

## Visual Field Changes with Coloured Cosmetic (Semi –Opaque) Soft Contact Lenses: A Pilot Study

**Kamal Pant**

Associate Professor Department Of Optometry, U.P. University Of Medical Sciences, Saifai, India

### Abstract

Conventional soft contact lenses (SCL) don't affect the visual fields significantly. But, coloured cosmetic SCLs affect on the visual fields was not clearly known. A pilot study was done to determine the exact effect of coloured cosmetic SCL on the visual fields of the Contact lens users. 25 subjects were randomly selected for this study through the following:

**Inclusion Criteria:**

- Age range between 15-30 years.
- Pupil size 3-6mm in normal daylight condition.
- Unaided visual acuity of 6/6 on Snellen's chart (no refractive error) in both eyes.

**Exclusion Criteria** (history of one or more):

- Glaucomatous or neurological visual field defects.
- Moderate to severe dry eyes.
- Presence of corneal scar or lenticular opacity.
- Allergic to Contact Lens solutions

Informed consent was taken from all the subjects enrolled for the study. All individuals were worked up in the CL clinic & detailed history, ocular examination on Slit Lamp bio-microscope, evaluation of coloured cosmetic SCL Fitting, visual fields charting with & without CL were done. There was a statistically significant decrease in visual threshold with the use of coloured cosmetic soft contact lens. Coloured cosmetic soft Contact lenses could be used for occasional or party wear and also for cosmetic purposes in case of disfigured eyes with a word of advice.

**KEYWORDS:** Visual field, Coloured Cosmetic, Soft Contact Lens.

### INTRODUCTION

Visual field is defined as the extent of the visual perception from the point of fixation (in all meridians) without any movement of eye & head. The extent of the normal visual field is restricted by anatomical features like the brow superiorly, the nose nasally and the cheek inferiorly. Normally with white target, it extends 60 degrees upward, 90 degrees outward, 70 degrees downward and 60 degrees inward. The extent is affected by factors such as illumination, size of the test-object, contrast of the test-object, state of the adaptation of eye and pupil size. Visual fields charting is of 2 types: Kinetic in which visual field is determined by moving stimulus from periphery to centre, while Static is measurement of retinal sensitivity at each point within the visual field.

Coloured cosmetic soft contact lenses (SCL) are lenses with iris patterns or imprints to enhance or change the natural iris appearance and hence the cosmetic appearance. These lenses are available in different iris-patterns like dot-matrix, circular fringe, etc. Initially, Walonker and Diddie<sup>1</sup> conducted an experiment to get the simulation of peripheral field restrictions through application of an opaque or translucent material

on posterior surface of contact lens. Many a times, contact lenses are designed with opaque peripheries for the purpose of reducing glare in special conditions like, Albinism<sup>9</sup> etc. So, opaque or semi-opaque periphery contact lenses find their therapeutic use as well as cosmetic application as per the requirements. Gabriel and associates<sup>2</sup> confirmed by an experiment that visual field is a function of pupil size. In this study, kinetic perimetry was performed on Goldmann perimeter using contact lens with different sized (ranging from 3-6.8mm) artificial pupils. This led to the conclusion that retinal sensitivity is directly proportional to the pupil size.

Josephson and Insler in their prospective study measured kinetic visual field restriction with cosmetic contact lens having semi-opaque peripheries<sup>3,4</sup> (i.e., a matrix of opaque dots that alter iris colour appearance). Insler and colleagues<sup>4</sup> performed Goldmann visual field charting on 10 volunteers (free from refractive error and any ocular disease) while they were wearing Durasoft-3 coloured SCL (having 5mm clear pupillary zone). In most of the subjects at least 5-10 degrees peripheral field loss was observed while wearing the contact lens, which could be attributed to the narrow clear pupillary zone of CL.

Lee and colleagues<sup>5</sup> as part of their study on static perimetry provided the only reported calculation of visual field extent with such lenses with semi-opaque periphery contact lenses. They calculated the field limit corresponding to the central clear zone of Durasoft contact lenses to be 38 degrees based on the Gullstrand exact schematic eye<sup>11</sup>, but did not describe the method or the assumptions they used to arrive at this figure. However, this approach ignores the interaction between the patient's ocular pupil and the contact lens aperture.

A study was performed by Wenos and associates<sup>6</sup> to compare peripheral visual field differences on a balance measure of contact and non-CL wearer. No significant difference in balance was found between groups; however, differences in measurements for peripheral vision between contact and non-contact lens wearers were evident.

It was obvious that there is a decrease in contrast sensitivity with contact lens wear and also constriction of field with coloured cosmetic lens. But, there was a scarcity of data in the available literature regarding effect of plano coloured cosmetic CL on the visual field threshold as well as on contrast sensitivity simultaneously. In view of this present pilot study was planned to evaluate the visual field and contrast sensitivity changes in coloured cosmetic (semi-opaque) SCL in our set up. Till to date, no such study has been performed and published on Indian scenario despite the fact that the usage of coloured cosmetic CLs is increasing very rapidly in this high potential market.

## **MATERIALS AND METHODS**

In this prospective pilot study, 25 subjects were taken randomly from the CL clinic of the department of Ophthalmology, Govt. Medical College and Hospital, Chandigarh (2012).

Patients fulfilling following criteria were included in this study.

- Age range between 15-30 years.
- Pupil size 3-6mm in normal daylight condition.

- Unaided visual acuity of 6/6 on Snellen's chart (no refractive error) in both eyes.

Patients having any of the following problems were excluded from the study

- Glaucomatous or neurological visual field defects.
- Moderate to severe dry eyes.
- Presence of corneal scar or lenticular opacity.
- Allergic to CL solutions.

Informed consent was taken from all the subjects enrolled for the study. All individuals were worked up in the CL clinic, where a Pro-forma was filled up which included detailed history, ocular examination on Slit Lamp bio-microscope, evaluation of coloured cosmetic SCL Fitting and visual fields charting.

Complete slit-lamp examination of each eye was performed for assessing the health of lids, conjunctiva, tear-film, cornea, lens & vitreous. Direct Ophthalmoscopy was done to examine the status of the fundus. Pupil diameter and corneal diameter (HVID) were measured with transparent ruler. Also, Goldmann applanation tonometer was used to check the IOP (Intra ocular pressure) and Visual acuity (VA) was recorded with Snellen's VA chart. The refraction was done with the aid of Streak retinoscope to select subjects having no refractive error for the study.

Coloured cosmetic SCLs used were of Bausch & Lomb's (B & L) Soflens disposable (Starcolors-II). The following are the parameters of the Starcolors-II lens:

- Material: Polymacon (FDA Group-I)
- Colour: Blue
- Water content: 38.6%
- Central thickness: 0.035mm
- Optic or clear pupillary zone: 6.00mm
- Base curve (B.C.): 8.4 or 8.7
- Power: Plano
- O.D. (overall diameter): 14.1mm

The contact lenses were fitted on the basis of Keratometry. One-hour time (for stabilization of CL) was given for post CL fitting examinations. It was ensured that there was proper centration of SCL with 0.5-1.0mm of movement (with push-up test).

Humphrey Field Analyser (HFA) was used to test visual field by Peripheral (60-4) Threshold test. Following were the parameters used for the test:

- Background illumination: 31.5apostilb (an apostilb is a unit of brightness =1milli lambert).
- Fixation target: central.
- Stimulus: III (Golmann) size, white.
- Strategy: SITA-FAST.

Visual fields were recorded before and after 1 hour of CL fitting.

Paired student 't' test was used to compare the changes in the visual fields (visual threshold) on wearing coloured cosmetic SCL. The comparison of each eye before and after 1 hour of CL fitting was done quadrant and also total field wise. For all analyses,  $p < 0.05$  was considered statistically significant with a 95% confidence level. All the procedures were carried out in the present pilot study on the human subjects are performed routinely in the department of Ophthalmology. The procedures were done after taking written and informed consent & the defined guidelines of the

Central Ethical Committee for Bio-medical research on human subjects by ICMR were adhered to in addition to those of Helsinki Declaration.

## RESULTS AND DISCUSSION

Visual threshold was recorded with peripheral 60-4 threshold strategy using Humphrey Field Analyser before and after 1 hour of SCL wear. The observations and results are as under:

### 1) DEMOGRAPHIC DISTRIBUTION:

#### (a) Age distribution-

Out of 25 subjects; Majority of the subjects 12(48%) were in the age-group of 16-20 years while 9(36%) and 4(16%) were in the age-groups of 21-25 years and 26-30 years respectively [Table I (a)], Fig 1(a).

#### (b) Sex distribution-

The majority of subjects included in the study were females 14 (56%) while males were 11(44%). Females were given due preference, as they are the more potential users of coloured cosmetic lenses than the males [Table I (b)], Fig 1(b).

### 2) AVERAGE VISUAL THRESHOLD:

#### (a) Right eye (R/E)-

Average visual threshold was highest (419.72 & 393.84dB) in IT quadrant while lowest (263.72 & 261.72dB) in SN both with and without CL. Percentage change was maximum (6.17%) both in IN & IT quadrant while minimum (0.76%) in SN. 't' values were significant at  $p=0.05$  (95% confidence) in all quadrants except in SN [Table II (a)], Fig 2 (a) & (b).

#### (b) Left eye (L/E)-

Average visual threshold was highest (416.04 & 400.64dB) in IT quadrant while lowest (263.44 & 251.48dB) in SN both with and without CL. Percentage change was maximum (6.53%) both in IN quadrant while minimum (4.13%) in ST. 't' values were significant at  $p=0.05$  (95% confidence) in all quadrants except in SN [Table II (b)], Fig 2 (b) & (d).

#### (c) Total field-

Percentage change in Average visual threshold was 4.26% & 4.62% in R/E and L/E respectively. 't' values were significant in both R/E & L/E at  $p=0.05$  (95% confidence) [Table II (c)], Fig 2 (e).

On discussing of the results following inferences were made:

1. There was a decrease in visual threshold significantly: SN & IN < ST & IT as nasal fields were overlapped. Temporal fields are important in case of Sports persons, drivers etc. It is supported by Bruce and Vingrys<sup>7</sup> study of static VFs with Durasoft-3 coloured SCL which concluded in slight depression (0.7dB) of visual sensitivity for peripheral fields (than to clear lens).
2. Significant decrease of visual thresholds in total peripheral field is quite evident which can be attributed to small clear zone of 5mm. Gabriel and associates<sup>2</sup> concluded Visual Field is a function of pupil size which is in accordance to the reasoning above.
3. Also validated by Insler and colleagues<sup>4</sup> study where at least 5-10 degrees peripheral field loss was reported, attributed to narrow clear pupillary zone.

## CONCLUSION

It was concluded that Coloured cosmetic SCL could result in statistically significant decrease of visual threshold even in subjects with no refractive error. But, the decrease in visual threshold values was prominent in periphery without obstructing

the normal practical viewing field. Thus, Coloured cosmetic soft Contact lenses could be used for occasional or party wear and also for cosmetic purposes in case of disfigured eyes with a word of advice.

### ACKNOWLEDGEMENTS

I am really thankful to Prof. Sunandan Sood, Head and also to Prof. Sudesh K. Arya, Department of Ophthalmology, GMCH-32, Chandigarh for providing me constant encouragement and access to all equipment and facilities necessary for the study.

### REFERENCES

1. Walonker AF, Diddie KR. Simulating decreased visual acuity with a contact lens system. *Amer J Ophthalmol* 1981; 92: 863-864.
2. Gabriel P, Kitchen C, Brown B. Effect of pupil size on the kinetic visual field measurements. *Clin Exp Optom* 1988; 71: 184-187.
3. Josephson JE, Caffery BE. Visual field loss with colored hydrogel lenses. *Am J Optom Physiol Opt* 1987; 64: 38-40.
4. Insler MS, Hendriks C, George DM. Visual field constriction caused by colored contact lenses. *Arch Ophthalmol* 1988; 106: 1680-1682.
5. Lee DY, Jurkus JM, Ma S. Effect of the opaque, colored dot-matrix contact lens on visual field. *ICLC* 1990; 17: 189-191.
6. Wenos DL, Meetz RE, Surburg PR, Suomi R. Comparison of peripheral visual field differences on a balance measure of contact and non-contact lens wearers. *Percept mot skills* 1994; 79: 1305-1306.
7. Bruce AS, Vingrys AJ. Does a colored contact lens change the visual sensitivity of patients? *Clin Exp Optom* 1990; 73: 200-204.

Table I (a). **Age Distribution**

Age Group	No. of Subjects	Percentage (%)
16-20	12	48%
21-25	9	36%
26-30	4	16%
<b>Total</b>	<b>25</b>	<b>100%</b>

Table I (b). **Sex Distribution**

SEX	No. of Subjects	Percentage (%)
Male	11	44%
Female	14	56%
<b>Total</b>	<b>25</b>	<b>100%</b>

Table II (a). **Average Visual Threshold in R/E**

Visual field (Quadrant)	Av. Visual threshold (in dB)		% Change	't' value*
	Without CL	With CL		
ST (Supra-Temporal)	349.56	338.88	3.05	2.56
SN (Supra-Nasal)	263.72	261.72	0.76	0.24

<b>IN (Infra-Nasal)</b>	287.2	269.48	6.17	2.22
<b>IT (Infra-Temporal)</b>	419.72	393.84	6.17	3.25

\* Table value of  $t_{24} = 2.06$  at  $p=0.05$

Table II (b). Average Visual Threshold in L/E

Visual field (Quadrant)	Av. Visual threshold (in dB)		% Change	't' value*
	Without CL	With CL		
<b>ST (Supra-Temporal)</b>	349.48	335.04	4.13	3.52
<b>SN (Supra-Nasal)</b>	263.44	251.48	4.54	1.59
<b>IN (Infra-Nasal)</b>	300.84	281.2	6.53	2.31
<b>IT (Infra-Temporal)</b>	416.04	400.64	3.70	3.83

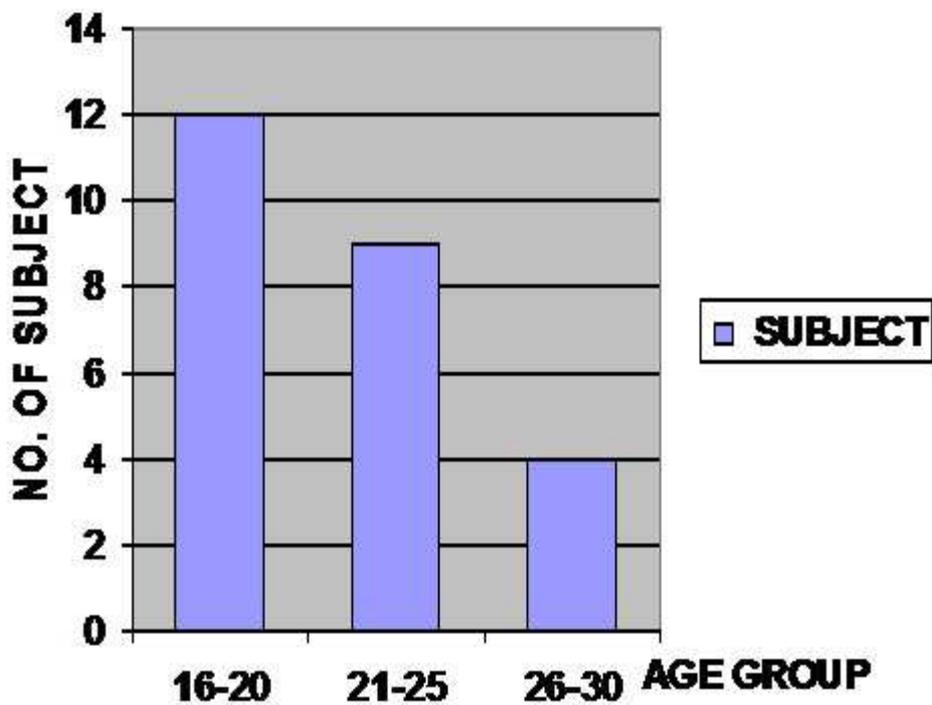
\* Table value of  $t_{24} = 2.06$  at  $p=0.05$

Table II (c). Average Visual Threshold in total field

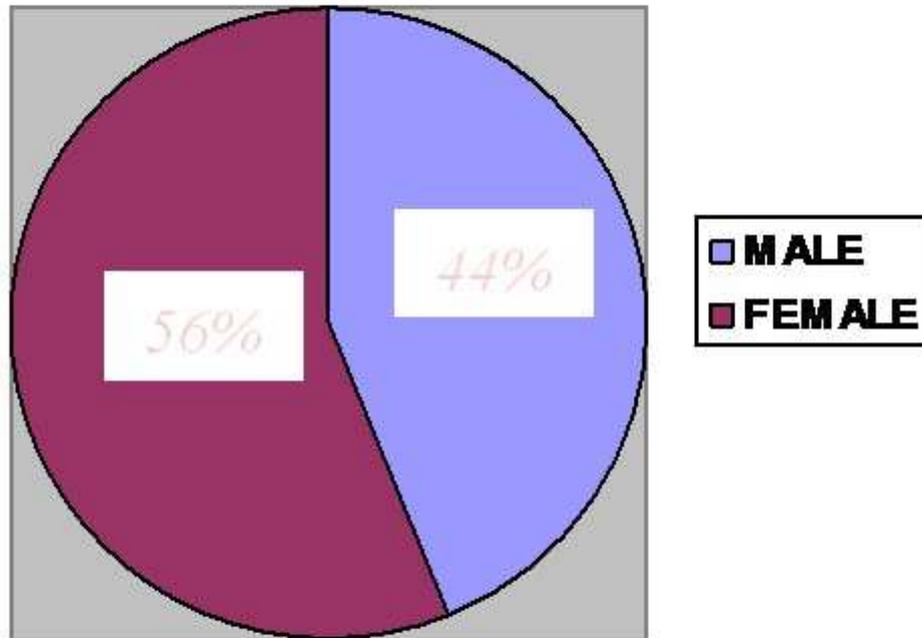
Total visual field	Av. Visual threshold (in dB)		% Change	't' value*
	Without CL	With CL		
<b>R/E</b>	1320.2	1263.92	4.26	2.41
<b>L/E</b>	1329.8	1268.36	4.62	4.01

\* Table value of  $t_{24} = 2.06$  at  $p=0.05$

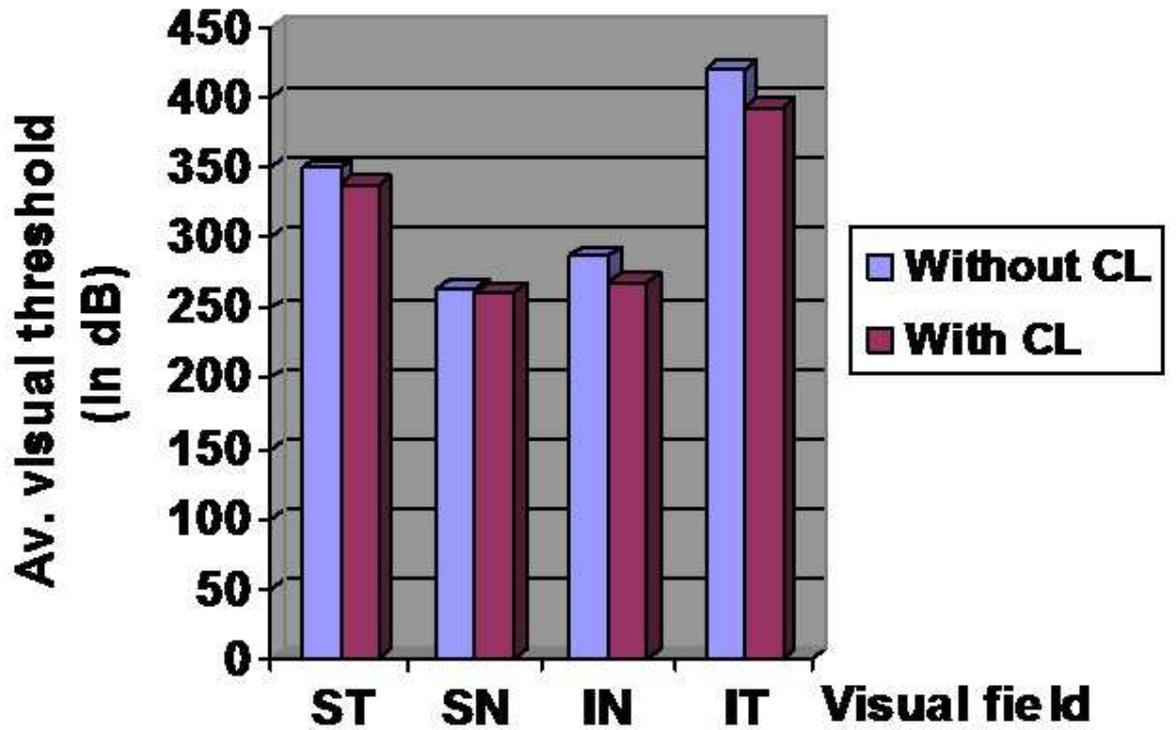
**Caption of the Figures**



**Fig 1(a). Age Distribution**



**Fig 1(b) Sex Distribution (Pie-chart)**



**Fig 2 (a). Change in R/E  
Average visual threshold**

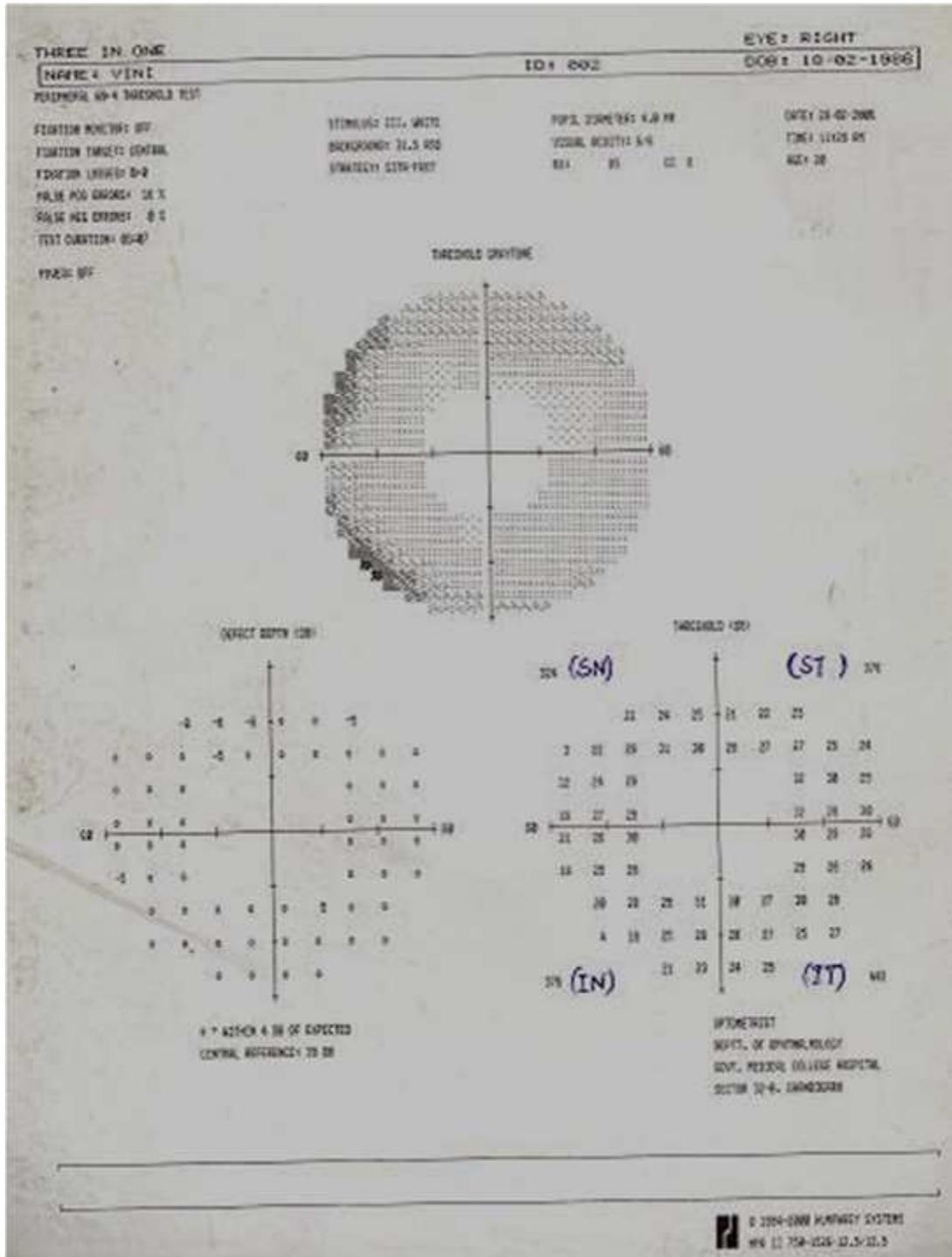
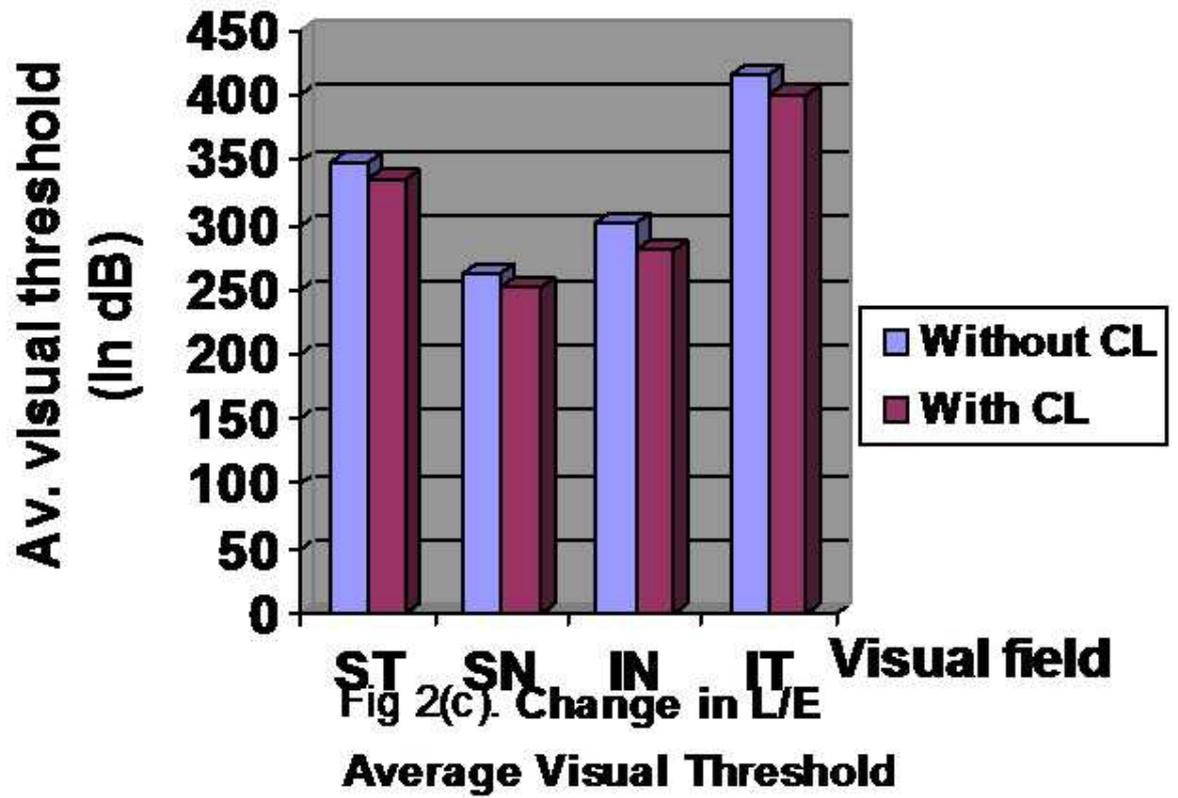
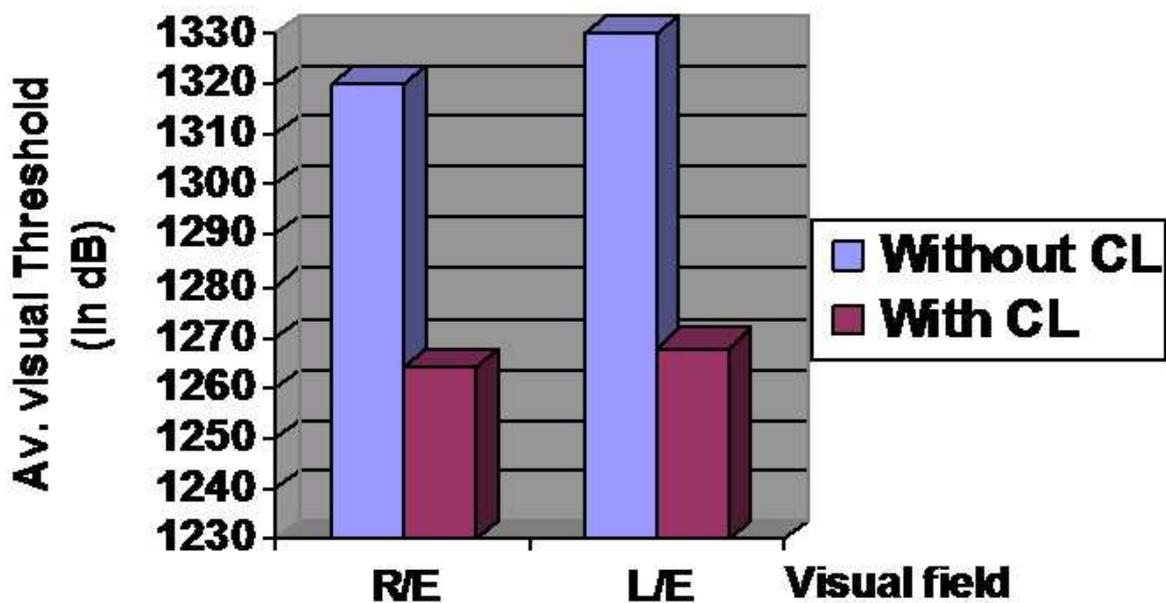


Fig 2(b) Visual field Plot of R/E







**Fig 2(e). Average Visual Threshold in total Field**