being given a device to keep on the bedside table (not necessarily to use) VibraTip® might remind a person with diabetes to put a hand in his or her shoe before putting a foot in it.

Key messages

- Reconsider neuropathy testing as an educational tool to reduce risk-taking behaviour
- The new device has a vibration perception threshold similar to a standard 128 Hz tuning fork: neuropathy detection was comparable to using a 10 g monofilament
- The new device is rapid, reliable and hygienic
- Patients and clinicians found the new device very acceptable