Research Paper　　　　　　　　　　　　　　　**Medical Science**

Assessment of Contrast Sensitivity Function in Indian School Children

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ABSTRACT

The aim of this study is to find out the normative Contrast Sensitivity Function among Indian School Children. A total of 79 children 8 – 16 years of age whose monocular distant visual acuity is 20/20 (0.0 Log Mar) at 100 % contrast and never had any eye ailments, ophthalmic surgeries, or refractive corrections were selected from a school in India. Visual Acuity at 5% and 2.5% contrast levels were measured with Dr. Lea's 3 meters distant acuity Translucent symbol charts with ESV 1500 ETDRS Standardized illuminated cabinet.

All 79 children showed normal acuities at 100% contrast. The Log Mar acuities mean and standard deviation for 5% and 2.5% contrast sensitivity measurements were found to be 0.11 +/- 0.06 and 0.26 +/- 0.09 respectively. This study found relatively normal visual acuity values at 100% , 5% and 2.5% contrast levels.

INTRODUCTION

The information on contrast sensitivity assessment is very important for Eye Care Practitioners and the people involved in Vision Rehabilitation. It helps in diagnosing certain eye diseases as well as in designing the learning material, living spaces for people with low vision. Assessment of Contrast Sensitivity Functions results in a detailed measure of visual function as it measures vision at various low contrast patterns as well as the ability to distinguish between the finer increments of light versus dark. Visual information at low contrast levels is very important and has the functional relevance with Communication and Interaction, Orientation & Mobility, Activities of Daily life and also Sustained Near Vision tasks (Lea, Namita, 2011). One may find it difficult to perceive the edges and curves in the environment if the person has poor contrast sensitivity and may fail to step down or to avoid bumps on the way.   Poor contrast sensitivity can be a result of eye or health condition even if the visual acuity is 0.0 in LogMAR (Gary, 2014).

The normal children reached the adult level contrast sensitivity after 10 years of age (Lisbeth, Sidse, Kringelholt, Liselotte et al., 2007). Contrast sensitivity has the ability to judge distances (Rubin, Roche, Prasada Roa et al., 1994) and discriminate objects (Scott, Feuer, Jacko, 2002). Many studies focussed on infant's contrast sensitivity which gradually increases with the child's age in weeks (Angela, Delwin, 2009). Measurement of contrast sensitivity at low luminance level provided information for evaluating vision of patients with Retinitis Pigmenosa (Hyvarinen, Rovamo, Laurinen et al., 1981).

Many Low Vision Rehabilitation Centres in rural and urban India carry out a few traditional functional tests to assess the contrast sensitivity of visual or multi-sensory impaired children to design individual education and rehabilitation programmes as the centres do not have the clinical measurement at 5% and 2.5% contrast levels from the eye hospitals. Generally in many countries, a routine eye examination does not have contrast sensitivity testing. There is no data available about the normal visual acuity range at 5% and 2.5% contrasts in India. The measurement at 2.5% is very much essential in visual communication, carving, ironing, exploring the new environment etc.

Understanding normal contrast sensitivity at various acuity and contrast levels is crucial to identify the abnormality. Children

with normal visual acuity and abnormal contrast sensitivity should be referred to the Vision centres to understand their visual development, diagnosis and treatment. This information from vision clinics would really help the parents, teachers and therapists in designing the environmental modifications in the study area as well as the living space for the children with low vision and multi-sensory impairment. Hence this study is planned to measure the normative contrast sensitivity levels for school children in India.

METHODS AND MATERIALS

Vision screening programme was conducted in a school in Chennai, Tamil Nadu, India for 1107 children and screened for 0.0 Log MAR monocular visual acuity with Dr. Lea's 100% contrast distant visual acuity symbol test against the ETDRS professional illuminated cabinet (Lighthouse International, NY, USA. Among 1107 children, 79 subjects were selected whose monocular distant visual acuity is 20/20 (0.0 Log Mar) at 100 % contrast and never had any eye ailments, ophthalmic surgeries, or refractive corrections. These children were randomly selected from 3rd to 10th grade. Informed consent was obtained from all subjects who were interested in participating the study. This study followed the tenets of the Declaration of Helsinki and it is approved by Frontline Eye Hospital's ethical committee.

Visual Acuity at 5% and 2.5% contrast levels were measured with Dr. Lea's 3 meters distant acuity Translucent symbol charts with ESV 1500 ETDRS Standardized illuminated cabinet. Testing is similar to visual acuity measurement at 100 %. The smallest size of the symbols recognised by the children were documented. The children were asked to identify the first or last symbol on each line. When the child hesitated or found difficult with the current line, one line was receded and the child was asked to read the entire line. The threshold line is recognition of 4 out of 5 symbols in the line.

STATISTICAL ANALYSIS

A statistical analysis was performed using Microsoft Excel data analysis. Paired t test and correlation tests were mainly used to analyse p values and correlation coefficients. The significance level at 95% or 0.05 is taken as a reference point in this work.

RESULTS

The total number of children participated in this study were 79. The age range of school children was found to be 8-16

years with mean and standard deviation being 12.7 +/- 2.19 years. All children selected were Emmetropes and their visual acuity was 20/20 for all 158 eyes. The Log Mar acuities mean and standard deviation for 5% and 2.5% contrast sensitivity measurements were found to be 0.11 +/- 0.06 and 0.26 +/- 0.09 respectively. The mode values were found to be 0.1 and 0.2 for 5% and 2.5% Log mar acuities. Fig 1 shows the relationship of mean and mode values for different contrast groups. A paired t test was performed between 100% and 5%, 100% and 2.5%, 5% and 2.5%. It was found to be statistically significant as p value was 0.00 for all the three groups.
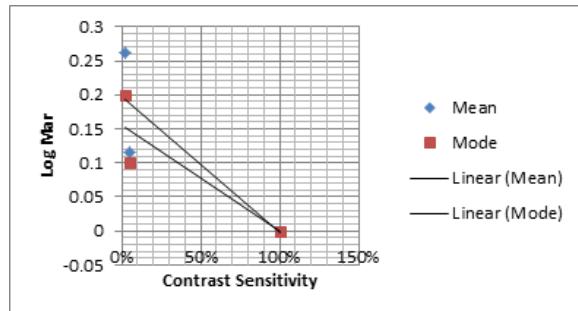
Fig 1: Mean and Mode Log Mar values for 3 contrast groups.

As the selected children were emmetropes, all of them had 0.0 Log Mar visual acuity. The 5% contrast sensitivity had a range of 0.0 to 0.3 Log Mar acuities, where as 2.5% contrast sensitivity acuities had a range of 0.0 to 0.5 Log Mar acuities. The Log Mar acuities for all the three groups are given in the Fig 2.
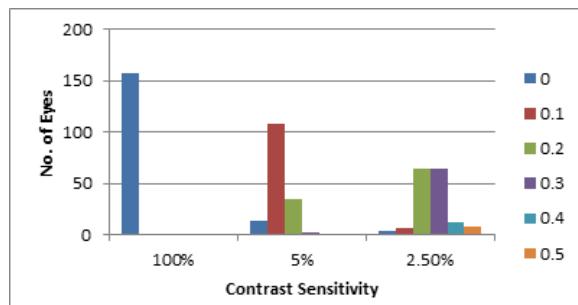
**Fig2: Log Mar acuity for three contrasts.**

All 158 eyes showed normal acuities at 100% contrast. Whereas 14 eyes and 4 eyes showed normal acuities even at 5% and 2.5% contrasts respectively. At 2.5% contrast, 12 eyes and 8 eyes showed 0.4 and 0.5 Log Mar acuities. Fig 3 shows the number of eyes at each step of Log Mar acuity.
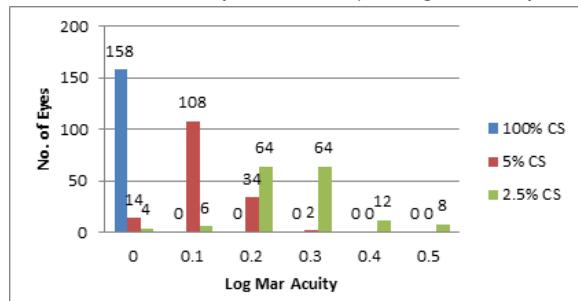
Fig 3: Number of eyes showing different acuities for 3 contrast groups

There was no significant correlation between age and all the three groups of Log Mar acuities. There was a significant pos-

itive correlation (p 0.00) between 5% and 2.5% as shown in Fig 4. The R and R^2 values were 0.47 and 0.22 respectively.
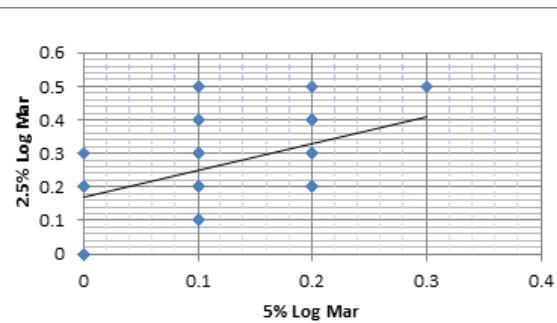
Fig 5: Correlation of 5% and 2.5% Contrast Sensitivity

DISCUSSION

There have been a number of studies measuring visual acuity, visual field, color vision with varying results based on the testing tools and procedures. Many studies focussed on infant'scontrast sensitivity which gradually increases with the child's age in weeks (Angela,2009). Sensitivity to contrast would gradually improve between 1 and 3 months of age (Banks MS, Salapatek 1978). Sweeping cognitive development (Piaget, 1956 & Gelman, 1979) and self-awareness (Flavel, 1979)develops in preschool and early school years.

Our study used Dr. Lea's Contrast Sensitivity charts to measure visual acuity at various contrast levels whereas earlier studies used different methods of contrast sensitivity testing using Teller Acuity Cards (Russell, Mary, 2002), Pelli Robson(Vitoria, Nicole et al.,1999) and VCTS 6500 (Larsson, Rydberg, Holmstrom, 2006) contrast sensitivity charts etc. Performance at 5% and 2.5% contrast levels is necessary in carrying out our day to day chores. This study attempted to know where the normal subject stands in the visual acuity chart for these contrast levels. The results revealed 0.1 and 0.26 Log Mar acuities for 5% and 2.5% contrast sensitivity respectively. All the 79 children have normal vision at 100% contrast whereas 7 and 2 children showed normal acuities even at 5% and 2.5% contrasts respectively. But 6 and 4 children showed 0.4 and 0.5 Log Mar acuities at 2.5% contrast which may suggest to look for the any hidden ocular anomalies or these children may develop any ocular anomalies in future. Hence it is recommended to do a prospective study for a larger school population in this regard.

Contrast sensitivity testing charts in eye care and vision rehabilitation centres will help in diagnosing certain ocular disorders when they come across infants, toddlers and multi-sensory impaired subjects. Contrast sensitivity assessment will provide the complete visual information as it plays a crucial role in visual communication, mobility, daily living, reading and writing than visual acuity alone. This testing procedure provides a satisfactory result within a reasonable timeframe and is recommended for clinical practice.

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