

# The Ipswich Touch Test

A simple and novel method to identify inpatients with diabetes at risk of foot ulceration

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**OBJECTIVE**—To promote foot screening of inpatients with diabetes, we simplified sensory testing to lightly touching the tips of the first, third, and fifth toes (the Ipswich Touch Test [IpTT]).

**RESEARCH DESIGN AND METHODS**—Respective performances of the IpTT and 10-g monofilament (MF) were compared with a vibration perception threshold of  $\geq 25$  V indicating at-risk feet in 265 individuals. The IpTT and MF were also directly compared.

**RESULTS**—With  $\geq 2$  of 6 insensate areas signifying at-risk feet, sensitivities and specificities, respectively, were IpTT (77 and 90%), MF (81 and 91%); positive predictive values were IpTT (89%), MF (91%); and negative predictive values were IpTT (77%), MF (81%). Directly compared, agreement between the IpTT and MF was almost perfect ( $\kappa = 0.88$ ,  $P < 0.0001$ ). Interrater agreement for the IpTT was substantial ( $\kappa = 0.68$ ).

**CONCLUSIONS**—The IpTT performs well against a recognized standard for ulcer prediction. Simple to teach, reliable, without expense, and always at hand, it should encourage uptake of screening and detection of high-risk inpatients requiring foot protection.

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Screening for diabetic foot disease in community and outpatient settings successfully predicts those at risk of ulceration (1–4). Hospitalized individuals with diabetes are older, largely bed bound, have more comorbidities, and are at greater risk; screening these patients should be a priority so that foot protection can be targeted. It is disappointing that a recent audit of diabetes care in U.K. hospitals found fewer than one-third of patients had received a foot examination and 3% had developed a new foot lesion during their inpatient stay (5). Admitting doctors commonly cite not being able to find the necessary equipment as a barrier to screening. In community settings, the 10-g monofilament (MF) has gained acceptability as a simple, quick, and inexpensive

method that detects a 7.7-fold increased ulceration risk (2,3,6). The MF has potential use in hospitals; however, its use would require training significant numbers of people as well as the initial purchase expense and recurrent expenditure to replace used filaments and lost devices. Furthermore, there is still the obstacle of having to find the device. In the absence of neurologic instruments, many physicians touch the feet with cotton wool or even with their fingers. We have taken this practice and formalized it into a simple, quick, and easily taught procedure that we have named the Ipswich Touch Test (IpTT). This study determines whether the IpTT has sufficient specificity and sensitivity for it to be recommended for inpatient screening when compared

with the MF and vibration perception threshold (VPT).

## RESEARCH DESIGN AND METHODS

The study included 265 individuals with diabetes comprising inpatients and attendees at foot and general diabetes clinics. Amputees and those unable to comply were excluded. Four physicians, nine podiatrists, and five medical students undertook the examinations.

## Test procedures

The VPT was measured in both halluces using a neurothesiometer (Horwell Scientific, U.K.) following the established method of limits (7).

Pressure sensation was assessed using a 10-g MF (Neuropen, Owen Mumford, U.K.) applied for 1–2 s to the tips of the first, third, and fifth toes and to the dorsum of both halluces (8). MFs were changed at the recommended frequency and rested after 10 applications (9).

The IpTT involves lightly touching/resting the tip of the index finger for 1–2 s on the tips of the first, third, and fifth toes and the dorsum of the hallux. Two screening methods were assessed. Method A involved touching all of the above sites in both feet and defined neuropathy as  $\geq 2$  insensate of the 8 sites. Method B involved touching only the tips of the first, third, and fifth toes and defined neuropathy as  $\geq 2$  insensate of the 6 sites. Examiners were instructed not to push, prod, tap, or poke because this may elicit a sensation other than light touch. With eyes closed, subjects were instructed to say yes whenever they felt the touch.

Interoperator reproducibility of the IpTT was assessed by repeat testing in a subset of 26 subjects by another assessor who was blinded to the original findings.

## Criterion standards

A VPT  $\geq 25$  V was the agreed gold standard because this is associated with an eightfold increased ulcer risk (10). We also directly compared the IpTT with the MF.

## Statistical analysis

Sensitivity, specificity, and predictive values were calculated for the MF and IpTT

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against the VPT standard. Interoperator reproducibility was assessed using the  $\kappa$  statistic, as was concordance between the IpTT and MF, with a  $\kappa$  of 0.61–0.80 indicating substantial agreement and a  $\kappa$  of 0.81–1 indicating almost perfect agreement (11). Receiver operating characteristic curves were generated for eight- and six-site examinations of the MF and IpTT. Data were analyzed using SPSS 17.0 for Windows.

**RESULTS**—The mean age of the study subjects was 64.5 years; 79% had type 2 diabetes and 24% had a previous foot ulcer.

Table 1 displays sensitivities, specificities, and predictive values for methods A and B. Direct comparison of the IpTT and MF showed almost perfect agreement, with discordance in only 20 of 265 individuals with method A ( $\kappa = 0.849$ ,  $P < 0.0001$ ) and in only 16 of 265 individuals with method B ( $\kappa = 0.879$ ,  $P < 0.0001$ ). Receiver operating characteristic areas under the curve for the MF and IpTT compared with the VPT were 0.87 and 0.84, respectively, for method A and 0.85 and 0.83, respectively, for method B.

The interoperator reproducibility represented by the  $\kappa$  statistic was 0.68 ( $P < 0.001$ ), indicating substantial agreement.

**CONCLUSIONS**—The IpTT was found to have a similar sensitivity, specificity, and operating characteristic as the MF when assessed against a VPT  $\geq 25$ . Furthermore, when compared directly with the MF, the IpTT was found to

have excellent concordance. The improvement in performance when eight rather than six sites were used was marginal and insignificant in clinical terms. Perhaps more meaningful, despite lacking the pressure precision of the MF, the IpTT used at six sites missed only 12 of the 147 patients diagnosed as at risk using the MF and gave only four false positives. We recommend using six rather than eight sites because the method is quicker and easier to teach and remember.

To ensure generalizability, the study was performed in three hospitals and by 18 different professionals. Although no nurses or care assistants participated, we see no reason why the method should not be transferrable.

The IpTT was devised out of a desire to prevent inpatient-acquired foot lesions through greater awareness of the need to protect the feet (5,12). The procedure is simple, reliable, and quick; requires no special instruments; is easily sterilized by hand washing; and is always at hand. The IpTT necessitates little training and can be undertaken by those tasked with providing pressure relief—care assistants and nurses—giving them immediate feedback as to which patients require protection. We believe that once introduced into hospitals, this test should result in increased screening for at-risk feet and in more diabetic individuals' receiving appropriate pressure relief.

Although initially devised to be used with inpatients, the IpTT may have applications for community screening, particularly in areas where funding for testing equipment is limited.

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G.R. developed the concept, designed the study, and wrote the manuscript. P.R.V. designed the study, researched data, and wrote the manuscript. N.B., C.G.T., and C.G. researched data, contributed to discussion, and reviewed the manuscript. A.I.A. provided statistical advice, contributed to discussion, and reviewed the manuscript. M.D. researched data, contributed to discussion, and reviewed the manuscript.

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**Table 1—Sensitivity, specificity, predictive values, and likelihood ratios for the MF and IpTT against a VPT  $\geq 25$  V as gold standard**

	Method A		Method B	
	MF	IpTT	MF	IpTT
Sensitivity (%)	85	79	81	76
Specificity (%)	88	90	91	90
PPV	89	90	91	89
NPV	81	79	81	77
LHR+	7.6	8.1	9.1	7.7
LHR–	0.16	0.24	0.2	0.27

Method A uses 8 sites (tips of first, third, and fifth toes and dorsum of hallux) and a criterion of  $\geq 2$  out of 8 insensate sites to indicate at-risk feet. Method B uses 6 sites (tips of first, third, and fifth toes) and a criterion of  $\geq 2$  out of 6 insensate sites to indicate at-risk feet. PPV, positive predictive value; NPV, negative predictive value; LHR+, positive likelihood ratio; LHR–, negative likelihood ratio.