# Two Point Discrimination Threshold Values And Its Relation With Age And Gender

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***Abstract-***

**Background:** The two-point discriminative sense is an extremely important assessment in patient with injuries to nerves distribution to upper extremity and in parietal lobe disorders.

**Objective:** The main objective of this study is to determine the variation in two-point discrimination sense with age and gender among healthy individuals.

**Methodology:** A Cross Sectional Study conducted among 309 Participants from age 21-60 years. Data Collected by Non-Probability Convenient Sampling Technique from the University of South Asia. The ability to distinguish the two-point was estimated in millimeters by using TPD tool. Results were analyzed by SPSS-25. Study completed within 4 months.

**Result:** Average TPD value is 2.4888±.75428 (male 2.57±.73124 and female 2.40±.76946). There is a significant difference between the mean value of TPD for Gender (male and female [P=0.04]) and Different Age Group (20-30 age (m=1.6462±.300), 31-40 age (m=2.1609±.341), 41-50 age (m=2.7224±.342) and 51-60 age (m=3.4678±.346), [P = 0.000].

**Conclusion:** There was a significant difference in Two Point Discrimination (TPD) values among different age groups and gender. Females have more sensitivity than males. TPD value increase with increase of age.

***Index Terms***- Age, Gender, Two Point Discrimination.

## I. INTRODUCTION

Differentiate two points applied to skin at the same time known as Two-point discrimination (TPD).(1) When two equal pressure and simultaneously stimulus applied on the skin the minimum distance between the stimuli is the measure of TPD.(2) In 1853 two point discrimination first defined by Weber.(3) TPD is divided into three types: static two point discrimination with dull tip, stationary two point discrimination with blunt tip, and static TPD with pointed tip.(4) Disk–criminate is used for first two types and Aestesiometer measure static TPD with sharp tip.(5)

Central nervous system (CNS) and peripheral nervous system (PNS) are two parts of nervous system. Peripheral nerves transmit the sensory information from the distant organ to the CNS and motor information from CNS to organ. Pressure, tactile light touch, pain temperature and proprioception are somatosensory senses.(6) These sensations play a great role in alertness, initiation and control of movement and knowledge of environment. The evaluation of these senses tell about the working ability of CNS and PNS.(7)

Moberg (1990) told that with the right procedure and tool valid and reliable results of TPD are possible.(8) For checking peripheral nerve injury and outcome or recovery of sensation after nerve injury TPD is easiest and commonest test that is used. (9) This test measures distance of 2 points feel by a person with same pressure. It is a tactile discrimination methodology giving exact data on space and is regularly utilized as a dependable technique to look at so esthetic sensibility.(10) the separation

utilized as a part of the test changes according to the body part estimated: one mm on the tongue, two-six mm on fingers, and 400– 600 mm on the lower back.(11)

TPD tends to the affectability of covering responsive fields on the body surface by producing regularizing values. These regulating esteems are the insignificant division (in millimeters) at which the patient can recognize these jolts and ought to be recorded in every limit.(12) For evaluation and testing hand injuries in neurological examination TPD is mostly used. To check that how much damage occur to peripheral nerve of hand normal values of DPT are used present previously. told that using Aestesiometer for testing TPD in upper extremity is most suitable and useful method.(2)

TPD values are different for different regions of body. Different past investigations on TPD analyzed impression of stress for fixed and moving segregation, observation procedures of TPD of ordinary individuals, and assessment models of TPD relying upon ages.(13)

There are many studies conducted on TPD but still the data for this is not enough. A lot of researches on TPD have been carried out in the West, but no longer a good deal has been found in Pakistan. Normal values are very important in sensation testing related to evaluation of result, assessing nerve damage of hand and post-surgical cases, its assistance is huge. The loss of sensory patterns are assessed by sensory exam. Any problem in somatic sense indicate by change in discriminative ability.(14)

The present study measured TPD values among healthy population with different age groups from 21 to 60 years to get basic statistic for goal assessment of sensory system. There is hardly availability of normal values of TPD in association of age and sex in local settings. Findings of this study will help others to compare irregular values of TPD with the normal values. Results will also help to understand effect of aging on sensory functions of male and female populations that is a core part of neuro physiotherapy.

## II. MATERIAL AND METHODS

Cross Sectional Study conducted among participants were included by using Rao software. Four groups were formed according to age 21-30 years, 31-40 years, 41-50 and 51-60 years with equal male and female ratio. Data was collected from university of South Asia, Railway Headquarter, Lahore and those who were easily available and agree to deliver the information that is correct and sufficient. Self-design questionnaire based on demographic data was filled. Static two-point discrimination test with Two Point Discriminator tool an Aestesiometer. Intra-rater reliability for hand ICC 0.82. Firstly, touch sensation was check by using cotton wisp then two-point discrimination tool was used to measure 2 PD values with close eyes on index finger of right hand. Values were recorded in millimeter (mm). when the participants could not differentiate two points separately. Nonprobability Convenient Sampling Technique was used to collect data. Subjects selected were interrogated to make sure that they fulfill the criteria of inclusion of the study after the synopsis was approved by the ethical committee of the University South Asia and authorization of all related departments. Participants were explained thoroughly about the testing procedure. All participants were agreeing to participate and available for further study and filled survey questionnaire. Age and Gender were Independent Variable while two-point discrimination was dependent Variable. The survey questionnaire was called as per the criteria of inclusion of the study. Participants Included in this study were Normal Healthy individuals. Both male and female. Age 21-60 years. Excluded were those having Any Neurological deficit, Peripheral neuropathy, Upper limb trauma within last 6 months, Burn, Scars and Dermal hypersensitivity, cutaneous disorders, Stroke, multiple sclerosis, and Cognitive issues. The study was finished within 6 months after the synopsis acceptance. Participants responses collected and all data entered in SPSS file. Descriptive data (e.g., gender, socioeconomic status, dominant hand) was measured by frequency table, graph, and charts. Quantitative data (which includes age, two-point discrimination values) was measured by mean and stander deviation. Independent sample t-test was used to compare males and females values of Two Point Discrimination. P-value of 0.05 or less was considered as significant. One Way ANOVA analysis was used to find the difference of mean values of 2PD among different age groups.

## III. RESULTS

Among 309 participants there are almost Equal number of male and female (50% in each group) in four different age groups from age 21-60 years (21-30, 31-40, 41-50 and 51-60)(25% in each group). 64.1% are employed and 35.9 % are unemployed. 97.7% are right-handed and 2.3% are left-handed. 8.1% are upper class (n=25), 83.5% are middle class (n=258) and 8.4% are from lower class (n=26)

Mean Two Paint Discrimination value of TPD for 309 participants is 2.4888±.75428 at right index fingertip. Minimum value is 1.15mm and maximum is 3.95mm. For male is 2.57±.73124 and for female is 2.40±.76946. Among 309 Participants, the mean of TPD for the 21-30 age group is 1.6462±.30040. The mean of TPD for the 31-40 age group is 2.1609±.34137, the mean of TPD for the 41-50 age groups is 2.7224±.34229 and the mean of TPD for the 51-60 age groups is 3.4678±.34600.

***Table 1: One Way ANOVA For difference between Age Groups and Within Age Groups***

| | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| **Between Groups** | 141.456 | 3 | 47.152 | 425.767 | .000 |
| **Within Groups** | 33.778 | 305 | .111 | | |
| **Total** | 175.234 | 308 | | | |

***Table 2: Post Hoc Test***

| Age Groups | (J) Age | Mean Difference (I-J) | Sig. |
|---|---|---|---|
| 21-30 | 31-40 | -.51469* | .000 |
| | 41-50 | -1.07617* | .000 |
| | 51-60 | -1.82156* | .000 |
| 31-40 | 21-30 | .51469* | .000 |
| | 41-50 | -.56147* | .000 |
| | 51-60 | -1.30687* | .000 |
| 41-50 | 21-30 | 1.07617* | .000 |
| | 31-40 | .56147* | .000 |
| | 51-60 | -.74539* | .000 |
| 51-60 | 21-30 | 1.82156* | .000 |
| | 31-40 | 1.30687* | .000 |
| | 41-50 | .74539* | .000 |

In table-2, Age and mean TPD value in four age groups (21-60 years) was compare by application of One-way ANOVA. Age Group 21-30 is significantly different from 31-40, 41-50 and 51-60 (P Value 0.00). Group 31-40 is significantly different from 21-30, 41-50 and 51-60 (P Value 0.00).Group 41-50 is significantly different from 21-30, 31-40, and 51-60 (P Value 0.00). Group 51-60 is significantly different from 21-30, 31-40, and 41-50 (P Value 0.00). $P < 0.05$ for all age groups. It means that there is significant difference between Two Point Discrimination values among different age groups [$F(3, 305) = 425.767$, $p = 0.000$].

***Table 3: Independent Sample t test Two Point Discrimination Difference among Genders***

| | Gender | Mean | Std. Deviation | Independent Samples Test |
|---|---|---|---|---|
| **Value of Two Point Discrimination at Right Index Fingertip (mm)** | Male<br>Female | 2.5744<br>2.4039 | ±.73124<br>±.76946 | t(307)=1.996, P =0.047 |

The table-3 shows mean of TPD for male is 2.57±.73124 and for female is 2.40±.76946.The mean value of TPD for male is found to be higher than female. Independent sample t-test reveals that there is significant difference between male and female as Two Point Discrimination (TPD) value was $p<0.05$, $t(307)=1.996$, $p =.047$.

## IV. DISCUSSION

Among 309 participants there are almost Equal number of male and female (50% in each group)in four different age groups from age 21-60 years (21-30, 31-40, 41-50 and 51-60)(25% in each group). 64.1% are employed and 35.9 % are unemployed. 97.7% are right-handed and 2.3% are left-handed. 8.1% are upper class (n=25), 83.5% are middle class (n=258) and 8.4% are from lower class (n=26). Mean Two Paint Discrimination value of TPD for 309 participants is 2.4888±.75428 at right index fingertip. Minimum value is 1.15mm and maximum is 3.95mm. For male is 2.57±.73124 and for female is 2.40±.76946. (15, 16)

A Study Conducted by *Asir and Kannathu* in 2014 revealed that fingertips have much free ending of nerves that why fingers are

more sensitive than rest of body for TPD sense. this study also determined that finger tips are very delicate part of human body.(2)

A Study Conducted by *Michael F.* according to which two-point separation affectability over the area of hand and determined 21.0 mm TPD value of interosseous muscle. Reason, why hand is picked to get TPD values in our study is that hand is an extremely exceptional organ with special capacities and adaptability in human body. This investigation indicates skin zone covering the volar surface of the tipoff pointers of right hand appeared of 2.4 mm Results showed TPD values are found better in younger age participants.(17)

In the previous studies different two-point discrimination tools were used disk-discriminator, Aestesiometer and drawing compass. The principle favorable position of Aestesiometer is as it permits break even with conveyance of weight by with least consideration in application. The instrument is planned with the end goal that the pointer has ordinary sharp tip. It is one of the easiest way to assess TPD with accuracy.(5)

A study Conducted by *cashin et al* in 2017 dissected the impact of age at esteems and they determined that age increment 2-point segregation esteems. This research reported that age cause change in senses. According to our study TPD sensitivity decrease with increase of age. It is revealed that person's age has an impact on 2-point segregation capacity.(18) A study conducted by *Ja-Pung Koo, Soon-Hee Kim,et al* In 2016. They measured TPD in upper limb they said that females have sort distance values of TPD than males, but females have greater TPD. The current research also tell that males are less sensitive than women and women have high 2PD values.(13)

## V. CONCLUSION

There was a significant difference in Two Point Discrimination (TPD) values among different age groups and gender. Females have more sensitivity than males. TPD value increase with increase of age.

LIMITATIONS

Due to time and resources limitation, study was conducted on a limited scale. Moreover, it was difficult to find out nondiabetic participants in age group 50-60 years. Age of participants is main consideration in current study therefore participants less than 20 years could not take part in this study.

RECOMENDATION

Studies focusing on comparative analysis of normal values and variation in TPD threshold due to different pathologies e.g., Nerve injuries, Stroke and Diabetes etc., can expand the scope of knowledge. Future studies can focus on larger scale by including population all over Pakistan. Further studies should be done for testing TPD sense include age less than 20 years.

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