National Journal of Physiology, Pharmacy and Pharmacology

RESEARCH ARTICLE

Comparative study of simple auditory reaction time between congenitally total blind people and normally sighted controls

Trushika S Patel, Anju S Mehta, Nilay Patel, Nayan Mali

Department of Physiology, B J Medical College, Ahmedabad, Gujarat, India

Correspondence to: Trushika S Patel, E-mail: trushika.patel25@gmail.com

Received: October 07, 2018; **Accepted:** November 02, 2018

ABSTRACT

Background: Time interval between the application of a stimulus and the appearance of appropriate voluntary response by a subject is known as reaction time. Three responses are involving in this. They are stimulus processing, decision-making, and response programming. Recently, sports physiology is the main field which uses reaction time. A practical implication of reaction time has great implication and may be of great consequence, for example, a slower reaction time in driving might have grave results. **Aims and Objectives:** The aims and objectives of this were to compare the speed of the central nervous system and coordination between motor and sensory systems in congenitally total blind people and visually normal subjects using simple auditory reaction time. **Materials and Methods:** A total of 25 cases of congenitally total blind people and 25 normal sighted individual were compared for the simple auditory reaction time at Andhajan Mandal, Vastrapur, Ahmedabad, and B J Medical College, Ahmedabad. **Results:** Mean auditory reaction time and shortest auditory reaction time are decreased in congenitally total blind people as compared to same-aged normal-sighted controls. **Conclusion:** Simple auditory reaction time is decreased in congenitally total blind people as compared to normal-sighted people. Training with auditory cues plays an important role in this condition.

KEY WORDS: Simple Auditory Reaction Time; Congenitally Total Blind; Cross Modal Neuroplasticity

INTRODUCTION

Time interval between onset of single stimulus and initiation of respond by the subject as early as possible is known as simple auditory reaction time.

Two theories are there how one sense loss affects the remaining senses. Firth is disability theory, which says that sensory and motor senses complement each other. Hence, when one sense losses, it will decrease other sensory systems if conditions are non-favorable.

Access this article online	
Website: www.njppp.com	Quick Response code
DOI: 10.5455/njppp.2018.8.1032402112018	

Second theory is the compensatory theory which says that, if conditions are favorable, when one sense losses, it will response to increase other sensory systems. Such compensation in blind will be achieved from side-to-side other senses, mainly hearing sense.[1] The brain has adaptation power to make our when one senses loss will increased the senses of other systems.

Many studies show that the phenomenon of cross-modal neuroplasticity says that when the brain is depressed in participation in one sensory modality, will auguments other Senses in blind people. The current research on deaf and blind humans said that electrophysiological, behavioral, and neuroimaging evidence of augmented capability and altered association of spared Modalities, there is still much argue about the characteristics of the brain systems that are transformed and the mechanism that arbitrate these changes.[2-4]

Objectives of the Study

The objectives of the study were to compare the speed of the central nervous system and coordination between motor and sensory systems in congenitally total blind people and visually normal subjects using simple auditory reaction time.

MATERIALS AND METHODS

After taking the permission from the Ethical Committee Review Board from BJ Medical College, Ahmedabad, the study was carried out. 25 congenitally blind males were taken from Andhjan Mandal, Ahmedabad, aged between 15 and 25 years as case. 25 normal sighted, age-matched males were taken as controls for comparison. Simple auditory reaction time was recorded by reaction time software in laptop. First, the procedure is explained to the subject about the procedure and written consent was obtained. Silent atmosphere was chosen for carrying out the study. Headset was provided for measuring responces. Randomly 3000 HZ of 90 db sound wave pass through the headsets. As early as possible, the study participants hearing sound has to press the spacebar. Time interval between hearing the sound and pressing spacebar was noted. A total of 10 such readings were measured. Mean and shortest and longest simple auditory reaction time was measured.

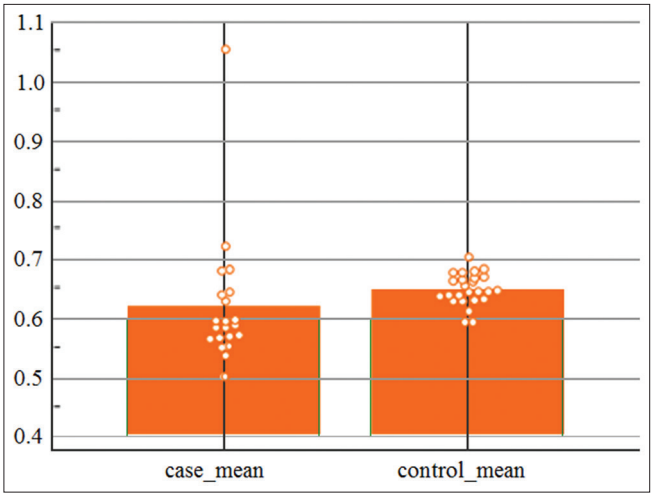

Figure 1: Box and plot graph for comparison of mean simple auditory reaction time

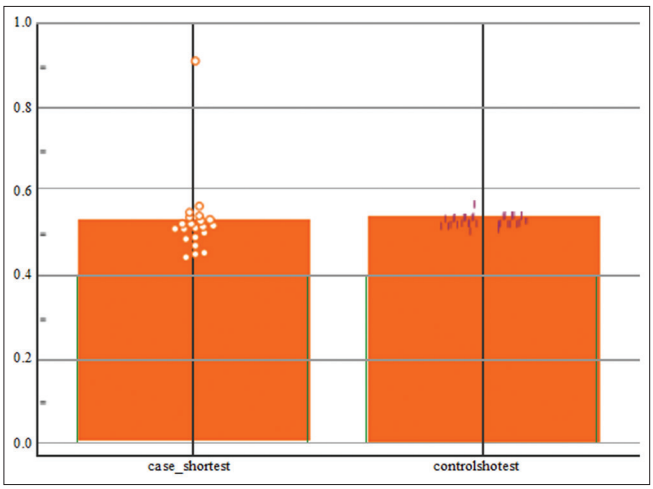

Figure 2: Box and plot graph for comparison of shortest simple auditory reaction time

Microsoft Excel sheets were prepared for statistical analysis. Mean and standard deviation was calculated. The data between cases and controls were analyzed in the WHO Epi Info software for the preparation of graph and statistical analysis.

RESULTS

There is a significant difference in mean and shortest auditory reaction time between case and control groups.

Mean auditory reaction time is decreased in totally blind people as compared to same-aged normal sighted controls. Box and plot graph visual clear impression about our finding that congenital blind have low mean auditory reaction time as compare to normal sight control groups. While comparing the shortest and longest simple auditory reaction time, we found statistically significant result for shortest auditory reaction time [Figures 1 and 2].

Table 1 shows that, in the present study, mean auditory reaction time for congenital total blind was 0.6087 ± 0.11 s, while for healthy sighted control, it was 0.6446 ± 0.027 s, enlightening that congenital full blind had faster reaction time than normal sighted control with data showing significant value ($P < 0.001$).

Table 2 shows that, in the present study, shortest auditory reaction time for congenital total blind was 0.5266 ± 0.094 s, while for healthy sighted control, it was 0.5373 ± 0.026 s, showing

Table - I: Comparison of Mean simple auditory reaction time

Statistics comparision of mean time	Case mean	Control mean
Sample size	25	25
Geometric mean	0.6087	0.6446
95% CI	0.5680 - 0.6522	0.6335 - 0.6560
SD	0.1121	0.02710
P value	<0.001	

SD: Standard deviation, CI: Confidence interval

Table -II: Comparison of Shortest simple auditory reaction time

Statistics comparision of shortest time	Case mean	Control mean
Sample size	25	25
Geometric mean	0.5266	0.5373
95% CI	0.4839 - 0.5694	0.5267 - 0.5479
SD	0.09399	0.02571
P value	<0.001	

SD: Standard deviation, CI: Confidence interval

Table -III: Comparison of longest simple auditory reaction time

Statistics comparision of longest time	Case mean	Control mean
Sample size	25	25
Geometric mean	0.8753	0.8701
95% CI	0.7997 - 0.9508	0.8192 - 0.9211
SD	0.1660	0.1234
P value	0.166	

SD: Standard deviation, CI: Confidence interval

that congenital full blind had faster reaction time than normal sighted control with data showing significant value $P < 0.001$.

Table 3 shows that, in the present study, longest simple auditory reaction time for congenital total blind was 0.8753 ± 0.17 s, while for healthy sighted control, it was 0.8701 ± 0.12 s. Though results were found to be insignificant ($P > 0.05$).

DISCUSSION

Our study data propose that simple auditory reaction time is statistically significantly reduced in congenitally total blind people compared to normal sighted participants. Mean auditory reaction time in congenitally total blind people was 0.6087 ± 0.11 s, decreased as compared to normal sighted control, and it was 0.6446 ± 0.027 s [Table 1]. Comparision shortest auditory reaction time between two groups. It was reduced in congenitally total blind people (0.5266 ± 0.094 s) as compared to normal-sighted participants (0.5373 ± 0.026 s) [Table 2].

Total blind people in the study group were trained from their early childhood to use hearing sense and tactile sense to confine procedures in their surroundings. Such early auditory preparation might have resulted in increased attentiveness and awareness toward environmental stimuli.

Brain neurons had the ability to recognize the residual sensory response, and it can be utilized in escalating brain performance by reversible induced suppression.[2] Bhirud and Chandan showed that the auditory reaction time is significantly reduced, in congenitally total blind persons compared to blindfolded sighted participants.[1] Dubal *et al*. showed in their study that simple Auditory reaction time in congenital full blind is faster (43 msec faster) compared with sighted control.[2] Collignon *et al*.[5] concluded that blind hase brilliant ability in auditory processing due to the involvement of occipital lobe of brain.

Hötting and Röder[6] concluded that the perception of auditory function is become batter with the increased use of auditory systems. Liotti *et al*.[7] concluded that ear intensity for reaction time become faster (91 msec faster) for congenitally blind people contrast to normally sighted individuals. All these studies supporting the results of our study regarding simple auditory reaction time of congenital total blind people are quicker than sighted people. Though John Bernard[8] showed insignificant result on reaction time between blind and normal sighted individuals.

Limitation of our study because of small sample size, stringent criteria not included, so our study is not generalized.

CONCLUSION

After the loss of one sense, the brain normally reacts to handle that and improve other senses and it get rewired. Brain neuron had ability to recognize themselves to increased residual sensory modality, and this can be used the increased brain performance by reversible induction.[9-11] Hence, the present study concluded that congenital total blind people had faster auditory reaction time as compared to normal sighted controls.

REFERENCES

1. Bhirud BG, Chandan LM. Comparative study of simple auditory reaction time in blind and blindfolded sighted individuals. Natl J Physiol Pharm Pharmacol 2016;7:64-7.
2. Dubal G, Bhabhor M, Shree MP. A comparative study of simple auditory reaction time between male congenital full blind and sighted control. Shah medical college, Jamnagar, Gujarat, India. Indian J Appl Basic Med Sci 2013;42-8.
3. Shenvi D, Balasubramanian P. A comparative study of visual and auditory reaction times in males and females. Indian J Physiol Pharmacol 1994;38:229-31.
4. Gandhi PH, Gokhale PA, Mehta HB, Shah CJ. A comparative study of simple auditory reaction time in blind (congenitally) and sighted subjects. Indian J Psychol Med 2013;35:273-7.
5. Collignon O, Voss P, Lassonde M, Lepore F. Cross-modal plasticity for the spatial processing of sounds in visually deprived subjects. Exp Brain Res 2009;192:343-58.
6. Hötting K, Röder B. Auditory and auditory-tactile processing in congenitally blind humans. Hear Res 2009;258:165-74.
7. Liotti M, Ryder K, Woldorff MG. Auditory attention in the congenitally blind: Where, when and what gets reorganized? Neuroreport 1998;9:1007-12.
8. Welford AT. Choice Reaction Time: Basic Concepts. In: Welford AT, editor. Reaction times. New York: Academic Press; 1980. p. 73-128.
9. Lange-Kuttner C. The importance of reaction times for developmental science: What a difference milliseconds make. Int J Dev Sci 2012;6:51-5.
10. Stevens AA, Weaver K. Auditory perceptual consolidation in early-onset blindness. Neuropsychologia 2005;43:1901-10.
11. Bavelier D, Neville HJ. Cross-modal plasticity: Where and how? Nat Rev Neurosci 2002;3:443-52.

How to cite this article: Patel TS, Mehta AS, Patel N, Mali N. Comparative study of simple auditory reaction time between congenitally total blind people and normally sighted controls. Natl J Physiol Pharm Pharmacol 2018;8(12):1697-1699.

Source of Support: Nil, **Conflict of Interest:** None declared.