

Effect of handedness on visual, auditory and cutaneous reaction times in normal subjects

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Abstract: *Background & Objective:* Simple reaction time is the time interval between stimulus and response. In this study the impact of handedness on auditory, visual and cutaneous simple reaction time have been investigated. *Methods:* 100 healthy male volunteers of age group 18-25yrs were participated as subjects. According to criteria of Cromwell and Rife the subjects were divided into 94 right handed and 6 left handed persons. The subjects were presented with auditory, visual and cutaneous stimuli by using an electronic response analyzer. *Result:* The paired 't' test for comparison of all the parameters of simple reaction time recordings between right and left hand values in right handed subjects show $P < 0.05$ for auditory and cutaneous reaction time, $P < 0.01$ for visual reaction time. In left handed male subjects $P > 0.05$ for all the parameters of simple reaction time. *Conclusion:* In right handed individual all reaction time parameters of right hand are significantly faster when compared to left hand values. Whereas there is no significant difference between right and left hand values in left handed subjects.

Keywords: Auditory reaction time; Cutaneous reaction time; Visual reaction time; Handedness.

Introduction

Reaction time is the time interval between stimulus and response and it determines sensorimotor performances. Handedness is the preferred use of the right hand, left hand or one or the other depending on the task. Handedness is genetically determined and is related with hemisphere specialization [1]. Previous study done shows that limb dominance has no influence on visual reaction time (VRT) in both sexes. Whereas auditory reaction time (ART) of left hand was faster in left handed women [2]. In one more experiment done using a computer mouse, showed that right-handed people were faster with their right hand, but left-handed people were equally fast with both hands. However, the reaction time advantage of the preferred over the non-preferred hands was very small [3]. In another study bimanual reaction times to centralized visual stimuli showed the faster reaction time for dominant-hand compared to the nondominant-hand in both right hander and left hander group [4]. Keeping these conflicting reports in mind the present study has been undertaken to have better knowledge of effect of handedness on simple reaction time.

Aims and objectives: This study is undertaken with following objective:

1. To perform comparative study of auditory (ART), visual (VRT) and cutaneous (CRT) reaction time between right hand values and left hand values in right handed individuals.
2. To perform comparative study of auditory, visual and cutaneous reaction time between right hand values and left hand values in left handed individuals.

Material and Methods

The present study was conducted in the Department of Physiology, Karnataka Institute of Medical Sciences, Hubli, after obtaining the ethical clearance from Ethical committee. 100 apparently healthy human volunteers of male gender of age group 18-25 years, were recruited randomly. All the subjects included in the study were healthy, nonalcoholic, nonsmoker, had clinically normal hearing, vision and tactile sensation. They were in sound mental state. Those involved in any athletic training or exercise

programmes and having any prior experience in recording procedures of reaction times were excluded from the study.

Method of collection of data: Informed consent was taken from each subject. After noting the relevant history, their height, weight and body surface area were calculated. Thorough clinical examination of subjects did not reveal abnormality of any system. According to Cromwell and Rife criteria [5] the subjects were divided into 94 right handers and 6 left handers. Each participant was explained about the study protocol and sufficient trials were given for proper understanding. They were subjected to response time experiment by using response analyzer in the morning from 9 a.m. to 12 noon under similar conditions, an hour after light breakfast. The intensity of stimulus kept constant. Simple reaction times were measured following auditory, visual and cutaneous stimuli. The mean of three readings was taken for each hand of all the subjects. All the tests were performed in constant order. No warning signal was given.

Auditory, visual and cutaneous reaction times were measured by using 'Response Analyzer' manufactured by 'Yantrashilpa' Electronics – 0101/ Pune (YSRT 0101) [6]. Results were analyzed by using paired 't' test.

Results and Discussion

The paired 't' test for comparison of right hand values and left hand values in right handed subjects shows; $P < 0.05$ for ART and CRT, $P < 0.001$ for VRT. In right handed subjects there is significant difference between right hand and left hand values, the right hand being faster than left hand for ART, VRT and CRT. The results are shown in table No.1. This could be explained on the basis of conduction velocity of peripheral nerve. Previous study done have shown that the right median nerve of right handers conduct faster than the left median nerve of same group ($p < 0.05$). In the left hander left median nerve has significantly faster conduction velocity than the right median nerve ($p < 0.05$) [7]. In one more study done the motor nerve conduction velocity was greater in the right limb as compared to the left limb both in the median nerve and the ulnar nerve although the difference was not statistically significant. However, the latency of the median nerve of the right upper limb was less than that of the left upper limb with a significant difference [8]. The present study result is in contradiction with previous study done which shows that handedness has no influence on VRT [2].

Table-1: Comparison of right hand values and left hand values of ART, VRT & CRT by paired 't' test in right handed adult males (n=94)

Parameters	Mean \pm SD in millisecond	't' value	'p' value	Remarks
ART Right & ART Left	203.36 \pm 28.32 205.79 \pm 28.54	2.04	<0.05	S
VRT Right & VRT Left	215.64 \pm 29.99 222.38 \pm 38.43	3.19	<0.01	H.S
CRT Right & CRT Left	237.59 \pm 33.87 242.96 \pm 37.43	2.02	<0.05	S

The paired 't' test for comparison of right hand values and left hand values of various parameters of simple reaction time in left handed adult males shows $P > 0.05$. There is no significant difference in right hand and left hand values of various parameters of simple reaction time in left handed males. The results are shown in table No. 2.

Handwise, there is no significant difference in left handed adult males. This could be due to in left handers 15% have no clear lateralization, 15% have right as dominant hemisphere, and in 70% left hemisphere is dominant [1].

Table-2: Comparison of right hand values and left hand values in ART, VRT & CRT by paired ‘t’ test in left handed adult males (n=6)

Parameters	Mean ± SD in millisecond	‘t’ value	‘p’ value	Remarks
ART Right & ART Left	183.66 ± 5.85 184.17 ± 9.47	0.098	>0.05	NS
VRT Right & VRT Left	200.94 ± 11.85 211.72 ± 24.35	1.892	>0.05	NS
CRT Right & CRT Left	234.44 ± 32.33 223.89 ± 22.21	0.776	>0.05	NS

Conclusion

In right handed adult males, right hand simple reaction time values are significantly faster than

left hand reaction time values for ART, VRT and CRT whereas handwise there is no significant difference in left handed adult males.

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