



A summary on normative values of Two-point discrimination in healthy Indian subjects: A review of literature

Dr. Shreya Upadhyay

Department of Physiotherapy, SPB Physiotherapy College, Veer Narmad South Gujarat University, Surat, Gujarat, India

Abstract

Introduction: Two-point discrimination is the combined cortical sensation. The assessment of TPD gives complete idea of the function of the nervous system as it involves tracts and cortical areas for the integrity. The assessment of the TPD is valuable for the diagnosis and prognosis of nervous regeneration and repair. The normal values of the TPD varies in the different geographical and anatomical areas of the body. It is necessary to establish normal values of the TPD for different age group population and various sites of the body for better clinical management.

Methodology: The literature search was done by key words such as Two-point discrimination, cortical sensation, normal values, healthy, adults on internet and various database and journals. From the literature the articles were selected using search strategy; irrelevant articles were excluded and only 7 articles of having Indian subjects were included in the study.

Result: From total 58 articles after removing duplicate articles and excluding irrelevant articles 7 articles were selected and reviewed. The data of year of publication, number of participants, age of subjects, body region of the measurement, result of normal values and additional point of discussion were extracted from the literature.

Discussion: The normative values of 18-25 year of the age group for different upper limb regions are established. Further extensive research should be done with larger sample size and various body regions for different age group.

Keywords: TPD, clinical management, healthy adults

Introduction

For assessment of nervous system sensory examination is the most important part of the examination. Sensory parts connect body with outer environment and there are various segments of sensory examination broadly classified as exteroceptive and proprioceptive sensation. Exteroceptive sensation comprise of touch, pain, temperature and pressure from which touch and pain are the protective sensation which directly transmits external sensation from spinal cord to brain [2]. Discriminative touch sensation is carried by dorsal column medial lemniscus pathway and any injury to this pathway will result in disturbance of somatic cutaneous sensation [3]. In 1853 weber introduced the term of two-point discrimination that measures the shortest distance when an individual is able to make out two points of the examining device that is used to stimulate the skin at the same time exerting similar pressure [4].

Examination of TPD test is commonly used to evaluate peripheral nerve injury, trauma and recovery [5]. TPD can be tested in the static and dynamic form. An Aesthesiometer and circular two-point discriminator are valid and reliable tool for the examination of TPD. The measurement of the TPD usually done with patient in comfortable position with a blind fold on eyes. The points on the device were applied with greater distance first and the distance was decreased and the patient is asked to reply whether they are feeling one point or two. The pressure applied with the device is used to be blanched not too much only paling of the skin should be noted. Usually, 8-10 stimulus are applied and the response is noted for subsequent stimulus. One point on the body part should not be touch repeatedly and to avoid accommodation there should be rest of 2 second. There is lack of standard procedure for the application of the stimulus is controversial because the application of pressure is subjective [6].

TPD test is useful clinical measure for recovery and regeneration of the nerve and integration of the nervous system. The normative data for the test varies from region to region. The values for the test differ according to the age and region of the body. The region, gender, side, BMI are the factors which can affect the normative data. The Normative values will help in the accurate assessment, comparison and conclusion. The data for normative values of TPD of various geographical regions and different site are available but there is a need for the study of the literature that will provide an information regarding available literature for the normative values of TPD in Indian population of different age group and different body region to summarize the available data and to give an insight to expand the literature and provide the scope for further research.

Methodology

The available literature was searched using the search strategies and key words such as Two-point discrimination, healthy, normative values with the use of internet. After that articles having Indian population between 2013 to 2024 were selected for the review. The articles of values of TPD in diseased population were excluded. Total 7 articles were selected for the review and the data such as the age group, sample size, body region and result were extracted from the literature.

Result

The articles selected for the review are summarized in table given below.

Author	Year	Number of participants	Age of participant	Body region	Result	Discussion
Kannathu Shibin <i>et al.</i> [7]	2013	50	18-28 years	<ol style="list-style-type: none"> Upper lateral arm, Upper medial arm, Lower lateral arm, Mid medial arm, Lower medial arm, Upper posterior arm, Mid posterior arm, Lower posterior arm, Mid lateral forearm, Mid medial forearm, Mid posterior forearm, Skin over 1st dorsal interossei Palmar surface of distal phalanx thumb Palmar surface of distal phalanx middle finger Palmar surface of distal phalanx little finger. 	<ol style="list-style-type: none"> 41.3±1.1 34.2±0.9 36.1±1.1 33.7±1.1 21.5±1 35.2±1.2 36.8±1.1 27.6±1.3 29.3±0.9 26.9±1.1 26.0±0.9 14.7±0.8 3.1±0.2 2.5±0.1 2.4±0.1 	<ul style="list-style-type: none"> No difference in gender Sensitivity decreases from distal to proximal
Karishma Jagad <i>et al.</i> [8]	2018	450	18-25 years	<ol style="list-style-type: none"> Tip of the little figure - ulnar nerve Tip of index finger - median nerve 	<ol style="list-style-type: none"> 2.9345± 0.964 3.2212 ± 1.061 	
Shri Prabha Thube <i>et al.</i> [9]	2020	100	40-59 years	<ol style="list-style-type: none"> Digits Midpalm region Thenar region Hypothenar region Dorsum of hand 	<ol style="list-style-type: none"> 3-5 12-13mm 11-12mm 11-13mm 15-17mm 	
K Uma Maheshwari <i>et al.</i> [10]	2021	50	18 years	<ol style="list-style-type: none"> Finger tips Fingers Palm Back of palm Forehead Forearm 	<ol style="list-style-type: none"> 5.88 4.76 11.65 22.8 13.82 27.41 	
Sanjiv Kumar <i>et al.</i> [11]	2023	150	18-25	<ol style="list-style-type: none"> L1 L2 L3 L4 L5 S1 S2 	<ol style="list-style-type: none"> L1 - 2.33±1.57 L2 - 2.59±1.48 L3 - 2.19±1.39 L4 - 1.75±1.24 L5 - 1.75±1.24 S1 - 1.48±1.34 S2 - 2.2±1.55 	<ul style="list-style-type: none"> No difference between rt and left side Lower limb values range between 1.46–2.61 to 1.18–1.63 Women are more sensitive than men
Neha Chaudhari <i>et al.</i> [12]	2024	100	35-40 years	<ol style="list-style-type: none"> Upper lateral arm (C5, C6), Lower lateral arm (C5, C6, C7, C8), Mid medial arm (T1, T2), Mid posterior arm (C5, C6, C7, C8), Mid lateral forearm (C5, C6), Mid medial forearm (C8, T1), Mid posterior forearm (C5, C6, C7, C8) 	<ol style="list-style-type: none"> 47 44.9 41.8 45.4 42.9 38.2 42.6 <p>(mean ranges of all seven regions)</p>	
S.K. Pandian K <i>et al.</i> [13]	2024	624 healthy adults	Adults of 18-65 years	<ol style="list-style-type: none"> Tip of thumb Tip of index finger Tip of middle finger Tip of ring finger Tip of little finger Thenar eminence Mid-palm, Hypothenar eminence 	<ol style="list-style-type: none"> 2.95_0.77 2.94_0.72 3.09_0.84 3.28_0.91 3.47_1.68 5.81_2.34 6.58_2.41 6.93_2.16 	The mean TPD is 2.78 to 3.5mm in the fingertips and 5.39 to 7.13mm in the mid-palm

Discussion

The TPD values varies according to age and it is important parameter to check sensory aging. The literature studied to summarized the normal values of the TPD in healthy Indian population.

The result of the study suggest that the finger tips are most sensitive are in the body. Because in smaller surface area there is more distribution of the Meissner's' corpuscles so there is more sensitivity compare to other regions. The review of the studies also suggests that female are more sensitive than men. The available literature shows normal values of TPD in different age groups. From 7 studies in India 4 studies are done in young adult age group from which 3 studies are giving normal values of upper limb region and only the study of Sanjiv Kumar *et al.* gives the normative values of lower limb region for the younger adult (18-25 years) age group which is the only data for the Indian population. Other 3 studies are covering the upper limb region suggests that the normative values of TPD on finger tips are ranged between 3-5 mm, Palmer surface of hand the value ranges between 10-13 mm, dorsum of palm it is 17-20 mm. comparing the results of the study of Shirprabha Thube which was conducted on the 40-59 years age group the values are more than the values of younger adult age group which suggest that the values of the TPD increase with age that is also known as sensory aging.

The TPD values are considered best in the 3rd decade of life when the chances of the trauma and occupational injuries are more, the study of Neha Chaudhari *et al.* gives the data for normal values of TPD in 35-30 years age group.

Conclusion

The Normal TPD values for Upper limb in 18-25 years age group are available which can be applied in the clinical setting. More studies with larger sample size are needed for the upper limb normal values in age group of 30-40 years and older adults as the chances of aging and diabetes are more after 40 years and TPD values are very useful for the early detection of the diabetic neuropathy. Further extensive research should be done to establish the normal values of lower limb and sole of foot region of the healthy Indian subjects.

References

1. Kim Bigley G. chapter 67 sensation Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd edition.
2. Dellon AL, Kallman CH. Evaluation of functional sensation in the hand. *J Hand Surg Am*,1983;8(06):865–870.
3. Vijusha T, Ponmathi P. Comparison of two-point discrimination of palmar surface of distal phalanx of thumb between dominant and nondominant in labourers. *Int J*,2018;1:01-6.
4. Shibin K, Samuel AJ. The discrimination of two-point touch sense for the upper extremity in Indian adults. *Int. J. Health Rehabil. Sci*,2013;2:38-43.
5. Dellon AL. The moving two-point discrimination test: clinical evaluation of the quickly adapting fiber/receptor system. *J Hand Surg Am*,1978;3(05):474–481.
6. Lundborg G, Rosén B. The two-point discrimination test–time for a re-appraisal? *Journal of hand surgery*,2004;29(5):418-22.
7. Shibin K, Samuel AJ. The discrimination of two-point touch sense for the upper extremity in Indian adults. *Int. J. Health Rehabil. Sci*,2013;2(1):38-43.
8. Jagad K, Dhanesha N. “The Normal Reference Values of Static and Dynamic Two Point Discrimination for Tip of Finger in Median and Ulnar Distribution in Healthy Young Indian Individuals.
9. Thube S, Shah MR, Kothari PH, Shah V. Assessment of two-point discrimination on hand in adult population: An observational study. *International Journal of Health Science and Research*, 2020, 10(5).
10. Maheswari KU, Devi RG, Priya AJ. Estimation of Tactile Sensation by Two Point Discrimination among 18 Years Old People. *Journal of Pharmaceutical Research International*,2021;33(47B):355-63.
11. Kumar S, Shetty A, Nale A, George CM, Yadav N. Normative Values of Two-Point Discrimination for Lower Limb Dermatomes in Healthy Young Adults and Its Correlation with Gender and Body Mass Index. *Archives of Medicine and Health Sciences*, 2023.
12. Chaudhary NI, Chaudhary S, Moon PS, Gajbe U, Hadap MK. Reference Values for Two-Point Discrimination Test in Arm and Forearm of Healthy Indian Adults. *African Journal of Biomedical Research*,2024;27(3S):10-6.
13. Thatte MR, Agarwal P, Rajendran S, Ibrahim M, Babu V, Madhavan L, *et al.* The Normal Static Two-Point Discrimination in the Palmar Aspect of Hand in Adults and Children in a Sample Indian Population. *Indian Journal of Plastic Surgery*,2024;57(04):263-9.