

# The comparison of thermal perception sensitometer in reference to biothesiometer in diagnosis of peripheral neuropathy in Type 2 diabetes mellitus

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## Abstract

**Background:** To determine the effectiveness of thermal perception sensitometer, in making an early diagnosis of peripheral neuropathy in type 2 diabetic patients and to compare its effectiveness with the biothesiometry, which is established method of diagnosing neuropathy in diabetic patients. **Patients and methods:** The study was conducted on 100 diagnosed patients of Type 2 Diabetes Mellitus above age of 25 years in Sir. T. Hospital, Bhavnagar. They are studied by using biothesiometry and Thermal perception sensitometer for comparison. **Results:** sensitivity for biothesiometry was 61.4% and specificity was 43.3 % and with thermometry (cold) sensitivity was 10.52 % and specificity was 46.91% and thermometry (hot) show sensitivity 38.46% and specificity 60.65%. **Conclusion:** thermal perception sensitometer, which tests for temperature discrimination, was compared with validated method for detection of neuropathy biothesiometry. Thermal perception sensitometer appears to be, less sensitive, but highly specific device for detection of diabetic neuropathy when compared with biothesiometer. And accuracy is more in biothesiometer (56%) than thermal perception sensitometer (cold 40 %, hot 52%)

**Key Words:** Diabetic neuropathy, Thermal perception sensitometer, Biothesiometer.

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diabetic complications combined and is responsible for 50% to 75% of non-traumatic amputations.<sup>2,3</sup> Quantitative assessment of various neural functions in diabetic patients provides information on the extent of deficits even at subclinical stages of diabetic polyneuropathy.<sup>4,5</sup> While large myelinated (A $\alpha$ , A $\beta$ ) fibre deficits may be detected using electrophysiological techniques<sup>6</sup> and by examination of vibration sensation<sup>6,7</sup> functional deficits of small myelinated (A $\delta$ ) and unmyelinated (C) fibres can be assessed by testing thermal sensitivity.

## INTRODUCTION

Long standing Diabetes Mellitus is associated with an increased prevalence of micro vascular and macro vascular diseases. The prevalence of peripheral neuropathy is 25.5% in India<sup>1</sup>. It is the most common form of neuropathy in developed countries, accounting for more admissions to hospitals than all the other

## AIM

To determine the effectiveness of Thermal Perception sensitometer a temperature discriminator, in making an early diagnosis of distal peripheral neuropathy in diabetic patients and to compare its effectiveness with biothesiometry, which is established method of diagnosing neuropathy in diabetic patients.

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## METHODOLOGY

The study was conducted on 100 diagnosed patients of Type 2 Diabetes Mellitus above age of 25 years in Sir. T. Hospital, Bhavnagar, Gujarat. Patients were coming in diabetic clinic OPD were taken for study. The research protocol was approved by institutional ethical committee of govt. medical college Bhavnagar.

**Inclusion criteria:-** (1) Age of patients should be more than 25 years (2) diagnosed patients of type 2 diabetes mellitus with duration of diabetes not less than 1 year.

**Exclusion criteria :-** (1) evidence of amputation of foot (2) patients with neurological disorders (3) patients with trauma to limbs (4) patients with peripheral edema (5) patients taking psychotropic or sedative drugs.

In this study ,we had to determine thermal perception threshold (for cold and hot ) on first toe, first metatarsal head ( 1<sup>st</sup> MTH), and 2<sup>nd</sup> MTH, 3<sup>rd</sup> MTH, 5<sup>th</sup> MTH , instep, heel , and three readings were taken and then average was taken by using Thermal perception sensitometer. The room temperature was maintained between 28 C° and 32 C° for accurate result. Another instrument used in this study was biothesiometer in which , we had to determine the vibration perception threshold (VPT) on the bony prominences of the metatarsal heads of foot by using Biothesiometer and three readings were taken and then average was taken. Data was collected and analysed statistically with Medcalc software. It is non-invasive procedure. Written consent from patients were taken.

## RESULT

**Table 1:** Comparison of Thermal perception sensitometer with biothesiometry

	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
Neuropathy detection by Biothesiometer	61.4 %	43.3 %	71.67 %	32.50 %	56 %
Neuropathy by detection Thermal perception sensitometer (cold)	10.52 %	46.91 %	4.44 %	69.09 %	40 %
Neuropathy detection by Thermal perception sensitometer (hot)	38.46 %	60.65 %	38.46 %	60.66 %	52 %

As per above table 1, Detection of neuropathy done by biothesiometer show sensitivity of 61.4% and specificity 43.3% (43 patients show severe neuropathy among 100 patients) and detection of neuropathy done by Thermal perception sensitometer show sensitivity 10.52% for (cold perception) and 38.46% for (hot perception) while specificity 46.91% for (cold perception) (2 patients show severe neuropathy among 100 patients) and 60.65 % specificity for (hot perception)( 15 patients show severe neuropathy among 100 patients). So thermal perception sensitometer shows more specificity than biothesiometer but less sensitive than biothesiometer for detection of neuropathy in diabetes patients. Also accuracy is more in biothesiometer (56%) than thermal perception sensitometer (cold 40 %, hot 52%)

## DISCUSSION

In present study, it was found that when diabetic patients were examined with Biothesiometer 43 patients show severe neuropathy among 100 patients and when patients were examined with thermal perception sensitometer with cold and hot probe 2 and 13 patients show severe neuropathy among 100 patients respectively. When we compare sensitivity Biothesiometer show more sensitivity (61.4%) than Thermal perception sensitometer (10.52% for cold, 38.46% for hot). And when we compare specificity Biothesiometer show less specificity (43.3%) than thermal perception sensitometer (46.91% for cold,

60.65% for hot). Another similar study done by V Viswanathan *et al*<sup>8</sup> shows that 97.3% sensitivity with biothesiometer and 98.3% sensitivity with tip therm (instrument used for temperature discrimination) and 100% specificity with biothesiometer and 92.1% specificity with tip therm. Another study done by Pasquale Cancelliere<sup>9</sup> show that Alpha fibers are also responsible for vibration sensation, which is typically the first sensation that is lost in DPN (diabetic peripheral neuropathy). DPN is essentially a demyelinating process where the large myelinated nerve fibers will be affected initially. Typically, C fibers, will be affected last and this is confirmed clinically that by the patient presents with impaired proprioception, they have lost all other sensory characteristics, and therefore places them at the highest risk. Another similar study done by Dan Ziegler *et al*<sup>10</sup> shows that the rates of abnormalities among the individual tests ranged from 0% to 27.5%, being lowest for vibration perception and highest for thermal perception thresholds after cold stimuli. Cooling perception tests were most sensitive in detecting abnormality.

## CONCLUSION

In present study, thermal perception sensitometer, which tests for temperature discrimination, was compared with validated method for detection of neuropathy biothesiometry. Thermal perception sensitometer appears

to be, less sensitive, but highly specific device for detection of diabetic neuropathy when compared with biothesiometer. And accuracy is more in biothesiometer (56%) than thermal perception sensitometer (cold 40 %, hot 52%) in diagnosis of peripheral neuropathy in diabetic patients.

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