

## Evaluation of hot and cold sensation of hand in type 2 diabetic patients in age group of 40-80 years

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### Abstract

**Introduction:** The aim of the study is to find out the effect of Type 2 diabetes (T2DM) on the hot and cold sensation of hand.

**Material and Method:** Total 100 subjects in the age group of 40-80 year, both male and female were included in this study. Subjects were divided into 2 groups. Group A: 50 subjects diagnosed type 2 diabetic mellitus. Group B: 50 normal healthy subjects investigated and diagnosed Non-diabetic mellitus. Before the start of the procedure, detailed neuro-musculoskeletal evaluation was done to meet inclusion and exclusion criteria and those who were ready to be part of the study, the written informed consent was obtained from them. Rolyan hot and cold discrimination kit was used to examine hot and cold sensation of both hands at pulp of index finger, little finger and dorsal web space.

**Result:** There was loss of hot & cold sensation in 10% subjects of T2DM group at index and little finger bilaterally and all these subjects have the duration of diabetes >15yr.

**Conclusion:** loss of sensation may lead to injuries of diabetic hands. Hand care should be taught to the patients to prevent injuries to the hand.

**Keywords:** Type 2 diabetes, Hot and cold sensation, Diabetic hand.

### Introduction

Diabetes will cause hand complication as 'diabetic hand'. The diabetic hand is defined as a syndrome of musculoskeletal manifestation of hand mainly, limited joint mobility, Dupuytren's contracture and trigger finger in diabetic patients, usually associated with long-standing diabetes, suboptimal glycemic control, and microvascular complications.<sup>1</sup> Other complications with diabetes are tropical diabetic hand syndrome-hand infection, peripheral neuropathy ulceration, carpal tunnel syndrome etc, all these complications more common and frequent with diabetics.<sup>1</sup>

Diabetic neuropathy is more common in lower extremity so special consideration is given to evaluating the effect of type 2 diabetes (T2DM) on the lower extremities as it the primary cause of non-traumatic amputation.<sup>2</sup> The hand is the most important part of the body and well involve mobility, strength sensation and coordination in all ADL activities.<sup>3</sup> Studies have shown that sensory nerve changes may cause burn and ulceration of hand in diabetics.<sup>4-6</sup> Hence the need of study arises to evaluate the hot and cold sensation of type 2 diabetic hand.

The objective of this study is to assess the hot and cold sensation in normal healthy & T2DM subjects and compare between both groups.

### Aim

The aim of the study is to find out the effect of Type 2 diabetes on the hot and cold sensation of hand.

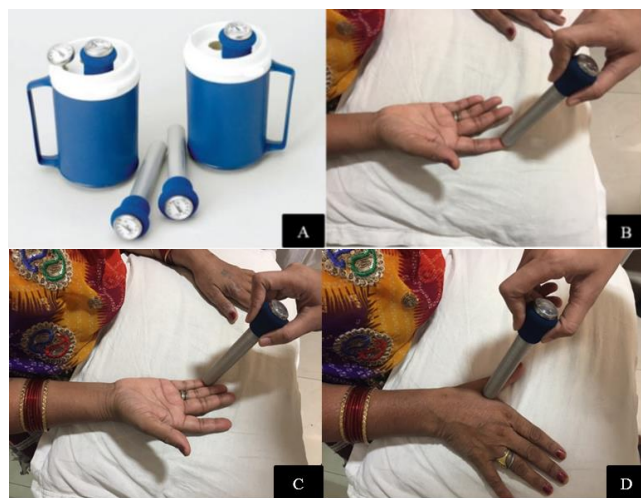
### Materials and Methods

After approval from the institutional Ethics committee and Maharashtra University of Health Sciences (MUHS), Nashik the study was started. All subjects were from the All

India Institute of Physical Medicine and Rehabilitation, Mumbai. Detailed information about the purpose of the study was explained to all subjects and those who were ready to be part of the study were chosen as the subject. Written informed consent was obtained from all subjects. Duration of study was 12 months from the date of synopsis approval. 100 subjects in the age group of 40-80 year, both male and female were included in this study. Subjects were divided into 2 groups. Group A- 50 subjects diagnosed type 2 diabetic mellitus, Duration of DM from 1 year to 20 years, Glycemic control level – fasting blood glucose  $\geq 126$  mg/dl and postprandial blood glucose  $\geq 200$  mg/dl. Group B- 50 normal healthy subjects investigated and diagnosed as non-diabetic mellitus. Blood glucose level  $> 300$  mg/dl and all neuro-musculoskeletal & vascular disorders were excluded from study.

Rolyan hot and cold discrimination kit was used to examine the hot and cold sensation of both hands. Rolyan hot and cold discrimination Kit is designed to assess temperature discrimination by a simple, accurate and quantifiable method and it is quick, painless and easy to use. Each kit contains two probes or test tubes each for hot and cold temperatures, and a thermometer to determine water temperature. Thermometers in each probe indicate the exact temperature along the entire hot-to-cold range, for accurate assessment and reporting. One test tube or metal cylinder was filled with warm water and other with crushed ice. The ideal temperature for warmth was between 40-45 degree C and for cold was between 5-10 degree C. The side of the test tube was placed in contact with the skin of hands i.e. pulp of index finger, pulp of little finger and first dorsal web space. The Subject was asked to verbally indicate when an applied stimulus is recognized by responding to 'hot' or 'cold'. The

response was recorded for analysis. A Niamh et al<sup>7</sup> concluded cold detection threshold and warm detection threshold were found to have fair reliability.



**Fig. 1A):** Rolyan hot and cold discrimination kit, **B):** Pulp of index finger, **C):** Pulp of little finger **D):** First dorsal web space.

**Results**

As data were nonparametric and quantitative, descriptive statistical analysis was done. The pie chart was used to show percentage.

**Table 1:** Percentage of subjects affected by hot & cold sensation in T2DM & Non-DM group

Percentage of subjects affected hot & cold sensation		
T2DM	NONDM	
Index finger	10%	0%
Little finger	10%	0%
Dorsal web space	0%	0%

**Graph 1**

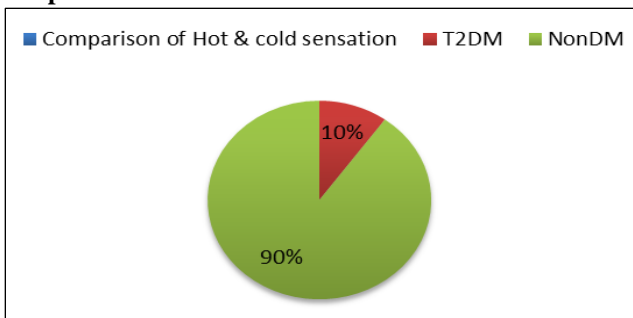


Table & graph 1 show percentage of subjects affected by hot & cold sensation in T2DM & Non-DM group. T2DM group 10% of subjects affected at index & little finger.

**Discussion**

In this study assessment of hot and cold sensation was carried out in 50 subjects in the age group of 40-80yr (mean age- 58.16±8.65) with the involvement of type 2 diabetes

(Group-A) and compared with 50 Non-diabetic (Group-B) subjects of 40-80yr (mean age- 57.9±9.55).

Table & graph 1 show there is a loss of hot & cold sensation in 10% subjects of T2DM group at index & little finger area and no changes at dorsal web space area. All these subjects have a duration of diabetes >15yr. Kumar S et al<sup>4</sup> 1998 concluded that patients with diabetes may need to select their teacup more carefully. Coppini DV et al<sup>5</sup> 2000 found in a clinic that hand neuropathy may occasionally lead to anaesthetic injuries. T Chia Shun et al<sup>8</sup> 2004, concluded elevation of thermal threshold as increase duration of diabetes in type 2 diabetics.

Chronic sensorimotor distal polyneuropathy (DPN) is the most common form of diabetic neuropathy. DPN may be either sensory or motor, and involve small fibers, large fibers, or both. In diabetics, the longest nerve fiber being affected first, they are manifested by reduced vibration sensation and two-point discrimination.<sup>9-11</sup> Cutaneous receptors Merkel’s discs & Meissner’s corpuscles are highly concentrated in the fingertips, they play an important role in two-point discrimination touch and localization of touch,<sup>12</sup> in diabetics these sensations affected first, that could be region of affection of hot and cold sensation at tip of index and little finger but no changes at dorsal web spaces area. Decreased thermal pain threshold due to damage of small unmyelinated c fibers and a decrease in nerve growth factor (NGF) which maintain small fiber neurons.<sup>8,10</sup>

V Anita<sup>13</sup> et al concluded there is significant reduction in amplitude and conduction velocity of the median, ulnar, radial, peroneal and sural sensory nerves in asymptomatic diabetic patients as compared to healthy volunteers. Most commonly affected nerves are Median Nerve in upper limb and Superficial Peroneal in lower limb. Author result support that median nerve most commonly affected in upper extremity of diabetic, comparatively radial nerve and superficial radial nerve branch supply to dorsal web space of thumb, that could be region that hot and cold sensation not affected in this area.

**Conclusion**

This study concluded that 10% of Type 2 diabetics subject has loss of hot and cold sensation. Therefore while evaluating diabetic subject; evaluation of hand sensation should be done to prevent hand injuries and its disabilities.

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**Conflict of Interest**

The authors declare no conflict of interest

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