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Original Article

The effect of median nerve mobilization on two point discrimination

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Abstract. [Purpose] Two-point discrimination (TPD) is expressed as the minimum distance at which two mechanical stimuli applied simultaneously to the skin can be perceived as two separate points. The aim of this study was to investigate the effect of median nerve mobilization on TPD in healthy adults. [Participants and Methods] This study included 120 healthy adults. Participants were randomized according to their gender into the Neural Mobilization Group (NMG) and Control Group (CG). Demographic data of the participants (gender, age, height, weight, BMI, smoking) were recorded and TPD measurement was performed with baseline aesthesiometer on the palm with distal phalanges of the thumb, index and middle finger on the right-left hand. After the baseline TPD test, participants in the NMG performed Median Nerve Mobilization for 14 days. Measurements were taken before and after training. [Results] A statistically significant difference was found in all other measurements in both groups, except for the right and left palm TPD measurements in the control group. [Conclusion] It is thought that it would be beneficial to investigate the healing effects of the neural mobilization applications, which include all parts of the nerve line in disease conditions.

Key words: Two-point discrimination, Neural mobilization, Median nerve

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INTRODUCTION

Two-point discrimination is a function of touch involving peripheral and cortical mechanisms and traditionally used as a measure of cutaneous innervation density[1)]. Inhibitory mechanisms in the central nervous system, including the receptor domain in the skin, spinal cord, sub-cortical structure, and cerebral cortex, contribute to the two-point discrimination (TPD) process[2)].

TPD test measures innervation density in the area tested[1)]. In the TPD test, it is evaluated whether the individual can identify two close points on a small skin area and how good the ability to distinguish it[2)]. It is a frequently preferred measurement method in clinics with its easy and fast results[3–5)].

Various studies which applied TPD tests, showed that there is insufficient TPD skill in conditions such as peripheral nerve lesion, compression neuropathy, nerve repair, and diabetes associated with nerve injuries[3–5)]. Skills such as TPD are of great importance for individuals who have to focus on the somatosensory system while performing activities of daily living, in conditions such as visual impairment, which may cause a deficiency in sensory integration independent of nerve injury. For example, in one study, it was shown that the reading finger of visually impaired individuals reading braille exhibits an enlarged cortical representation in the somatosensory area[6–8)]. It has been determined that the median nerve sensitivity evaluated by TPD in visually impaired people who read Braille is at a better level in the palm than in individuals with text reading. It has been suggested that median nerve sensitivity can be improved in these individuals with neurotherapy-based physiotherapy methods[9)].

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Nerve mobilization exercises are applied to improve nerve conduction by increasing axonal transport. In addition, with mobilization, the current pressure on the nerve is reduced and the blood flow to the nerve increases, resulting in an improvement in nerve function. This can allow the injured nerve to regenerate and heal. At the same time, it seems possible that an undamaged nerve will also increase its sensitivity with mobilization[10, 11].

In the literature, it has been seen that nerve gliding exercises, which involve the distal part of the median nerve or closer joints, are often applied in the treatment of median nerve damage[12–15]. In our study, it was aimed to improve TPD in healthy individuals by applying median nerve mobilization with the wall stretching method to cover the entire line of the median nerve. We anticipate that this method we have applied will shed light on the inclusion of individuals who need to develop TPD into the treatment program.

PARTICIPANTS AND METHODS

The study was approved by the Non-Intervention Ethics Committee of Istanbul Medipol University (approval number: 10840098-604.01.01-E.63690). Informed consent was obtained from all volunteers in accordance with the Declaration of Helsinki. A total of 120 adult volunteers (60 females, 60 males) aged between 20–30 years were included in the study. Patients with any of the following criteria were excluded: neurological disease, skin disease, burn or scar tissue, diabetes, chronic pain, and cognitive problems. Participants were randomized according to their gender into the Neural Mobilization Group (NMG, n=60) and Control Group (CG, n=60) using the closed-envelope method.

Demographic data of the participants (gender, age, height, weight, BMI, smoking) were recorded and a TPD performed on the palmar face of both hands from the distal phalanx of the thumb, index and middle finger, and palm (median nerve, thenar branch).

TPD was performed with the Baseline aesthesiometer in a quiet environment with the participant sitting in the chair and with his eyes closed. TPD measurement was performed following the staircase method[16]. The distance between the two points gradually increased until the participant felt two different points. The participant was instructed to say ‘one’ if he felt one point, ‘two’ if he felt two points and ‘not sure’ (forced choice method) if he was in doubt. Seven correct answers out of ten were accepted as valid for determination of the threshold. During the test, care was taken to touch the two points to the skin simultaneously and not to cause pain. Inter stimulus interval was a minimum of 5 s[16, 17].

After the baseline TPD test, participants in the NMG performed 2 sets of 5 repetitive Median Nerve Mobilization (total of 20 sessions) per day for 14 days. In the upright position, the hand rests against the wall as shown (Fig. 1). Routine: The affected upper extremity undergoes: (1) Slight glenohumeral abduction (2) Shoulder girdle depression (3) Elbow extension (4) Lateral rotation of the whole arm (5) Wrist, thumb, and finger extension. The head is turned to the opposite side, and held in this position for 5 s[18, 19]. The neural mobilization method was created based on the mobilization time and session frequency in Heebner et al.’s study[18]. After the neural mobilization, the TPD measures repeated in all groups.

The SPSS version 21; (IBM Inc., Chicago, IL, USA) was used for data analysis. The sample-size calculation was based on the mean and standard deviation of index finger[20]. The minimum necessary sample size was determined to be 40 participants for each group, with a 20% absence rate. The alpha level used in determining the sample size was 0.05, and the ideal power was considered to be 80%. The calculation was made in G* Power 3.1.9.4 program. The Shapiro–Wilk test was used to determine the normality of the parameter distributions, and the data show not a normal distribution ($p<0.05$). Descriptive statistics are reported as the mean ± SD and %. Inter-group differences in demographic and baseline variables were tested using a Wilcoxon test. $P<0.05$ was considered significant.

Fig. 1. Median nerve mobilization.

RESULTS

Demographic information of 120 participants included in the study is shown in Table 1. The two groups were similar in terms of gender, height, weight, BMI and smoking, except for age ($p>0.05$). Table 2 shows the change in TPD values of the groups before and after exercise. A statistically significant difference was found in all TPD measurements of the right and left hands in NMG ($p<0.05$). A statistically significant difference was determined in the measurements of the right and left thumb, index and middle fingers in CG ($p<0.05$). There was no change in TPD measurement for the right and left palms on CG ($p>0.05$).

DISCUSSION

In the study we aimed to investigate the effect of median nerve mobilization on TPD in healthy adults. Improvements were observed in the right and left hand thumb, index and middle finger TPD values of the participants in both nerve mobilization and control groups. While significant improvement was observed in the right and left palm TPD values in the neural mobilization group, these parameters did not change in the control group.

The improvements in thumb, index and middle finger TPD values in both groups in our study may be due to the learning effect of individuals. However, it was observed that the predicted learning effect was not reflected in the parameters of the right and left palms (thenar region) in the control group. The improvement in TPD ability in the right and left palm measurements in the neural mobilization group made us think that it was the result of the effect of the median nerve mobilization we applied.

While the sensory fibers of the median nerve pass more superficially in the thenar region, the motor fibers pass deeply. In the applied median nerve mobilization; In the stretching position on the wall, the radix of the median nerve is relaxed by moving the head to the opposite side, and the nerve's trace is stretched by extending the arm[21–23]. Thus, a stretch is obtained along the median nerve line, and the increase in the activation of the sensory fibers of the median nerve superficial in the thenar region with this application is thought to be the reason for the improvement in TPD values.

Table 1. Baseline participant characteristics

Variable	NMG (n=60) Mean ± SD	CG (n=60) Mean ± SD
Age (years)	21.00 ± 1.65	23.31 ± 2.66*
Height (cm)	1.71 ± 0.09	1.71 ± 0.08
Weight (kg)	68.15 ± 13.14	69.91 ± 14.15
BMI (kg/m^2)	23.10 ± 3.15	23.60 ± 3.31
Gender	NMG (n=60)	CG (n=60)
Female (n, %)	30, 50%	30, 50%
Male (n, %)	30, 50%	30, 50%
Smoking (n, %)	23, 38%	22, 36%

NMG: Neural Mobilization Group; CG: Control Group; SD: Standard Deviation. *$p<0.05$.

Table 2. Intragroup comparison of right-left hand measurements of participants before and after exercise

	NMG (n=60)		CG (n=60)	
	Before Mean ± SD	After Mean ± SD	Before Mean ± SD	After Mean ± SD
R thumb	0.26 ± 0.01	0.18 ± 0.01*	0.29 ± 0.01	0.23 ± 0.01*
R index finger	0.23 ± 0.009	0.15 ± 0.008*	0.24 ± 0.009	0.24 ± 0.009*
R middle finger	0.25 ± 0.01	0.17 ± 0.008*	0.28 ± 0.01	0.28 ± 0.01*
R palm	0.59 ± 0.03	0.42 ± 0.03*	0.71 ± 0.03	0.71 ± 0.03
L thumb	0.26 ± 0.01	0.18 ± 0.008*	0.27 ± 0.01	0.23 ± 0.009*
L index finger	0.22 ± 0.01	0.15 ± 0.007*	0.24 ± 0.01	0.19 ± 0.009*
L middle finger	0.24 ± 0.009	0.17 ± 0.007*	0.26 ± 0.01	0.21 ± 0.009*
L palm	0.61 ± 0.03	0.46 ± 0.03*	0.72 ± 0.02	0.67 ± 0.03

NMG: Neural Mobilization Group; CG: Control Group; SD: Standard Deviation; R: Right; L: Left. *$p<0.05$.

There are studies in the literature showing that as the sensitivity of the median nerve increases, an improvement can be seen in the dermatomes it spreads and the functionality of the hand muscles innervated by the nerve[23]. Previous studies have included nerve gliding exercises, often involving the distal part of the median nerve, in disease states mostly caused by nerve compression and injury, and results on sensory discrimination appear to be inconsistent[13, 23].

It is thought that it would be beneficial to investigate the healing effects of the neural mobilization applications, which include all parts of the nerve line, in the palm of the hand shown in this study, also in disease conditions. Median nerve mobilization can take place not only in injury conditions, but also in the rehabilitation of visually impaired individuals who need the ability to distinguish sensory information (braille alphabet studies, etc.), thus increasing the sensitivity of the thenar region.

In the current study, the use of a subjective method for TPD measurement can be said to be a limitation of the study. In future studies, it is recommended to contribute to the literature with objective data to be obtained by using different techniques in median nerve mobilization and using electrodiagnostic tests in the evaluation of TPD.

Funding and Conflict of interest

The authors declare no conflict of interest.

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