International Journal of Medical Science and Dental Research

Comparison of Two Point Discrimination of Palmar Surface of Distal Phalanx of Thumb between Dominant and Non Dominant in Labourers

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ABSTRACT

BACKGROUND:Two point discrimination test assess the ability to perceive two points applied to the skin simultaneously applied with equal pressures. The finger tips and palm of the hand are considered to be the most sensitive parts which perceive the two-point in a small distance when compared to other parts of the body.**OBJECTIVE:** To compare the tactile acuity of the thumb finger between dominant and non dominant hand n labourers. **STUDY DESIGN** :Observational study.**PROCEDURE**: Subjects were made to sit in a comfortable position and were asked them to close their eyes. With the aesthesiometer stimulus was given and were asked the subjects to perceive the points. Values were noted accordingly.**RESULTS**: . Mean and standard deviation of dominant hand is 2.627 and 0.5205. And of non dominant hand is 2.013 and 0.4954.

CONCLUSION: This study concluded that there was a difference in tactile acuity of thumb in dominant and non dominant hand. It differesaccording to their profession and usage of dominant hand.

KEY WORDS:Two point discrimination, labours, dominant and non dominant

I. INTRODUCTION

Human skin is embedded with numerous sensory receptors that responds to various types of external stimulus. Information from our skin helps us to perceive different types of sensations like vibration,tapping,pain,pressure and temperature. Information to the higher centres of brain is carried by somatosensory pathways. Somatosensory pathway consists of chain of neurons from the receptor organ to somatosensory cortex which is responsible for perception of various sensations[2,3,5].

Mainly somatosensory pathway neurons are located in the dorsal root ganglion,the spinal cord and the thalamus. These neurons terminate in the parietal lobe of cerebral coxtex.There are three major types of sensory pathways named posterior coloumnspinothalamic and spinocerebellar tracts. The primary sensory cortex receives fine touch, vibration and proprioception stumuls from the opposite posterior coloumn tracts. Cerebellum gets proprioception sensations from the spinocerebellar tract [2,4,7,10].

Medial Lemniscus-Dorsal Column pathway mediates conscious proprioception, sensation of tactile discrimination, vibratory sense and form recognition[2].

Sensory input is "mapped" onto specific brain areas. A cortical homunculus represents the areas and proportions for motor and sensory functions which are based on neurological “map” on human brain. Sensory mapping represents the sensory processing for different divisions of the body. The primary sensory cortex is located in the postcentralgyrus[1,6,8,12].

In sensory homunculus thumb occupies the major part on cortex.This represents the fingertips contain higher receptor density and receptor fields.The ability of two point discrimination depends upon the density of receptors and size of density fields. For example arm sensory receptor carries information from a

large area of skin.In arm the sensory receptors are not interrupted by adjacent receptors so arm can perceive two points when the distance is of 35-40mm whereas fingertips can perceive of lesser distance[1,10,13].

In two point discrimination two separate populations of neurons gets activated. This determines that receptors should be densely packed and the size of receptive fields should me small[10,11,12].

For nerve damage,two point discrimination tests is used as one of the parameter in neurological examination.It is a classic test of sensibility of protective sensation.This testing is more accurate on fingertips.

The ability to differentiate two nearby points by touch stimuli on the body at the same time is two point discrimination.[1,13,14]

The two point discrimination test was invented by Weber. The test is closely related to tactilegnosis and functional ability of the patient to use the hand for the fine motor and skilled tasks.The moving two point discrimination test was introduced by Dellon and conveyed that fingertip sensibility is highly dependent on motion[10].

Normal two point discrimination value 6mm, fair-6mm to 10mm and poor-11mm to 15mm.American society for Surgery of the Hand and International Federation of Hand Surgery Society had suggested these values for reference[9].

Knowledge on assessment of hand two point discrimination is sparse among Physical therapist .The importance of two point discrimination is neglected and no recent research also provide the normative values. Labourers work hard with their hands and so far the normative data for them has not been documented. Hand injuries are quite common among labourers and so for the purpose to help with hand rehabilitation,this study was designed to know the normative values of thumb. Least data were available on the difference of twopoint discrimination between dominant and non dominant hands also.So keeping all these criteria in mind,this study was developed to compare the tactile acuity of thumb between non dominant and Dominant hands among the population of Mason Labourers.Further more studies on hand is quite less in India so this study becomes the need of the hour.So the aim of this study is to compare the tactile acuity of the thumb finger between dominant and non dominant hand among labourers.

II. METHODOLOGY

Cross sectional ,Observational study.Labourers of minimum 3 years of experience ,both gender ,age group of 18-30 years were included in the study and subjects with Eczema,Psoriasis,Nerve injuries ,Major burns on hands were excluded from the study.A total sample of 108 subjects were randomly selected from SRM University labour workers.Institutional Ethical Clearance was obtained(13h/IEC/2017).subjects informed consent was taken after proper explanation of the purpose of the study.The tactile acuity was determined for the pulp of both thumb distal phalanx on dominant and non dominant hand. A 10mm square testing area was marked on the pulp of thumb finger.

Subjects were seated on an appropriate height stool and arms were placed on a firm cushion or therapist hand,ensuring that it was supinated comfortably without harming or over stretching the joints of the arm.Subjects was instructed to keep the hand in comfortable position to avoid over stimulus and injury. First the procedure was explained to the subjects.Then the vision was occluded. Aesthesiometerpoints are adjusted to 3mm and then the subjects were askedto perceive and say whether he/she is perceiving one or two points. If he/she was able to perceive two points then distance was decreased if not increased by 1mm until he/she perceives one point. Values are noted accordingly and then 3 out of 10 values was taken.

Figure 1: Testing the marked area with the AESTHESIOMETER

RESULTS:The collected data was tabulated and analysed using descriptive statistics. To assess all the parameters mean standard deviation were used.Paired t test was used to compare the dominant and non dominant data.

TABLE 1

Comparison of tactile acuity of thumb between Dominant and Non Dominant hand among Labourers by mean values.

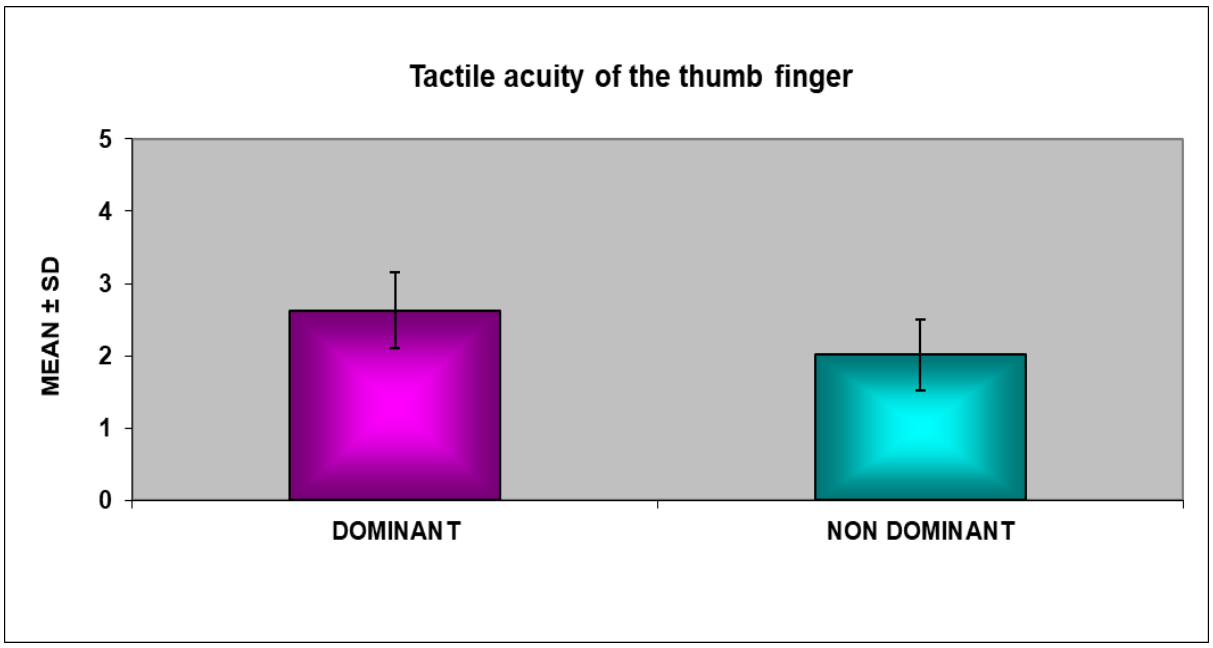
THUMB ACUITY	DISTANCE MEAN(IN mm)	STANDARD DEVIATION	T VALUE	P VALUE
DOMINANT	2.6	0.52	8.878	0.000
NON DOMINANT	2.0	0.49		

P<0.05

There exist a significant difference between dominant and nondominant tactile acuity on thumb among labourers.On analysis,non dominant thumb has more tactile acuity compared to dominant

GRAPH 1

Comparison of mean values of thumb acuity between Dominant and Non Dominant hand among Labourers.



III. RESULTS

Table 1 and Graph 1 shows that the mean of dominant hand was 2.627 and non dominant hand was 2.013.Hence showing more tactile acuity of thumb in non dominant hand statistically.

IV. DISCUSSION

Mason labourers were recruited for this study to assess the thumb acuity as they work with mineral products like cement, stones, brick etc,.

In this study 108 samples were taken out of which 91 are males and 17 are females.Mean and standard deviation of dominant hand is 2.627 and 0.5205 and of non-dominant hand is 2.013 and 0.4954.

On comparison non dominant hand showed with better acuity than dominant hand($p<0.05$,Table and Graph 1)

Usually tactile acuity of hand is more accurate in dominant than in non dominant in general population. But in Labourers, they work with products which are having minerals so they would have showed difference in tactile acuity of thumb.This better explains the results.

Cement consists of calcium oxide Cao, silica oxide $Si0_2$and aluminium oxideAL_2O_3 andwhen these are mixed with water it forms to hydroxide compounds. Exposure to these compounds affects eye skin and respiratory tract. These leads to skin burns, corrosion of eye, upper respiratory infections.

Usually skin undergoes desquamation for every 27 days. But in mason as they work with such mineral products it effects the skin mainly of hands.It shows effect on sensory receptors which are main inputs of sensory pathway to brain. Due to this mineral products mason labourers thumb acuity value is more in non dominant hand compared to dominant hand. Because of such mineral products effects on skin there was difference of thumb acuity compared to general population.

This goes in hand with Omar (1980) who showed that heavy callus over the skin could influence the result value[(4)].

This goes in hand with E. S. Dellon (1995) who concluded that there exist a relationship between skin hardness,perception and twopoint discrimination in fingertip[(10)].

This helps as reference for assessing the hand injuries in physiotherapy for hand rehabilitation. And also helps to spread the awareness of safety measures in hard working labourers.Two point discrimination should be given due importance in its assessment and also profession should be taken in to account in hand rehabilitation.

Thumb acuity may vary between dominant and nondominant hands and hand therapist should bear this in mind when assessing and managing the patients. Precision activities thus may differ and this should be taken in to account while framing the exercise protocol.

With this normative data assessed it can be used as the reference to compare for the labourers and the difference may also bring an information regarding the management of hand injury subjects.

This study also tends to bring the awareness about the importance of skin thickness while assessing and treating subject and also recommends the use of appropriate safety measures to prevent any injury. The results indicates that the thumb acuity is reduced in dominant hand and these labourers use the dominant hand lot for hard work which increases the incidence of injury to that hand.So more care to be taken for the workers to prevent injury and to improve the welfare.

Limitations of this study were Working experience is not calculated ,Sample size is small ,Age and Gender has not been classified .Future studies can be done on Different proffesionals ,Effect of stress on Two point discrimination can be studied further and also Two point discrimination in mobile users can be documented

V. CONCLUSION

This study concluded that there was a difference of tactile acuity according to their profession and usage of dominant hand. In massion labourers there is difference in tactile acuity on dominant hand because of effect of minerals with which they work.

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