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Physiology

"COMPARATIVE STUDY OF COLOR INTERFERENCE (STROOP TEST) IN DEAF AND NORMAL HEARING SCHOOL GOING SUBJECTS BETWEEN THE AGES OF 8 TO 18 YEARS"

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ABSTRACT

Background : As it is very challenging to survive for normal human being in today's life for making his earning,we can imagine how difficult it would be for a physically challenged individuals.But if we study the literature we get to know that if one sense is deficient, the power of other sense is enriched. As in deaf,the visual area of brain is more developed and widened perceptual systems as compared to normal hearing subjects.

Objectives : To study the color interference function by comparison of
Stroop Test (ST) - Number of correct attempts in 60 sec

Materials and methods: The study population of 8 to 18 years of age and sex matched school going children.Group A were 20 deaf students,Group B were normal hearing 20 students under the criteria of inclusion and exclusion.Informed written consent and assent were taken.The ability of color interference is assessed by noninvasive computer based standardized test named Stroop test by using software cognitivefun.in.
Statistical analysis was done by using GraphPad Prism 7 online software by Unpaired Student-t test.

Results : Comparison of accuracy was highly significant ($p < 0.001$) between the groups which was suggesting that deaf children showed more correct response in Stroop task as compared to normal hearing children.

Conclusions : In conclusion, the result of this study for the color interference test, support the perceptual compensation, or the experiential deficiency hypothesis. It also suggest the hearing impaired people may differ from normal hearing people in development of perceptual processing rather than analytical processing strategy.

KEYWORDS : Colour Interference,deaf

Introduction

The ability to hear sound is one of the fundamental ways that organisms are able to perceive the external environment.

This mechanical signal is converted to neural signals and relayed to the brain. The brain receives and interprets these signals and the result is what we perceive as hearing.

Neurocognitive testing, also known as neuropsychological testing, is a comprehensive evaluation of the patient's cognitive status by specific neurologic domains, i.e., memory, attention, problem solving, language, visuospatial, processing speed motor, and emotion. Testing is mainly comprised of paper and pencil tasks and/or computerized tasks, done in a one-on-one setting. It is physically non-invasive.

In profound deafness, detection of changes in the environment and orientation of attention occurs primarily through vision.

Studies have proved that hearing impaired subject has more accurate color discrimination and prefers colors more than normal hearing subjects.

Here,in this study we will focus on visual perception and attentiveness along with the cognitive evidence in relation to auditory deprivation.It is known that physically challenged deaf children are more reserved, stiff, emotionally detached, less stable, shy, serious, dependent, withdrawn and have poor home and health adjustments than normal individuals.The facilities (helping aids, trained teachers, necessary physical training and exercises etc.) in special education institutes are quite inadequate as compared to normal schools.

Methods

Study population

This is descriptive observational study. The subjects participating in this study were healthy school going children between the ages 8 to 18 years. They were grouped into two groups:Group A (cases): consisting of individuals with severe-to-profound deafness(n=20) and Group B (controls) : consisting of individuals with normal hearing (n=20). Study was done in the school set up under the guidance and with the help of teachers who will explained the procedure to the participants in Proficient and fluent sign-language or best way of their understanding method.

Initial evaluation

Baseline information was collected: age,gender. For the participants normal or corrected-to-normal vision was confirmed by Landolt's chart .Normal color vision was confirmed by Ishihara chart. Analysis for hearing were tested by hearing test : for Group A, Binaural hearing loss of at least 90 dB by Pure-tone Audiometry with average at 0.5,1 and 2 kHz with or without hearing aid, from birth or from the age below 3 years were done and for Group B auditory threshold not less than 25 dB hearing level (pure-tone average at 0.5,1 and 2 kHz) confirmed by Watch test.

Ethics :

Institute Ethical committee approval was taken prior to the study. Permission of Head of Department of Physiology was taken to conduct the study at school set up. Permission from the principal of respective schools were taken before conducting the study. Informed verbal consent of each parent or guardian of the child was taken before the interview and nature & purpose of study was explained to them.

Privacy, confidentiality and anonymity were maintained throughout the study.

Study Protocol

Stimuli was presented and recorded the response using a MacBook Air laptop with 11.6-inch (diagonal) LED-backlit widescreen display monitor. Stimulus and collection parameters are programmed using **cognitivefun.in online freeware.** Participants seated directly in front of the monitor with their chins resting firmly in a chin rest at a distance of 18 in. The height of the chin rest was set 10 inch. above the table so that the eyes of each participant would be directly in front of the computer screen. The height of the chin rest was kept constant across participants. However, participants were able to adjust the height of the chair if they want.

Color Reading Interference (Stroop test) : Participants Type the first letter of the name of the COLOR that is shown.Number of correct answers in given time period of 60 seconds were recorded.

Statistical analysis

Statistical analysis was done using GraphPad Prism 7 online software. Mean and standard deviation were calculated.

p value less than 0.05 was taken as statistically significant.

Results :

Table No. 1 : Sexwise Distribution of study population

	Male	Female
Cases	12	8
Control	5	15

Chi-square = 3.683, D.F. = 1, p value is 0.0550, Statistically not significant.

Table No. 2 : Age wise Distribution of study population

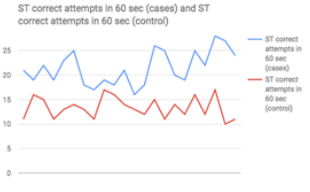
AGE (yrs)	CASES	CONTROL
MEAN ± SEM	11.32 ± 0.4284	11.91 ± 0.4695

p=0.3578, using unpaired t-test, P value<0.05 is considered significant

Table No. 6: Comparison of Stroop test between Cases and Control

GROUPS	CASES	CONTROL
MEAN ± SD	21.45 ± 3.4741	13.36 ± 2.1722

Unpaired t test, p value= 0.0367, CI = 95%, Statistically significant (p < 0.05, Statistically significant)



This suggest that deaf children has more score in color interference test than in normal hearing children.

Discussion

The purpose of this study was to compare the neurocognitive functions of individuals with auditory impairment and those of controls without any impairment in order to investigate whether individuals who lack one sense have an enhanced ability with the other. The neurocognitive functions were tested using vision as the sensory stimuli.

1) We found that the hearing impaired children have better perception to colors when presented with color-word interference task as seen in stroop test.
2) In present study , there is significant difference in color interference test i.e. stroop test between deaf children and normal hearing children. This is suggestive of better execution with respect to color identification than word formation in deaf children compared to normal hearing individuals.

Furth (1961) gave a non-verbal paired associate task to prelingually , moderately hearing-impaired and normal-hearing children(7 to 12 years).The subject's task was to associate four colors with toys (two colors for each toy) and successful performance was defined as correct association for 10 trials in succession. The results showed that the hearing impaired and hearing children did not differ in their performance in younger age groups than in older age groups. He suggested lack of training and motivation affect the cognitive learning attitudes of the older hearing impaired children. In present study there is better performance in hearing impaired children than hearing impaired in all range of age groups which suggestive of better learning attitude of institutional set up for hearing impaired children.

Furth and Youniss (1964) compared the color interference between hearing impaired students and normal hearing children(10 to 11 years and 6 to 7 years of age). They found the interference task was more difficult than the neutral task for normal hearing children at both ages ,while there was no difference in task difficulty for hearing impaired groups at both ages. This study is showing parallel result to our study, as we found the hearing impaired have shown better performance for incongruent stimuli than normal hearing children. The possible interpretation of this results are that the verbal mediation in normal hearing children may have strong association between conventional color names and actual color perception. The other possible reason that Furth and Youniss(1964) suggested was that hearing-impaired people,being experientially deficit, did not have strong associations between conventional color names and the objects the toys represented and hence, there was no difference in their performance. Also, as in our study also, the experientially deficit of word formation over color identification can be contributing to the better performance for color interference test in hearing impaired than normal hearing children.

ROSSLYN GAINES University of CaliFornia, Los Angele~ Studies (1, 2) reported hearing school children prefer form on color-form preference tests. Doehring (3) found deaf children (ages S to 12) prefer color; Larr (4) reported inconsistent results. In the present study, both color-form . tests, which produced differing results among deaf Ss, were used. Hypothesis I: deaf children prefer color; hearing children prefer form. Hypothesis II: colorform preferences relate positively to ability to accurately discriminate within color and within form stimuli series.

Conclusion

In conclusion, the result of this study for the color interference test, support the perceptual compensation, or the experiential deficiency hypothesis. It also suggest the hearing impaired people may differ from normal hearing people in development of perceptual processing rather than analytical processing strategy.

References

1. MacLeod CM (March 1991). "Half a century of research on the Stroop effect: an integrative review". Psychological Bulletin. 109 (2): 163–203. doi:10.1037/0033-2909.109.2.163. PMID 2034749.
2. Van Maanen L, van Rijn H, Borst JP (December 2009). "Stroop and picture-word interference are two sides of the same coin". Psychon Bull Rev. 16 (6): 987–99. doi:10.3758/PBR.16.6.987.PMID 19966248.
3. Taylor, S (1997). "Isolation Of Specific Interference Processing In The Stroop Task: PET Activation Studies.". NeuroImage. 6 (2): 81–92.doi:10.1006/nimg.1997.0285.
4. Milham, M (2003). "Practice-related Effects Demonstrate Complementary Roles Of Anterior Cingulate And Prefrontal Cortices In Attentional Control". NeuroImage. 18 (2): 483–493. doi:10.1016/s1053-8119(02)00050-2.
5. Banich, M; et al. (2000). "fMRI Studies of Stroop Tasks Reveal Unique Roles of Anterior and Posterior Brain Systems in Attentional Selection". Journal of Cognitive Neuroscience. 12 (6): 988–1000.doi:10.1162/08989290051137521.
6. Bush, G; et al. (1998). "The Counting Stroop: An Interference Task Specialized For Functional Neuroimaging Validation Study With Functional MRI". Human Brain Mapping. 6 (4): 270–288.doi:10.1002/(sici)1097-0193(1998)6:4<270::aid-hbm 6>3.3.co;2-h.
7. Gruber, S; et al. (2002). "Stroop Performance in Normal Control Subjects: An fMRI Study". NeuroImage. 16: 349–360.doi:10.1006/nimg.2002.1089.
8. Johnson, A (2004). Attention: theory and practice. Thousand Oaks, Calif: Sage Publications.
9. McMahon, M. "What Is the Stroop Effect". Retrieved November 11,2013.
10. Lamers, M.J.; et al. (2010). "Selective Attention And Response Set In The Stroop Task". Memory & Cognition. 38 (7): 893–904.doi:10.3758/mc.38.7.893.
11. McMahon, M. "What Is the Stroop Effect". Retrieved November 11,2013.
12. Monahan, J.S (2001). "Coloring single Stroop elements: Reducing automaticity or slowing color processing". Journal of General Psychology.128 (1): 98–112. doi:10.1080/00221300109598901.
13. Stirling, N (1979). "Stroop interference: An input and an output phenomenon". Quarterly Journal of Experimental Psychology. 31: 121–132. doi:10.1080/ 14640747908400712.
14. Cohen, J.D. (1990). "On The Control Of Automatic Processes: A Parallel Distributed Processing Account Of The Stroop Effect".Psychological Review. 97 (3): 332–361. doi:10.1037/0033-295x.97.3.332.
15. Cohen, J.D.; et al. (1990). "On The Control Of Automatic Processes: A Parallel Distributed Processing Account Of The Stroop Effect".Psychological Review. 97 (3): 332–361. doi:10.1037/0033-295x.97.3.332.