

SHORT COMMUNICATION

Influence of Motor Task on Handedness**Jayasheela G.Bagi, Padmashri S.Kudachi* and Shivaprasad S.Goudar***Department of Physiology, J.N. Medical College Belgaum, Karnataka, India*

Abstract: Preferred hand used to perform various task is more skilled than the non preferred hand and use of non preferred hand to execute a task induces fatigue at a faster rate. To evaluate the possible functional asymmetries of motor tasks on dominant hand versus the non dominant hand, in the present study hand preference was assessed by using items from a standard questionnaire like Edinberg, Annet inventories and examined the manual asymmetry for both the skilled and strength/power task on handedness using different motor tests. In consistent with previous studies, the present findings point that right hand performed better than left hand in right handers [Finger Tapping; Right hand(22.0 ± 3.2) Left hand(18.2 ± 3.0), Grip Strength; Right hand(22.0 ± 3.2), Left hand(18.7 ± 5.3), $p=0.050$] and left hand performed better in left handers [Finger Tapping; Right hand(18.8 ± 3.0), Left hand(18.8 ± 3.3), Grip Strength; Right hand(20.0 ± 8.4) Left hand(22.5 ± 11.8), $p=0.040$] but the asymmetries observed were less for left handers compared to right handers.

Key words: Grip strength, Finger tapping, Handedness, Motor task, Performance skill.

Introduction

Handedness is perhaps the most blatant behavioral asymmetry observed in humans [1]. Approximately 90% of population shows preference for right hand and other 10% for left hand [2]. The term handedness however may refer either to hand preference or to the asymmetrical performance of manual tasks [3]. Interest in hand preference is because of its impact on hand skill and relation to brain function [4]. The degree of manual asymmetry is generally assumed to vary with different task and the basis for this variation is not well understood. On most manual tasks usually the preferred hand is used more than the non performed hand [5]. However variation in task performance depends on nature of task, as the output function executed depends on muscular activity that has three components: force, speed and accuracy and these components are further to a limited extent influenced by factors like age, sex, physical environment, energy to perform the task [6]. Previous study suggested that different types of manual tasks are independently lateralized [3] while other study contradicted stating that the degree of asymmetry decreased with the task [5]. Hence we intended to measure the asymmetries in manual tasks by tests that examine speed and accuracy by finger tapping and the grip strength that measures strength/power among medical students. The results may enable modification of skilled oriental instructional sessions as well as designing training programmes to optimize the functions of non dominant hand.

Materials and Methods

First year medical students (n=150, 92=males, 58-Females) in the age group of 17 to 23 years (M=18.49 yrs, SD=0.954) were enrolled.

Selection of subjects: The physical deformity is known to prevent the performance of the tests. The subjects with neurological illness like reduced power and symptoms like tingling numbness in the hands were excluded from the study.

Tests & Procedure: Hand preference was assessed by a self reported questionnaire that included name, age, sex and handedness by birth and a self reported hand preference for a series of motor tasks (12 items) selected from Annett (1970) [7] and Edinburgh Handedness Inventory [3]. Responses to the Questionnaire were recorded using a 3 point rating scale. Distinct handedness groups (right and left) were obtained on the basis of their scores on the questionnaire ranging from 33-28 (right handed) 24 (ambidextrous) and 20-15 (left handed). In this study two tasks, skill and strength were administered to test task specificity. Hand performance asymmetries were measured by two tasks: Finger tapping on a Tap key, grip strength using a hand dynamometer (model 5030 Jamar dynamometer) The unit of measurement were Kilogram (Kg) of force [1].

Speed: We measured finger speed by asking the subjects to use their index finger to tap the tap key for ten seconds. Right and left hand scores were derived by the number of taps for 10 seconds.

Static strength: Static strength was measured with a hand – held dynamometer. The participants were asked to hold the instrument at their side and squeeze the dynamometer handle as hard as possible.

Statistical analysis –Correlation of the tests were analyzed by multiple regression analysis and mean scores for handedness effect on task using modified ‘t’ test. The results were considered statistically significant with $p(<0.005)$.

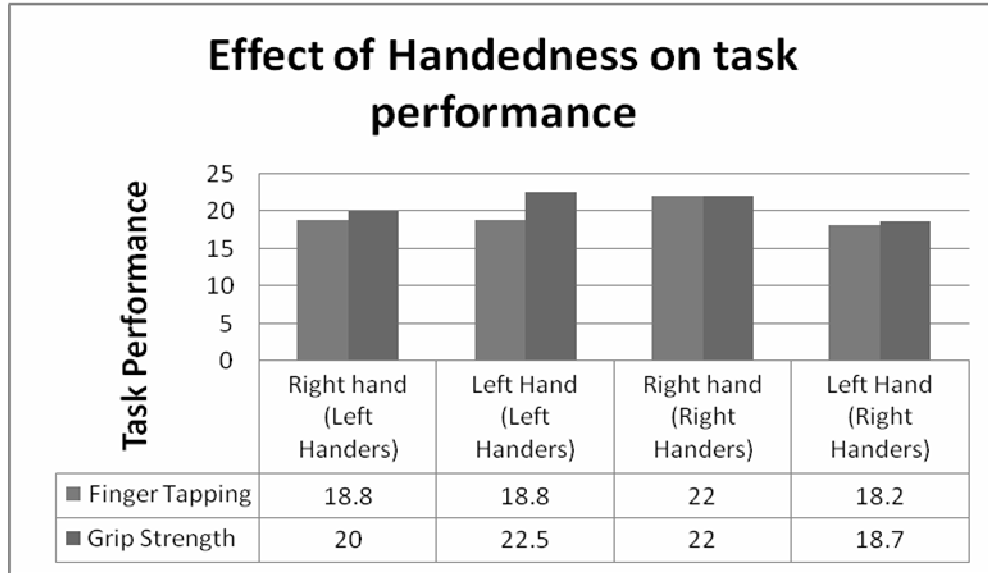
Results

In the present study two groups were quantified that is right handers 146 (97.3%) and left handers 04 (2.70%) no either or ambidextrous group was formed. Comparison of scores between self reported and laterality scores were highly significant ($p = 0.000$). Modified ‘t’ test for the two tasks performed indicated a significant relationship ($p < 0.05$) on the mean degree of manual asymmetry such that right hand performed better than left hand in right handers and left hand performed better in left handers. The degree of asymmetry observed among left handers was less compared to right handers which could be attributed to less lateralization. Details of the effects of handedness on task performance shown is [Fig.1]

Table-1: Correlation of hand preference based on self report and scoring on Annett questionnaire

Hand	Based on Self report		Based on scoring	
	Number	Percentage	Number	Percentage
Right handers	146	97.30%	146	97.30%
Left handers	004	02.70%	004	02.70%
Total	150	100.00%	150	100.00%
p = 0.000		t = 13.70	df = 148	

Fig.I: Mean scores for handedness effect on task performance



Using discriminant function analysis it was observed that the percentage of correctly classified hand preference was more than 90% for both forms of tasks. Therefore this accuracy rate did not differ between hand preference groups, $p=0.000$ (Table 2).

Table-2: Predicting hand preference group from performance measures by using discriminant function analysis

Tasks	Handedness	Preference		λ	X^2	p	%
		LH	RH				
Finger Tapping	Left Handers	04	000	0.799	33.04	0.000	96%
	Right Handers	06	140				
Grip strength	Left Handers	03	001	0.884	18.162	0.000	94%
	Right Handers	08	138				

Discussion

Questionnaire used to classify handedness groups are subjective, strongly lateralized and places demand on cognitive process. One disadvantage is that it categorizes more left or right handed. Hence, performance based measure being objective is used to predict levels of manual asymmetry. As previous studies have linked manual asymmetry or the use of preferred hand more for skilled tasks than unskilled or strength task [5,7-8], in this study we examined the manual asymmetry for both the skilled and strength/power tasks. Different types of manual tasks may vary according to the type and nature of the work. Our findings revealed a strong preference for right hand across all age groups (17.23 yrs). The degree of asymmetric hand preference was maximum for both the motor tasks in right handers and a moderate degree of asymmetry for speed task compared to the task assessing strength in left handers.

Right hand performed better than left hand in right handers and left hand performed better in left handers. The results of this study is consistent with previous studies [5,7-9]. The advantage of preferred hand could be attributed that the preferred hand is 6% more stronger when compared to non preferred hand [6] and few studies on transmagnetic stimulation [9-10] have showed a functional asymmetry of the motor cortex between the dominant hand and non dominant hand for right handers and these differences were not observed in left handers. However, decreased asymmetry for left hander could be due to the equilibrated system of bimanual control[11] and another possible source could be associated with activation of both the right (contralateral) and left (ipsilateral) sensory motor areas[12]. In contrast another study showed that left handed persons showed a much more variable asymmetry pattern compared with right handed people[13]. Thus differences in the degree of hemispheric asymmetry in right and left handers might reflect the corresponding difference in their cerebral organization in the primary cortex [14].

Conclusion

Most of the medical students exhibited manual asymmetry. The preferred hand use was more pronounced for both the tasks suggesting that task specificity did not affect the frequency of preferred hand. Though the degree of manual asymmetry was less in left handers compared right handers, hand asymmetries in these tasks contributed independently to predicting hand preference. This could be related to asymmetries in multiple neural substrates, differences in strength and skill of the right hand and left hand, larger muscles, more efficient neuromuscular coordination. Since the medical students need to use non dominant hand in many skilled activities during their medical practice, training programs may be devised. Tools like writing system, use of keyboard by non dominant hand may help to improve the skills strength & endurance in manual activities.

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