# A COMPARATIVE ANALYSIS OF SIMPLE VISUAL REACTION TIME BETWEEN CONGENITAL DEAF AND NORMAL CHILDREN

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**Abstracts**: **Background & objectives*:*** Cross modal plasticity research studies shows that unused brain neurons in case of loss of sensory organ can be utilize for other sensory modalities, thus enhancing ability of disable individual to perform day today tasks as equal or in some cases even better than normal individual. Present study gives insight on the same principle of "Cross modal plasticity". **Methods:** Total 223 cases were included in present study. Out of 223 cases, 100 deaf children and 123 normal children were included in our study. Study was conducted at various schools in Jamnagar city and prior permission from IEC and respective school principals was taken. Information sheet was provided about present study and only when voluntary consent given by school teachers, students were included in study. Simple Visual Reaction Time (VRT) was done using DirectRT© software in laptop. Data analysis was done using Excel 2016 data analysis tool pack. P<0.05 was considered significant. **Results*:*** Mean VRT of deaf (674.58 msec) was significantly shorter (by 176.49 msec) than normal children (851.07 msec). However, p value was 0.265 using unpaired t test. **Interpretation & conclusion**: Present study shows that mean VRT of deaf children is definitely shorter than normal children. Similar results are also obtained by Charlotte J. Codina et al study[4] . But in that study p value was 0.03 thus proving association of deafness with faster visual reaction time. As reaction time is affected by various factors like environment, fatigue, sports activity etc, it needed to be research at high sample size in future.

**Key Words**: Deafness, Visual reaction time

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**Introduction:**

Huge amount of research is conducted to prove "cross modal plasticity[1]" in brain. "Cross" means non-native (other than normal), "modal" means sensory modality and "plasticity" means ability to change or adapt its functions. So, for example, for hearing, auditory cortex is native and for vision, occipital cortex is native. Thus, in cross modal plasticity, it is hypothesized that the part of brain which receives specific sensory signals can adapt itself to receive other sensory modalities if that particular sensory organ (to which it is specific) is lost. Hence brain enhances other sensory modalities in case of loss of some sensory functions. For example, in our case we have conducted a study to include congenital deaf children and find out whether their auditory cortex (responsible for hearing) compensates by receiving visual signals and help in visual processing faster than normal individuals. If cross modal plasticity is proven in our study than it not only confirms hypothesis of cross modal plasticity but also help scientific community in utilising these, so called extraordinary sensory modalities, for making lives of deaf and blind more meaningful and provide them ability to live in main stream society. Similar studies have also been conducted on blind, dumb etc to find whether cross modal plasticity is present or not. Some studies were also conducted on deaf cats to find out whether their visual processing power was more than normal cats[2].

Thus, in our study, we have collected visual reaction time from congenital deaf children and compared them with normal children's visual reaction time to find out whether congenital deaf children react faster than normal or not.

**Material and Methods:**

The present study includes comparative analysis of visual reaction time of 100 deaf children and 123 normal children. Approval from Institutional Ethics Committee (IEC) was taken before starting study.

Participating children where in age group of 6 to 18 years in case of deaf and 7 to 12 years in case of normal children. Students from primary schools were selected for normal children and students from deaf and dumb school were selected for deaf children. Thorough motor examination and visual tests were conducted to rule out any muscular or visual disabilities. Thus, only healthy and sighted students were allowed to participate in present study. Those students who were having any kind of physical or mental illness or those unwilling to participate in present study were excluded to ensure any confounding factors which might affect study results.

Prior permission from school principal was taken and study was conducted without disturbing teaching schedule of all students. Consent form was given to students and thoroughly explained whole study procedure and specifically instructed that no invasive procedure is done and this study would not harm them in any manner. Those students who willfully wanted to participate where taking permission from respective class teachers and consent formed was signed by those class teachers as their guardians. All preliminary data like name, age, gender were taken and motor and visual acuity and color vision tests were conducted. Then their weight was taken with portable digital weighing scale. Height of student was measured with measuring tape (in cms). Visual reaction time test was conducted on laptop using Direct RT© software. Initially test trial was given to student where students where shown white screen and red circle would appear at center of white screen, student has to respond to that red circle immediately by pressing space bar. The time interval between red circle arrival and pressing the space bar is recorded as Visual reaction time (VRT). Such 10 trials were given and then 10 actual recordings were obtained for analysis in the present study.

Results in software were stored in three sets: Minimum Visual Reaction Time (VRT), Maximum VRT and Average VRT

Care was taken to not allow student to press space bar continuously. Also, red circle arrival was randomized so student can't predict when red circle will come.

Statistical analysis was done by Excel 2016 data analysis tool pack. Unpaired t test was done between Average Visual reaction time of deaf and normal children.

$p>0.05$ is considered as not significant. $p<0.05$ is considered as significant. $p<0.01$ is considered as highly significant.

**Result:** In present study, in total there were 223 subjects out of which 100 where congenital deaf and 123 where normal children. All in age group 6 to 18 years.

| **Gender** | **Normal (%)** | **Deaf (%)** |
|---|---|---|
| Male | 96 (78%) | 48 (48%) |
| Female | 27 (22%) | 52 (52%) |
| **Total** | **123** | **100** |

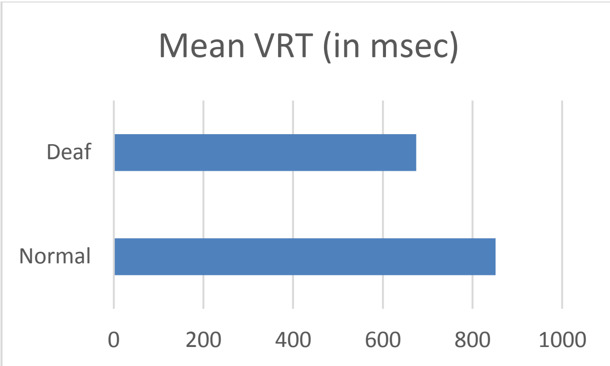
**Table 1: Gender distribution in normal and deaf children**

Table 1 shows that 78% of normal children were male and 22% were female. While in deaf, 48% were male and 52% were females.

| | **GROUPS** | **MEAN (msec)** | **Standard Deviation (msec)** | **P Value** |
|---|---|---|---|---|
| **MEAN VRT** | Normal | 851.07 | 1712.02 | 0.265 |
| | Deaf | 674.58 | 312.62 | |

**Table 2: Mean VRT in normal and deaf children along with standard deviation and p value**

Table 2 shows that mean VRT of deaf children is shorter than (by 176.49 msec) normal children. Also, standard deviation of deaf children was strongly shorter (by 1399.4 msec) than normal children, indicating that deaf children were more alert during test and were able to produce consistent result. However, p value was 0.265 (>0.05) thus indicating there is no association between deafness and faster visual reaction time (VRT).




**Graph 1: Mean visual reaction time (VRT) of deaf and normal children**

Below table shows that out of 100 deaf children 11 were left handed and 89 were right handed. Mean VRT of left handed deaf children was shorter than (by 69.33 msec) right handed deaf children. Also, standard deviation of left handed children was shorter by 40.04 msec compare to right handed deaf children, indicating that left handed deaf children were more alert and producing consistent result. As p value is greater than 0.05, we can conclude that handedness has no association with mean VRT in deaf children.

| | Handed-ness | N | Mean (msec) | Standard Deviation (msec) | P value |
|---|---|---|---|---|---|
| Mean VRT (Deaf) | Left | 11 | 612.88 | 277.26 | 0.455 |
| | Right | 89 | 682.21 | 317.30 | |

**Table 3: Handedness and mean VRT in deaf children**

**Discussion:**

In present study, there were 100 deaf children and out of that 48 were male and 52 were female. Also, in present study, normal children were 123, out of which 96 were males and 27 were females. Average age for deaf group is 12 years while in normal children it is 10 years. In Charlotte J. Codina et al study[4], in deaf group, there were 17 adults, out of which 11 were males and 6 were females. In normal group, in same study, there were 18 adults, out of which 9 were males and 9 were females. Average age in same study for deaf group was 33.25 years and for normal group was 30.28 years. In present study, mean VRT for deaf was 674.58 msec and for normal was 851.07, with p value of 0.265 using unpaired t test. In Charlotte J. Codina et al study[4], mean VRT for deaf was 585.31 msec and for normal was 731.77 msec with p value of 0.03 using ANOVA (as third group of interpreter was added). In Douglas P. Sladen et al study[5], mean VRT for deaf was 460 msec and for normal was 410 msec (based on data available on graph). In Ali Tatlici et at study[6], mean VRT for deaf was 260 msec (after conversion) and for normal was 250 msec (after conversion) with p value of 0.92 and 0.72 respectively. Thus, mean VRT of present study is more congruent towards Charlotte J. Codina et al study[4].

In present study, out of 100 deaf children, 11 were left handed and 89 were right handed. Mean VRT for left handed was 612.88 ± 277.26 msec and for right handed was 682.21 ± 317.30 msec. in Ali Tatlici et at study[6], out of total 9 deaf wrestlers, mean VRT of left handed was 260 ± 30 msec and that of right handed was 260 ± 20 msec.

**Conclusion:**

To conclude, present study does show that mean VRT of deaf children is definitely shorter than normal children by 179.49 msec but with p value greater than 0.05 we can tell that there is no association between hearing loss and faster visual reaction time. However, one should not that reaction time is affected by number of other factors like environment, amount of unavoidable distraction during tests, age, gender, fatigue, motivation, sports activity, sleep etc. Thus, it requires tremendous effort to standardize whole procedure and produce repeatable results. However, with more controlled environment and more sample size could give clearer picture in future.

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