

VISUAL ACUITY IN DIFFERENT INTENSITIES OF LIGHTShruthi K¹, Suresh Babu Gangasagara², Venkatesh S³**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: BACKGROUND: Visual acuity is the resolving power of eyes which enables to distinguish the details and shapes of the objects. It is influenced by the intensity (illumination) of light falling on the object. Measuring visual acuity is a simple test in assessing-health of the eyes, the pathway and visual brain. Intact normal vision is mandatory for selection of posts related to driving and traffic services. Intactness of visual acuity is influenced by a number of factors and one among them is intensity of ambient light. Hence, this study is undertaken to assess optimum light intensity for better visual perception. **AIM:** To evaluate the association between visual acuity and intensity of light and the optimum intensity of light to carry out for better perception of vision. **MATERIALS AND METHODS:** 100 literate subjects - 50 males and 50 females between 15-45 years, act both as cases and controls. Subjects, instructed to read alphabets and numbers from Snellen chart in 15 watts, 20 watts, 40 watts, 60 watts, 100 watts, 200 watts were considered as the study group and the same subjects in this study in day light as controls. Chart was placed at 6m distance. Both right and left eyes were tested separately in dark room illuminated with controlled light intensities. Number of correct characters read were noted for different illuminations and compared with that of controls. **RESULTS:** Reduced illumination significantly increased the no of incorrect choices and was statistically significant ($P < 0.05$) between 15 - 100 W. Visual acuity was best in 200 W in comparison with day light but was not statistically significant. However Visual acuity showed no significant difference between males and females for different intensities of light.

KEYWORDS: Intensity of light, Visual acuity, Illumination.

INTRODUCTION: The visual system provides a supremely efficient means for the rapid assimilation of information from the environment to aid in the guidance of behavior, the act of seeing begins with the capture of images focused by the cornea and lens upon the light sensitive membrane in the back of the eyes the retina which acts as a transducer which converts the patterns of light energy to neuronal signals¹ and focusing of a clear image requires adaptation of focal length of the optic lens by altering the curvature of the lens to suit the varying distance of the entering rays.² which requires good ambient lighting and is directly influenced by the intensity and amount of ambient light luminance which falls upon an object,³ which resolves the power of the eyes to perceive the details and contours of an object which has to be perceived by the eye,⁴ this functions is taken by the 5 million cones present in the human which function under day light conditions (Photopic) retina. Humans have a limited capability to identify object detail under diminished light conditions, it is seen that visual acuity decreases linearly with reductions in luminance and an greater increases in luminance is necessary to provide better changes in acuity hence visual changes over a range of background of luminance levels, Measurement of visual acuity assesses the health of the eyes, and the visual pathway to brain⁵ and luminance levels are necessary at various common areas such as road lighting, vehicular head lights, reading with artificial lights, sign hoardings and advertisements and

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intactness of visual acuity is mandatory for selection posts related to driving and traffic services. This study was undertaken to determine the effect of different intensities of light on visual acuity.

OBJECTIVE:

- To evaluate the association between intensity of light and visual acuity.
- To evaluate the optimum intensity of light for carrying out better perception of vision.

MATERIALS AND METHODS: A comparative study comprising 100 literate subjects of both the genders 50 each in the age group of 15-45 yrs who acts as controls in day light and cases in 6 different intensity of light. Written informed consent was taken and ethical clearance was obtained. A detailed eye examination including anterior segment, Posterior segment and refractive errors was done by an Ophthalmologist. Vision status was evaluated and those with h/o of acute or chronic ocular causes, h/o recent or past head injuries, tuberculosis, diabetes, and refractive errors were excluded. A written informed consent was taken and visual acuity was measured for far vision in bright day light and in an enclosed room with controlled light at different intensities 15W, 20W, 40W, 60W, 100W, 200W and the illuminance levels were chosen to be appropriate and to appreciate the ambient intensity of light by using incandescent light in a dark enclosed room. The no of characters read correctly at day light and different intensities was noted, compared and statically analyzed.

STATISTICS: Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean \pm SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Student t test (Two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters.

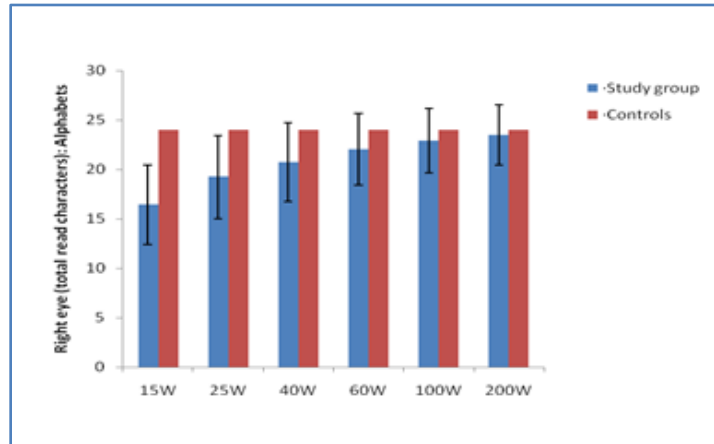
Gender	No. of patients	%
Female	50	50.0
Male	50	50.0
Total	100	100.0

Table 1: Gender distribution of patients studied

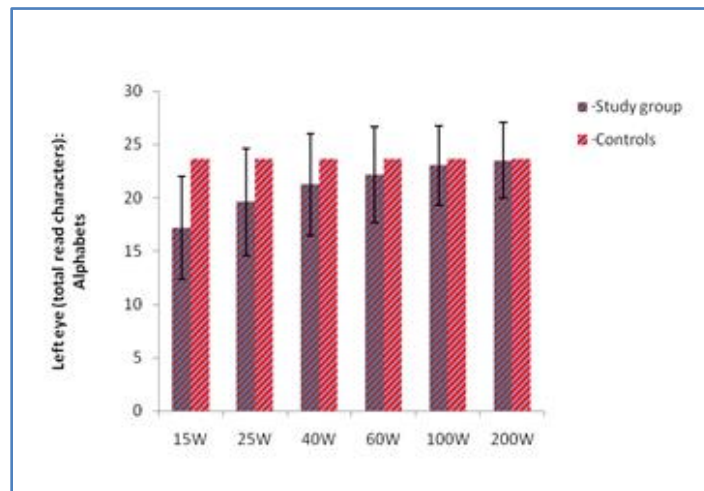
Right eye	STUDY GROUP	CONTROL	P VALUE
15 W	16.43 \pm 4.00	23.99 \pm 2.51	<0.001**
25W	19.24 \pm 4.20	23.99 \pm 2.51	<0.001**
40 W	20.71 \pm 4.00	23.99 \pm 2.51	<0.001**
60 W	22.03 \pm 3.65	23.99 \pm 2.51	<0.001**
100W	22.91 \pm 3.29	23.99 \pm 2.51	<0.001**
200W	23.71 \pm 3.05	23.99 \pm 2.51	0.312

Table 2: Comparison of total read characters (Alphabets)

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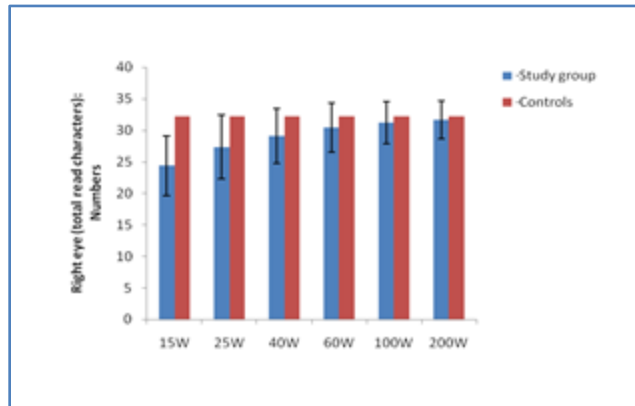
Left eye	STUDY GROUP	CONTROL	P VALUE
15w	17.14±4.82	23.66±3.29	<0.001**
25w	19.58±5.05	23.66±3.29	<0.001**
40w	21.24±4.77	23.66±3.29	<0.001**
60w	22.15±4.52	23.66±3.29	<0.001**
100w	23.04±3.74	23.66±3.29	0.006**
200w	23.49±3.55	23.66±3.29	0.328



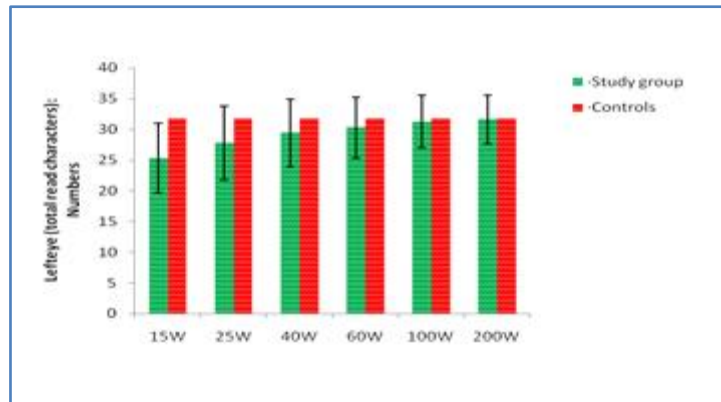
Right eye	STUDY GROUP	CONTROL	P VALUE
15w	24.41±4.74	32.19±2.31	<0.001**
25w	27.34±5.08	32.19±2.31	<0.001**
40w	29.10±4.38	32.19±2.31	<0.001**
60w	30.46±3.87	32.19±2.31	<0.001**
100w	31.18±3.35	32.19±2.31	<0.001**
200w	32.11±2.97	32.19±2.31	0.243

Table 3: Comparison of total read characters (Numbers)

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Left eye	STUDY GROUP	CONTROL	P VALUE
15 w	25.33±5.69	31.79±3.53	<0.001**
25w	27.76±6.06	31.79±3.53	<0.001**
40w	29.41±5.52	31.79±3.53	<0.001**
60w	30.27±4.91	31.79±3.53	<0.001**
100w	31.25±4.26	31.79±3.53	0.011*
200w	31.61±3.97	31.79±3.53	0.289



RESULTS: Number of choices read incorrectly was more with reduced illumination 100 W -15 W and was statistically significant ($P < 0.05$). Visual acuity was best in 200 W in comparison with day light but was not statistically significant.

DISCUSSION: Retina acts as a transducer to convert light energy to neuronal signals and which is directly proportional to illuminance. Light sensitive photo receptors cones hyperpolarize in response to light and these cells translate the visual image impinging upon the retina into continuous action potentials which propagate along the optic pathway to the visual centers within the brain.¹

CONCLUSION: 200 Watts or natural day light is best for visual perception and no need to go for higher light intensities thereby conserving energy.

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Visual acuity is associated with intensity of light however regulation of the amount of light that enters varies with the size of pupil that is constricted in bright light and dilates in dim light as the photoreceptors get bleached out by too much light.⁶

LIMITATIONS OF THE STUDY: Hence the limitations of this study is to further see at what luminance does the bleaching of photoreceptors occur and to define the suitable range of intensity of light for better perception.

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