



TWO-POINT DISCRIMINATION ON THE PALMAR SURFACE OF HANDS IN MBBS STUDENTS: INFLUENCE OF BMI, GENDER AND AVERAGE VALUES

Physiology

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ABSTRACT

Aim: In our study, we attempted to measure the average two-point discrimination values on the pulp of all distal phalanges and the mid-palmar surface of the hands of Healthy MBBS Students and its influence on BMI and Gender. **Study Population & Methodology:** We conducted this experiment using a two-point esthesiometer on 100 healthy 1st MBBS students (Females 52, Males 48) aged between 18-20 years from Guntur Medical College, Andhra Pradesh. Based on the BMI we classified subjects under five categories as per WHO ASIAN-BMI SCALE. **Results:** Average two-point threshold value in females for right and left first distal phalanx 3mm, 2.76mm, for second distal phalanx 1.92mm, 2.38mm, for third distal phalanx 2.69mm, 2.26mm fourth distal phalanx 2.84mm, 2.38mm, fifth distal phalanx 3.30mm, 2.84mm, mid palmar surface 6mm, 6.76mm respectively. From our study, the two-point threshold is more for the mid-palmar surface. Two-point discrimination has a positive correlation between the right and left palmar surface of the hand but the relationship between variables is weak in the distal phalanges and moderate in the mid-palmar surface. As per BMI, the Two-point discrimination threshold has a positive correlation in the left first distal phalanx, right and left fourth distal phalanges, right fifth distal phalanx and right mid palmar surface. We see an association between gender and the two-point discrimination threshold in the right and left first distal phalanx and the remaining areas don't have any association.

KEYWORDS

BMI, Gender, Two-Point Discrimination

INTRODUCTION

Weber introduced the two-point discrimination test. The test assesses the minimal distance at which the person can distinguish whether one or two points are in contact with the skin. For assessing tactile perception, hand surgeons and orthopaedic surgeons use the Two-point discrimination test. A L Dellon et al. state that the time required for object recognition correlates with the two-point discrimination threshold². The posterior column-medial lemniscus pathway is responsible for two-point discrimination sensation. Therefore, damage to this pathway can impair the two-point discrimination threshold³. Knowing the average two-point discrimination threshold in healthy subjects helps to identify if an alteration of two-point discrimination exists. In our study, we measured the average two-point threshold values on the pulp of all distal phalanges and the mid-palmar surface of both the hands of Healthy MBBS Students and their influence on BMI and Gender.

AIMS AND OBJECTIVES:

The main aim of our study is to assess the average two-point discrimination threshold of all distal phalanges and the mid-palmar surface of both the hands. The secondary aim is to assess the correlation between both hands and their influence on BMI and Gender.

Study Population:

We conducted this study on 100 First Year MBBS Students aged between 18-20 years (Female-52, Male-48) study includes only healthy students. We excluded the students with scars, burns and neurological deficits from the research.

METHODOLOGY:

The study period was from 17th August 2022- 26th August 2022. Participation in the study was voluntary. The student's consent was taken for participation in the study. The BMI of each student was measured by using their respective height and weight. The subjects are classified under four categories as per WHO ASIAN BMI SCALE. The instrument used for the Two-point discrimination test was a two-point esthesiometer with one fixed and one adjustable needle. This instrument has a Vernier-type construction structure. It can measure up to a threshold point of 1mm. The two-point discrimination threshold of all the distal phalanges on their pulp and mid-palmar area of both hands is measured. Each subject puts their hand on a table with their palm touching its surface. We instructed the subjects to close their eyes throughout the test. The two points of the esthesiometer made vertical contact with the skin for one second with minimum pressure. The student says either one or two points. We increased the distance between the two points of the esthesiometer by 1mm and continued the

test till the subject perceived two distinct stimuli and said two points. Mean and standard deviation extracted from the data. T value and P values are measured to know the influence of gender on two-point discrimination threshold values. We measured the correlation between BMI and the two-point discrimination threshold value by the Pearson coefficient.

Place of Study:

Department of Physiology, Guntur Medical College, Guntur, Andhra Pradesh.

Table 1: BMI Details of the study population

Category	Number of students
NORMAL WEIGHT	40
OVERWEIGHT	20
MILD RISK OBESITY (TYPE-1)	24
MODERATE RISK OBESITY (TYPE-11)	16

RESULTS:

Table 2: Mean and Standard deviation in different regions of hand in females

Area	Mean		Standard Deviation	
	Right	Left	Right	Left
1 st DP	3mm	2.76mm	0.565	0.587
2 nd DP	1.92mm	2.38mm	2.415	0.894
3 rd DP	2.69mm	2.26mm	2.168	0.751
4 th DP	2.84mm	2.38mm	1.376	2.384
5 th DP	3.30mm	2.84mm	2.712	1.956
MID PALMAR	6mm	6.76mm	2.712	2.712

Table 3: Mean And Standard Deviation In Different Regions Of Hand In Males

Area	Mean		Standard Deviation	
	Right	Left	Right	Left
1 st DP	3.41mm	3.33mm	0.775	0.867
2 nd DP	2mm	2.33mm	0.589	0.761
3 rd DP	2.83mm	2.58mm	1.167	1.791
4 th DP	2.91mm	2.91mm	0.974	1.411
5 th DP	3.41mm	3.08mm	1.282	1.059
MID PALMAR	6.25mm	7.166mm	1.870	2.078

From the above data two-Point threshold is more for the Mid-palmar area in both hands. Hence the distal phalanges are more sensitive than the mid-palmar areas in both hands

Table 4: Correlation Of Two Point Threshold Between Right And
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Left Sides

	1 st DP	2 nd DP	3 rd DP	4 th DP	5 th DP	MID PALMAR
Pearson coefficient(ρ)	0.1343	0.0107	0.2023	0.3747	0.2979	0.6706

There is a positive correlation between the right and left palmar surface of the hand but the relationship between variables is weak in the distal phalanges and moderate in mid-palmar surface.

Table5: T And P Values In Association With Gender

	1 st DP		2 nd DP		3 rd DP		4 th DP		5 th DP		Mid Palm	
	rt	lt	rt	lt	rt	lt	rt	lt	rt	lt	rt	lt
T	3.03	3.87	-0.22	-0.30	0.39	1.18	0.29	1.35	0.4	1.0	0.5	1
P	0.003	0.002	0.82	0.764	0.69	0.24	0.77	0.17	0.65	0.27	0.59	0.32

From the above table there is an association between gender and two-point discrimination threshold in right and left first distal phalanx and the remaining areas doesn't have any association.

Table 6: Correlation between BMI and Two-Point Discrimination threshold

Pears on coef ficien t(ρ)	RIGHT						LEFT					
	1 st DP	2 nd DP	3 rd DP	4 th DP	5 th DP	Mid Palm	1 st DP	2 nd DP	3 rd DP	4 th DP	5 th DP	Mid alm
BMI	-0.213	-0.427	-0.188	0.0518	0.237	0.0084	0.383	-0.261	-0.295	0.058	-0.002	-0.076

Two-point discrimination threshold has a positive correlation in the left first distal phalanx, right and left fourth distal phalanges, right fifth distal phalanx and right mid palmar surface.

DISCUSSION:

We performed the study to identify the two-point discrimination threshold in the palmar area of the hand of the first MBBS Students aged between 18-20 years. The mid-palmar surface of both hands is less sensitive than the distal phalanges. Female students have more sensitivity to right and left first distal phalanx than males. These results are similar to⁴. We found a positive correlation between the right and the left side. The relationship between variables is weak in the distal phalanges and moderate on the mid-palmar surface. Giulio Valagussa et al. state that Two-point discrimination values of both lower limbs have a good correlation between the right and the left sides⁵. We found no correlation between the two-point discrimination threshold and BMI. Our findings are similar to⁵.

CONCLUSION:

We conclude that women have less two-point discrimination threshold in some areas of the hand than men. It might be because they have great cortical receptive fields controlling the senses of the hands⁶. The subjects were more sensitive in the distal phalanges than in the mid-palmar area. It may be because the receptive areas for tactile sensation in distal regions get smaller and the receptors used in everyday life are more developed than those in other regions⁷. Our study has certain limitations. We have done research on healthy MBBS students. Studies have shown that two-point discrimination distance may vary on the amount of pressure applied, and the surrounding environment⁸. Some studies are questioning the reliability and validity of the two-point discrimination test. There are studies which state that the two-point discrimination test is less sensitive^{9,10}. Hence our present study helps in determining the normal two-point discrimination threshold value in the palmar aspect of hand as our study includes healthy subjects.

REFERENCES:

- Shooter, David (2005). "Use of two-point discrimination as a nerve repair assessment tool: Preliminary report". ANZ Journal of Surgery. 75 (10): 866-868. doi:10.1111/j.14452197.2005.03557.x. PMID 16176227. S2CID 25300643.
- Dellon AL, Kallman CH. Evaluation of functional sensation in the hand. J Hand Surg Am. 1983 Nov;8(6):865-70. doi: 10.1016/s0363-5023(83)80083-5. PMID: 6643961.
- O'Sullivan, Susan (2007). Physical Rehabilitation Fifth Edition. Philadelphia: F.A. Davis Company. pp. 136–146. ISBN 978-0-8036-1247-1
- Nolan MF: Two-point discrimination assessment in the upper limb in young adult men and women. Phys Ther, 1982;62: 965–969.
- Valagussa, Giulio & Meroni, Roberto & Cantarelli, Francesco & Molteni, Luca & Galbiati, Laura & Cerri, Cesare. (2016). two point discrimination in lower limbs in healthy people: average values and influence of gender, dominance, height and bmi.

10.13140/RG.2.1.2771.3520.

- Barrett KE, Barman SM, Boitano S, et al.: Ganong's Review of Medical Physiology, 24th ed. McGraw-Hill Medical, 2011.
- Lundy-Ekman L: Neuroscience: Fundamentals for Rehabilitation, 3rd ed. Elsevier, 2007, p 113.
- Tamura Y, Hoshiyama M, Inui K, et al.: Central mechanisms for two-point discrimination in humans. Neurosci Lett, 2003, 342: 187–190.
- vanNes SI, Faber CG, Hamers RMTP, et al Revising two-point discrimination assessment in normal aging and in patients with polyneuropathies Journal of Neurology, Neurosurgery & Psychiatry 2008;79:832-834.
- Van Boven, RW; Johnson, KO (February 1994). "A psychophysical study of the mechanisms of sensory recovery following nerve injury in humans". Brain: A Journal of Neurology. 117 (1):14967. doi:10.1093/brain/117.1.149. PMID 8149208.