

SENSITIVITY OF THE 10g MONOFILAMENT AND 128Hz TUNING FORK AT SITES OF PREVIOUS ULCERATION

**Slater RA, Ramot Y, Buchs A, Koren S,
Rapoport MJ**

Diabetes Unit, Assaf Harofeh Medical Center

Diabetic Polyneuropathy

- Distal Symmetrical Neuropathy is the most common form
 - Prevalence is approximately 30%
 - 4% develop neuropathy annually
 - Primary factor in diabetic pedal ulceration

Loss Of Protective Sensation (LOPS)

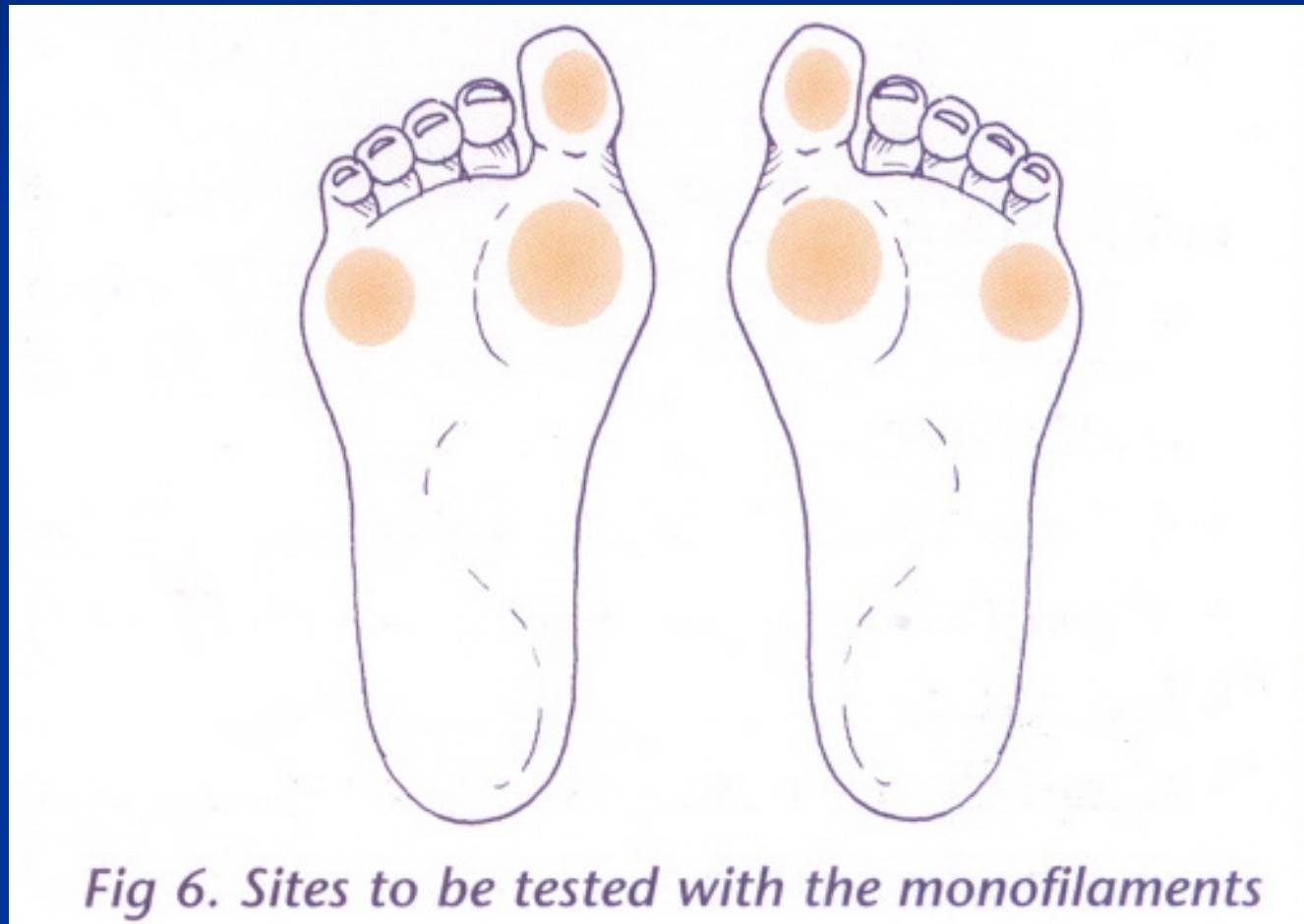
- Absence of pain when injury occurs
- Not present in all patients with diabetic neuropathy
- 10g Semmes-Weinstein Monofilament and 128Hz tuning fork tests are the clinical gold standard methods to determine risk for neuropathic ulceration

PROTOCOL

International Working Group on the Diabetic Foot

- Monofilament applied to 3 sites: plantar aspect of hallux, 1st metatarsal, and 5th metatarsal
- Tuning fork is applied to the dorsum of the hallux at the base of the proximal phalanx
- 2 genuine and 1 “sham” application per site
- Patient is asked each time if they feel a stimulus

Monofilament Sites



What Defines LOPS?

- “Fewer than 2 correct answers out of 3”
- *However:*
 - “...*there are no evidence based data describing how often and where on the foot a monofilament should be applied.*”
 - It has been assumed, without corroborating data, that these diagnostic tests will approach 100% sensitivity at sites of previous ulceration.

Aim of Investigation

- To determine the sensitivity of the monofilament and tuning fork by testing sites of previous neuropathic ulceration

Methodology

- 40 diabetic patients with history of neuropathic ulceration at 67 different sites were tested
- The hallux, 1st metatarsal, and 5th metatarsal were divided into medial and lateral zones, each tested individually
- All wounds were closed at the time of testing
- Patients with amputations were excluded
- Protocol of International Working Group was followed for each site tested

Sites Tested



Fig 6. Sites to be tested with the monofilaments

Scores on Tuning Fork Test

sites tested=60

Score	0/3	1/3	2/3	3/3
number (%)	1/60 (2%)	21/60 (35%)	19/60 (31.5%)	19/60 (31.5%)
Abnormal vs. Normal	22/60 (37%)		38/60 (63%)	

Scores on Monofilament Test

Total n=113

(21 wounds with single scores + 46 with medial and lateral scores)

Score	0/3	1/3	2/3	3/3
Number (%)	12/113 (10.6%)	64/113 (56.7%)	27/113 (23.9%)	10/113 (8.8%)
Abnormal vs. Normal	76/113 (67.3%)		37/113 (32.7%)	

Monofilament Results by Site

Total n=67 wounds

	Abnormal	Normal	Split Scores
Single Test Site (n=21)	12	9	N/A
Med. + Lat. Test (n=46)	24	4	18
Total (%)	36/67 (54%)	13/67 (19%)	18/67 (27%)

Tuning Fork as Crosscheck

- 12/13 sites with normal monofilament scores were tested with the 128Hz tuning fork
- Only 2/12 (17%) sites had an abnormal score

Split Monofilament Scores

Total sites=18

	Medial Zone Abnormal	Lateral Zone Abnormal	Tuning Fork Abnormal
Hallux n=10 (%)	8/10 (80%)	2/10 (20%)	5/10 (50%)
1 st Metatarsal n=6 (%)	6/6 (100%)	0/6 (0%)	1/6 (17%)
5th Metatarsal n=2 (%)	0/2 (0%)	2/2 (100%)	0/2 (0%)

Ulcer Sites With No Abnormal Scores

Site	Number
Hallux	2
3 rd Toe	4
5 th Toe	3
1 st Metatarsal	0
3 rd Metatarsal	1
5 th Metatarsal	1
	Total=11/67 (16.4%)

Conclusions

- The 10g monofilament is a reliable diagnostic tool when positive, but its sensitivity may be much lower than previously thought
- The 128Hz tuning fork has low sensitivity, but it may help to clarify equivocal results on the monofilament test
- The high percentage of conflicting medial/lateral scores may indicate that the progression of diabetic neuropathy is not perfectly symmetrical