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Optical Quality Analysis In Normal Indian Population

Dr. Shikha Dhawan, Dr. Rohit Shetty, Dr. Bhujang Shetty K., Dr. Chintan Molhotra

In recent years, the double-pass technique has been shown to be a useful tool for comprehensively evaluating the optical quality of the eye. Double-pass systems are based on recording images from a point-source object after reflection on the retina and a double pass through the ocular media. In contrast to wavefront aberrometry, the double-pass systems directly compute the modulation transfer function from the acquired double-pass retinal image by Fourier transformation, allowing the complete characterisation of the optical quality of the eye, mainly degraded by higher-order ocular aberrations and scattered light. The Optical Quality Analysis System (OQAS, Visiometrics SL, Spain) is the only instrument based on the double-pass technique that is currently available for use in daily clinical practice. It is based on the asymmetric scheme of the double-pass technique, that is, with different entrance and exit pupil sizes, enabling the detection of both symmetric and asymmetric aberrations. Asymmetric aberrations such as coma cannot be measured by a conventional symmetric double-pass system. The Optical Quality Analysis System computes the modulation transfer function from the double-pass images that are acquired. It also provides many other optical quality parameters (MTF cutoff frequency [MTF cutoff], Strehl ratio [Strehl2D ratio] and OSI (objective scatter index) to simplify the study of the optical quality of the eye. In this study we report normal values for the optical quality and intraocular scattering parameters provided by the double-pass based system measured in a healthy homogeneous sample population aged between 18 and 40 years.

Tscherning Aberrometer is a ray tracing device that measures the wavefront aberration in the image plane and uses retinal imaging to photograph the patient’s actual retinal image, incorporating the visual distortion to facilitate diagnosis of conditions. In order to test the hypothesis of a population having eyes free of higher-order aberrations, we have measured the wavefront aberrations for a group of young adults using a Tscherning aberrometer (Allegretto Wave Analyzer, WaveLight). For a better understanding of the nature of higher-order aberrations in a normal population, this study was
focused on emmetropes, because it is more reasonable to test the hypothesis in normal emmetropic eyes rather than in eyes with refractive errors.

MATERIALS AND METHODS
Healthy young volunteers aged from 18 to 40 years were recruited for this prospective, observational, cross-sectional, nonconsecutive case study from the staff and students of the Narayana Netralaya, Bangalore. Subjects with no history of ocular pathology or surgery underwent a standardised examination between April and June 2011. Ethical committee approval was obtained.

Criteria for inclusion in the study were a logMAR visual acuity (VA) of 0.0 or better, normal contrast sensitivity function values in mesopic conditions. The optical quality and intraocular scattering were measured using the Optical Quality Analysis System with the subject’s retinal image optimally focused. The patients’ refractive errors were corrected during these measurements: the spherical refractive error was automatically corrected by the double-pass system and astigmatism over 0.50 D was corrected with an external cylindrical lens. The size of the artificial pupil is controlled by means of a diaphragm wheel located inside the double-pass system. Room illumination was kept low during testing. For Tscherning aberrometry, the experiment was performed with room lights off. For all patients, a pupil size of 6.0 mm was selected to acquire wavefront data so that pupil size would not be a confounding factor. The right and left eyes were tested in random order, and Zernike polynomials were recorded.

Statistical analysis
The statistical analysis of the data was performed using Minitab software (version 15.0, Minitab Inc, USA) for Windows. The Kolmogorov-Smirnov test was used to evaluate the normal distribution of all variables. A p value of 0.05 was considered to be statistically significant. The mean (±SD, standard deviation) and the corresponding range (minimum and maximum) are given for each analysed variable.

RESULTS
We examined 100 eyes of 168 persons, of whom 58.8 per cent were female. The mean age was 32.47 ± 5.04 years (range: 18 to 40 years) and subjects had a spherical equivalent of 1.02 ± 1.39 D (range: -4.00 to +2.00 D). In this study, all analysed variables (demographics, clinical data and optical quality parameters) were normally distributed (p > 0.15). Table 1 shows the statistics of the optical quality and intraocular scattering parameters provided by the double-pass system as well as the corresponding normal cutoffs. No statistically significant differences were observed for the optical quality parameters, when the influence of the spherical equivalent, cylinder, age, sex and eye were tested, as well as when the influence of the examiner was analysed (p > 0.05). The
mean value for defocus, spherical aberration and coma for a 6mm pupil was 0.35±0.34, 0.04±0.03 and 0.08±0.04 respectively (Table 1). The influence of pupil diameter was not analysed, as all optical quality parameters were measured using a 6.0 mm pupil.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mtf Cutoff (Cpd)</td>
<td>41.21</td>
<td>7.08</td>
<td>20.04 – 56.21</td>
</tr>
<tr>
<td>Strehl Ratio</td>
<td>0.216</td>
<td>0.06</td>
<td>0.11 – 0.32</td>
</tr>
<tr>
<td>Osi</td>
<td>0.428</td>
<td>0.18</td>
<td>0.1 – 1.2</td>
</tr>
<tr>
<td>Defocus</td>
<td>0.35</td>
<td>0.34</td>
<td>-1.91 – 3.48</td>
</tr>
<tr>
<td>Spherical Aberration</td>
<td>0.04</td>
<td>0.03</td>
<td>-0.54 – 0.48</td>
</tr>
<tr>
<td>Coma</td>
<td>0.08</td>
<td>0.04</td>
<td>0.03 – 0.39</td>
</tr>
</tbody>
</table>

**DISCUSSION**

For the parameters MTFcutoff, Strehl 2D ratio, which account for the optical quality of the eye, the upper limit found has no clinical significance (it is the lower limit rather than the upper limit that matters when distinguishing normal from abnormal performance). The lower limit of normal for the MTFcutoff was 20.04 cpd. For the Strehl 2D ratio, the lower limit of normality was 0.11. For the objective scatter index, the upper normal limit established (1.2) is the one with clinical relevance, as it quantifies the amount of scattered light present in the eye. This parameter has been used in previous studies to establish an objective gradation for cataracts.\(^4\) Previous studies have demonstrated that intraocular scattering is highly affected by the subject’s age.\(^5,6\) In this work, the objective scatter index was also shown to be influenced by age (a p value of 0.001 was found when we analysed the influence of the subject’s age on the results). A wider range of ages should be analysed to establish the correct relationship between these two variables, due to the limited range of ages analysed in this study. In conclusion, the study allowed us to establish the normal limits in healthy young subjects for the objective optical quality and intraocular scattering parameters provided by the double-pass system, which may facilitate addressing patients’ ocular problems. Our data provide a new basis for evaluating optical quality in clinical environments and can be a reference for discriminating healthy from early abnormal eyes, in which the optical quality or sensory function is impaired. The data gathered here are representative of healthy young adults. Future studies in this area should focus on other age ranges.

This study also indicates that the population is not free of higher-order aberrations. This means that the human eye has not reached yet the perfect optical condition during the process of evolution. While visual acuity was
found to be improved as the higher-order aberrations were completely corrected in several recent studies with adaptive optics,\textsuperscript{7,8} aberration as a cue for accommodation was also demonstrated in some subjects.\textsuperscript{9} Clearly, further studies on this issue are expected.

**REFERENCES**


**Uncorrected Refractive Error in Central India. The Central India Eye and Medical Study (CIEMS)**

**Dr. Nangia Vinay Kumar B., Dr. Anshu Khare, Dr. Jost Jonas**

One of the most frequently encountered reasons for visual impairment has been undercorrection of refractive errors.\textsuperscript{1-6} Since frequency and reasons of visual impairment may differ between regions and populations, it was the purpose of the present study to evaluate the frequency of undercorrection of refractive errors in elderly Indian in a rural population and an urban population in the area of Central Maharashtra.
MATERIALS AND METHODS

The Central India Eye and Medical Study (CIEMS) is a population-based cross-sectional study in Central India. It was carried out in 8 villages in the rural region of Central Maharashtra at a distance of about 40 km from Nagpur. The Medical Ethics Committee of the Medical Faculty Mannheim of the Ruprecht-Karls-University Heidelberg and the ethical committee of Suraj Eye Institute/Nagpur approved the study and all participants gave informed consent, according to the Declaration of Helsinki. Inclusion criterion was an age of 30+ years. Out of a total population of 13606 villagers, 5885 subjects fulfilled the inclusion criterion of an age of 30+ years and were eligible for the study. Out of these 5885 subjects, 4711 people participated, resulting in a response rate of 80.1%. The mean age was 59.5 ± 13.4 years (median: 47 years; range: 30-100 years). The mean refractive error was -0.12 ± 1.77 diopters (median: 0 diopters; range: -21.75 to +8.75 diopters). All examinations were carried out in the hospital. Trained social workers filled out a questionnaire including 200 questions on the socioeconomic background and living conditions, known diagnosis of major diseases, and on the family history of eye diseases.

The ophthalmic examinations included testing of visual acuity by ophthalmologists or optometrists. Automated refractometry and subjective refraction was performed for all subjects independent of the visual acuity. Using modified ETDRS charts (Light House Low Vision Products, New York, NY, USA) at a distance of 4 meters, we measured uncorrected visual acuity, visual acuity with the subjects’ glasses (habitual visual acuity), and best corrected visual acuity. Undercorrected refractive error was defined as an improvement in presenting or habitual visual acuity of the better eye by at least 2 lines with best refractive correction.

RESULTS

Visual acuity measurements were available for 4699 (99.7%) subjects. An undercorrection of refractive error was detected in 1588 subjects. The rate of undercorrection was 33.8 ± 0.07% (95% confidence interval: 32.4, 35.2). In univariate analysis, refractive undercorrection was significantly associated with female gender (P<0.001), higher age (P<0.001), lower level of education (P<0.001), low best corrected visual acuity (P<0.001), higher myopic refractive error (P=0.02), higher corneal refractive power (P<0.001), higher astigmatic refractive error (P<0.001), shorter axial length (P<0.001), higher lens thickness (P=0.008), thinner central corneal thickness (P<0.001), and lower anterior chamber depth (P<0.001).

A multivariate analysis with the presence of refractive undercorrection as dependent variable and all parameters as independent variables which were significantly associated with refractive undercorrection in univariate
analysis, revealed that refractive undercorrection remained to be significantly associated with higher age (P<0.001; odds ratio (OR): 1.06 (95%CI: 1.05, 1.07), female gender (P<0.001; OR: 1.41 (95%CI: 1.20, 1.67), lower level of education (P<0.001; OR: 0.87 (95%CI: 0.81, 0.93), higher hyperopic refractive error (P=0.001; OR: 1.09 (95%CI: 1.04, 1.14), higher corneal refractive power (P=0.006; OR: 1.09 (95%CI: 1.05, 1.07), and higher astigmatic refractive error (P<0.001; OR: 2.15 (95%CI: 1.92, 2.40). It was no longer significantly associated with best corrected visual acuity, axial length, anterior chamber depth, lens thickness, and central corneal thickness. Among the subjects with under correction, 38.1% of the subjects were myopic (i.e. a myopic refractive error of more than -0.50 diopters). Using the World Health Organization (WHO) definition of visual impairment and blindness for habitual visual acuity, 819 (51.6%) subjects out of the 1588 subjects with refractive undercorrection had visual impairment (habitual visual acuity in the better eye <20/60 and ≥20/400). One subject fulfilled the criteria of blindness (habitual visual acuity <20/400). After best correction of the refractive error, 120 (14.6%) subjects out of the 820 subjects with visual impairment or blindness (based on the habitual visual acuity) remained visually impaired. For all other 700 (85.6%) subjects, best corrected visual acuity in the better eye was higher than 20/60.

Comment

Undercorrected refractive error has been one of the leading causes of visual impairment in recent studies on various population groups. In Australia, the Victoria Visual Impairment Project and the Blue Mountains Eye Study found that prevalence rates of undercorrected refractive error of about 7.5% to 10%. In the population-based study in the Shatin area of Hong Kong, 68.9% of visual impairment was explained by undercorrected refractive error. In the Singaporean Tanjong Pagar study, the adjusted prevalence rate of undercorrected refractive error was 17.3%, so that undercorrected refractive error was a leading contributing cause of bilateral low vision in Singaporean Chinese persons aged 40 to 79 years. In most of the previous studies as in the present study, refractive undercorrection were highest among elderly female subjects with a lower level of education. Since the population in rural Central India was significantly more hyperopic than in East Asia, the practical impact of a refractive undercorrection may be even more troublesome in the Central Indian population, in addition to the higher prevalence of refractive undercorrection in Central India.

In conclusion, the rate of refractive undercorrection was 33.8 ± 0.07% in rural Central India. Refractive undercorrection was significantly associated with higher age, female gender, lower level of education, hyperopic refractive error, corneal refractive power, and higher astigmatic refractive error. About 50% of the subjects with refractive undercorrection were visually impaired. After supplying best possible correction of the refractive error, 85% the subjects with
habitual visual impairment were no longer visually impaired. It may show, that refractometry and supplying adequate glasses may be the most efficient and cheapest way to reduce the prevalence of visual impairment in rural Central India.

REFERENCES

Acceptance Rate of Low Vision Aids in Tertiary Eye Care Hospital – Our View

Dr. Mikeen Shah, Dr. Dayakar Yadalla

Vision is the ability to see with a clear perception of detail, color and contrast, and to distinguish objects visually. In most cases, reduction in visual capability can be corrected with glasses, medicine or surgery. However, if the visual changes occur because of an incurable eye disease, condition or injury, vision loss can be permanent. Many people around the world with permanent
visual impairment have some residual vision which can be used with the help of low vision services, materials and devices. According to a World Health Organization (WHO) consultation report, person with low vision is someone who has: an impairment of visual function, even after treatment or refractive correction; a visual acuity of less than 6/18 (20/60) to perception of light or a visual field of less than 10° in the better eye, but who uses, or is potentially able to use, vision for the planning and/or execution of a task.\(^1\) Low vision is one of the priorities in the global initiative, VISION 2020—The Right to Sight, along with cataract, trachoma, onchocerciasis, childhood blindness, and refractive error.\(^2\) Comprehensive low vision service provides suitable low vision aids. These devices help people to read and to do daily activites.\(^3\) However, even the benefits of low vision aids are poorly recognized.

There have been relatively few studies of the effectiveness of low vision aids. Those that have been conducted have used survey techniques to evaluate the performance of low vision aids, and they have not objectively quantified the reading performance before and after low vision aid provision.\(^5,6\) Information on the prevalence of cataract, age-related macular degeneration, diabetic retinopathy, glaucoma, and other eye diseases and the risk factors for these diseases have been reported in this rural south Indian population.\(^7,8,9\) The rehabilitation of people with visual impairment has been relatively ignored in India.\(^10\) Reasons given to explain this apparent lack of interest include (i) the overwhelming demand for cataract surgery, (ii) the lack of postgraduate training in the field of low vision rehabilitation, (iii) the perception that low vision rehabilitation is time consuming and generally unsuccessful, (iv) the very poor availability of locally made low vision aids, and (v) the difficulty and expense in importing overseas low vision aids.\(^11\) Yet visual rehabilitation clinics exist, and are successful, in other developing country settings such as Kenya and Uganda\(^12\) Workers in the field have called for improvement of vision rehabilitation services in India for many years.\(^10,11\) Yet, to justify the creation of low vision rehabilitation services it is first required to show a need of low vision aid therefore its acceptance.

To assess the acceptance level we did a retrospective study of data of parameter of low vision patient in our hospital. It is important to collect and analyze data from low vision patients in order to offer low vision care. Therefore, we investigated characteristics of low vision patients such as age, cause of low vision, type of prescribed low vision aids, and there acceptance rate. We expect these data can be useful for planning low vision services, active care and rehabilitation.

- The aim of this study is to evaluate the acceptance of LVAs in patients of diversified aetiology for low vision.
• To evaluate the most commonly preferred low vision device in diversified causes of low vision in our population.
• To increase the of importance of low vision clinic in tertiary eye hospital.

MATERIALS AND METHODS
This is a retrospective study done based on the parameter details available to us from our low vision clinic. Data collected from medical records of 10830 patients who attended our low vision clinic from year 2008-2010. The data consists of total number of patients presented to our low vision clinic. General identification data along with details pertaining to individual patient and their cause of low vision as well as the low vision device prescribed to them and the improvement with the device were analyzed.

RESULTS
The total data collected from the parameters of our low vision clinic was of 10380 patients who from the year 2008-2010. The total number of new patients attended our out patient department was about 7114 (66%) and review cases were remaining 3266 (34%). We had grouped the patients in two groups those presenting with vision 6/18-3/60 were 8169 (75%) and those with vision less than 3/60 were 2679 (25%). Depending on the groups made on the age basis patients less than 15 years were 4124 (38.07%), patients between the age 16 years and 40 years were 3162 (29.19%) and patient above 40 years were 3544 (32.72%). The grand total number patient who had visual improvement with low vision devices and continued the usage of low vision device were 31.20% (3238).

In age less than 15 years electronic device were most commonly accepted devices which is about 50%. Whereas in age between 16-40 years most common device accepted was hand and stand magnifiers which was about 41%. Whereas those above 40 years were accepting spectacles as low vision device.

Acceptance of spectacles was high in the age group above 40 years which was about 45% and those below it had acceptance of 31% in the age group less than 15 years and between 16-40 years. In case of hand and stand magnifiers, age group between 16-40 years were the one most common accepting the low vision device which was about 41% whereas in age group less than 15 years it was about 32% and about 22% in age group above 40 years.

Telescope were also accepted by some patients and most commonly in the age group less than 15 years and in the age group between 16-40 years 29% and those above 40 years had 20%. Other devices like electronic devices were also accepted by some population and most commonly were less than 15 years which was about 50% and 29% in 16-40 years age group and above 40 years were accepting only 17%. Non-optical device were least of all accepted but
was more accepted in 40% followed by 25% in less than 15 years and 22% in patients above 40 years.

Macular degeneration had acceptance rate of 50% in spectacles followed by hand and stand magnifiers 44%, telescope around 41%, electronic device were 20% and 8.33% of non-optical device. In other retinal disease spectacles were accepted for 38% followed by 31 % of hand and stand magnifiers, telescope (25%),non-optical device(20%) and electronic device (12%)

In cases of temporal pallor and optic atrophy acceptance rate of spectacle (45.16%), hand and stand magnifiers (41.53%), telescope (22.22%), electronic device (9.09%), non-optical device (20%). Cases of retinitis pigmentosa acceptance rate of spectacle (47.19%), hand and stand magnifiers (34.61%), telescope (100%), electronic device (38.88%), non-optical device (5.26%). In congenital optic nerve pathology acceptance rate hand and stand magnifiers (8%), electronic device (60%) were the only devices which were accepted in our clinic. In high myope acceptance rate of hand and stand magnifiers (55.12%) were highly demanding among the these patient, telescope (9.09%), non-optical device (3.33%) and spectacle (7.14%). In glaucoma acceptance rate of spectacle (40%), hand and stand magnifiers (35.08%), telescope (60%), electronic device (25%), non-optical device (33.33%). In albinism patients are more comfortable with spectacles as acceptance rate of spectacle (50%), hand and stand magnifiers (46.66%),telescope (20%), electronic device (0%), non-optical device (0%). In congenital nystagmus acceptance rate of spectacle (40.65%), hand and stand magnifiers (30.49%), telescope(42.42%), electronic device (35.29%), non-optical device (33.33%).

DISCUSSION

Defective vision is the most common reason to seek eye care in addition to other general ocular symptoms. Patients were referred to the low vision clinic from various out patient department in our hospital and also referred from outside by ophthalmologist after excluding treatable conditions and refracted. Patients were assessed by low vision staff in our hospital. The low vision therapists are qualified orthoptists who have undergone 3 months of additional specialised training in low vision rehabilitation. In addition to prescribing and supplying various LVAs, the low vision therapist (i) carries out a functional assessment of the patient’s visual needs, (ii) gives counselling on the nature and consequences of the particular visual impairment, (iii) gives advice and, where necessary, training in the use of LVAs including eccentric fixation techniques, steady eye strategies and focusing, tracking, and scanning skills, (iv) gives information and advice about lighting, and non-optical LVAs; and finally, (v) when appropriate, the therapist also contacts social services and other agencies, on the patient’s behalf. During the assessment, patients
are encouraged to try various types of aids, and the most appropriate device is dispensed to the patient. Follow up appointments as deemed necessary by the therapist or at the request of the patient are advised. For the purpose of comparison with other low vision device each patient’s age, diagnosis, visual acuity assessment and the devices showing improvement were assessed. On follow up patients were surveyed to analyse their ongoing satisfaction and LVA acceptance rate. In addition, wherever possible, patients were objectively reassessed in the low vision clinic where visual acuity. If visual acuity had fallen by two Snellen’s lines or more, patients were reviewed by an ophthalmologist.

From our study we conclude that low vision clinic is responsible for rehabilitating one third of the low vision population nearly 32% being referred to any low vision clinic. Most attenders at low vision clinics tend to be elderly and frail likely to request and benefit most from simple low vision aids for near vision tasks and nearly about 75% presenting to our clinic of the above type. Since most of the patients are referred at earlier age due to realisation of poor vision by the patient or their relatives the most common age group presented to our opd was below 15 years. Depending on the age, acceptance of various low vision aids were very significant. As elderly people are more in comfort for reading with spectacles than using any other heavy type of low vision device which reduces the mobility and efficiency of devices use. The study showed that the acceptance rate of spectacles was more common in age patients with above 40 years of age (45%) were as it was nearly 31% in the other two type of age group. Children often favour the use of single vision spectacle magnifiers, because they do not mind the close working distances needed and have short and flexible limbs and they can provide a large field of view and relax eye strain.

Advantage of the single-vision spectacle magnifier is that it is hands-free. Its greatest disadvantage, however, is that it involves a relatively short viewing distance, which usually causes head and neck fatigue after prolonged use. Whereas the acceptance was more of hand and stand magnifiers in the age group 16 -40 years which is 41% ,This is more likely because the use of hand-held magnifiers requires steady hands and good eye-hand co-ordination, especially for high power lenses. This limits the usefulness of low vision device in very young age group.

The patients belonging to middle age group like between 16 to 40 years are most likely to be considered as appropriate age group and they fall in the age group which is more involved in reading. They are at more comfort at handling things in hand and working with them in daily activities. The greater the distance between the magnifier and the object or text (provided it is less than one focal length), the higher the magnification will be. Decreasing the distance between the eye and the magnifier also increases the magnification
power. Hence, patient can choose the most suitable and comfortable viewing distance for each of their activities, depending on the size of the object or the text. In addition, the availability of strong magnification powers and built-in illumination also make hand-held magnifiers a good choice, especially for those who need above-average illumination, such those with retinitis pigmentosa and maculopathy.

Telescopes were highly accepted in the age group less than 15 years roughly around 39% as compared to other age group between 16 to 40 years and those above 40 years showed 28 % and 20% respectively. As many children with low vision like to use telescope, an optical low vision device that can conveniently bring the image of a distant object many times closer. The telescope offers advantages to children in many daily activities, such as reading what is written on the blackboard and reading street signs and bus numbers. A 4x telescope can make something that is 20 m away visible at 5 m, and an 8x telescope can shorten the distance to 2.5 m.

Children require intensive training to learn the focus control and target searching techniques they need to use the telescope well. The acceptance rate of 50% in age less than 15 years as compared to 21% and 16% in age group between 16 – 40 years and above 40 year. The use of non-optical devices can compensate for some of the disadvantages of optical low vision devices. For example, tables with adjustable tilt help to improve poor posture caused by short viewing distances and the bending of body and neck over the table. The use of a table lamp with a ‘gooseneck’ to control the direction of the light can be helpful for those children who need above-average illumination. On the other hand, children with media opacities such as corneal scarring are sensitive to glare; special absorptive filters, preferably with side shields, are useful for filtering scattered and glare-producing light. Non-optical devices are reasonably easy to obtain; they can often be bought in stationers’, furniture shops, or optical shops. In addition, parents, teachers, or clinicians can make simple devices to assist children with writing or drawing: they can cut black cardboard into frames or ‘windows’ to create reading slits or writing and drawing guides; they can also draw bold black lines on white paper, which make for easier writing.

The acceptance of non-optical device is higher in age between 16-40 year about 40% whereas in age group less than 15 years is 25% and about 22% in above 40 years. Electronic low vision devices provide the largest field of view, the most comfortable viewing distances, and the highest magnification which are more comfortable for younger age group patients which is evident However, they are also the most expensive type of low vision device. The most commonly used electronic low vision device is closed-circuit television(CCTV). It offers brightness and contrast enhancement controls and is a good choice for
children with severe visual impairment. However, because CCTV systems are so big and heavy, they are usually fixed in one place, such as a library. Portable electronic low vision devices are also available, although they are very expensive. They consist of a digital camera which captures images and enlarges them to the desired magnification.

Low vision clinic stand an immenent place in any tertiary eye centre. As it provides vision to those set of population who can be not improved by either medical or surgical means. Spectacles are the low vision device mostly accepted in all age group and in various etiologies. The cost of low vision device should also be taken into consideration as low vision devices are helpfull for one third of patients being referred to low vision clinic.

REFERENCES

Vision Enhancement Devices and Techniques For Cone Dystrophy and Cone-Rod Dystrophy

Dr. Meenakshi Gopalakrishnan, Dr. Srikanth R., Dr. Aarthy G.

Cone and Cone-Rod dystrophy are hereditary retinal diseases that belong to the group of pigmentary retinopathies that cause progressive visual loss and may also result in profound visual impairment. They are characterized by primarily loss of cone function. Low vision devices and vision enhancement techniques are important interventions in the management of these patients.

To study the use of low vision care devices and vision enhancement techniques in patients with cone-rod and cone dystrophy.

MATERIALS AND METHODS

Patients were included from the Low Vision (LVC) Clinic from May 2010 to March 2011 with the diagnosis of Cone or Cone-Rod dystrophy based on an ERG. Data collected included age, sex, presenting symptoms, family history, consanguinity, systemic findings, previous treatment given, distance and near visual acuity and refraction, anterior and posterior segment examination, presence of nystagmus and strabismus, visual fields, FFA and ERG. Data from the LVC clinic included detailed recording of difficulty in activities of daily living, distance and near reading, writing, using computers, with mobility and brightness. Also recorded was use of prior LVA, occupation of the patient, binocular acuity for distance and near as well as for each eye using the LogMar chart. Data regarding refraction, contrast sensitivity, color vision, Amsler’s chart were noted.

Preference of Low vision devices for distance and near and the best corrected acuity that was achieved was noted. Reading speed was graded as Good, Medium and Poor. Use of non optical devices, tints, computer and mobile softwares as applicable, preference for contrast, color, ADL and mobility enhancing devices was noted. Data was analyzed using SPSS 15 and MS Excel.

RESULTS

38 subjects were included of which 26 (68.42%) were males and 12 (31.57%) were females. Mean age was 21.2 years (range 5 to 68 years). All 38 subjects presented with decreased vision. Photophobia was present in 65.8%. Shaking of eye balls and poor color vision were present in 2 patients each. History of consanguinity was elicited in 5 patients (13.15%). None of the patients had any anterior segment abnormality. Fundus examination findings are shown in Table 1.

Humphrey visual field analysis was done for 8 patients and it showed defects
ranging from central scotoma to constricted visual field, which was the commonest finding in 4 patients. All the 38 participants underwent ERG to confirm the diagnosis of cone dystrophy in 21 patients (55.26%) or cone rod dystrophy in 17 (44.73%). Use of prior Low visual aids could be elicited in 17 subjects (44.74%). The occupation of the subjects was as shown in Table 2. Nineteen patients complained of difficulty viewing the blackboard; 5 of difficulty watching television, 4 with recognizing faces, two patients each with bus numbers and climbing stairs. As for near vision, 11 patients had difficulty with school or college books, while 5 with reading newspapers. Eight patients other than students complained of difficulty reading printed books, ten with using computers, seven patients with mobility. Twenty seven of 38 subjects had difficulty with brightness (71.05%).

### Table 1

<table>
<thead>
<tr>
<th>Fundus findings</th>
<th>%</th>
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<tbody>
<tr>
<td>Bull’s eye maculopathy</td>
<td>21.04%</td>
</tr>
<tr>
<td>Diffuse atrophy of the posterior pole with spotty macular pigment clumping</td>
<td>21.05%</td>
</tr>
<tr>
<td>Temporal disc pallor</td>
<td>23.68%</td>
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<tr>
<td>Retinal vascular attenuation</td>
<td>10.53%</td>
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<tr>
<td>Lattice degeneration</td>
<td>7.89%</td>
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### Table 2

<table>
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<tr>
<th>Occupation</th>
<th>N=38</th>
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<td>Students</td>
<td>25</td>
</tr>
<tr>
<td>Software engineer</td>
<td>3</td>
</tr>
<tr>
<td>Shopkeeper</td>
<td>3</td>
</tr>
<tr>
<td>Accountant</td>
<td>2</td>
</tr>
<tr>
<td>Retired employee</td>
<td>1</td>
</tr>
<tr>
<td>Housewife</td>
<td>1</td>
</tr>
<tr>
<td>Farmer</td>
<td>1</td>
</tr>
</tbody>
</table>

Visual Acuity for distance ranged from 1.69897 logMar to -0.47712 logMar and near acuity ranged from 1.35 logMar to -0.6 logMar. 37 of the 38 subjects qualified for the revised definition of low vision per WHO criteria of less than 6/18 in the better eye. Refractive error was found in the subjects as shown in Table 3. Of the 38 total subjects 34 were wearing refractive correction at presentation. After low visual assessment 12 patients preferred their own glasses (31.58%) while 6 patients (15.79%) preferred new glasses. 18 subjects preferred the improved visual acuity with telescopes ranging from 2X to 8X 18 patients (47.36%) showed more than two lines improvement with optical devices for
distance, while there was less than two lines improvement in 8 patients (21.05%) and 12 (31.57%) patients did not experience any improvement. Near LVA preference was as shown in Table 4:

Table 3

<table>
<thead>
<tr>
<th>Refractive error</th>
<th>i. N</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii. Myopia</td>
<td>3 (7.89%)</td>
</tr>
<tr>
<td>iv. Hypermetropia</td>
<td>4 (10.53%)</td>
</tr>
<tr>
<td>vi. Myopic astigmatism</td>
<td>18 (47.37%)</td>
</tr>
<tr>
<td>viii. Hypermetropic astigmatism</td>
<td>10 (26.32%)</td>
</tr>
<tr>
<td>x. Plano</td>
<td>3 (7.90%)</td>
</tr>
</tbody>
</table>

Table 4

<table>
<thead>
<tr>
<th>Modality</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>New glasses</td>
<td>6</td>
</tr>
<tr>
<td>Own glasses</td>
<td>3</td>
</tr>
<tr>
<td>Plano</td>
<td>3</td>
</tr>
<tr>
<td>Dome magnifier (3.5X)</td>
<td>17</td>
</tr>
<tr>
<td>CCTV</td>
<td>2</td>
</tr>
<tr>
<td>Hand held magnifier (2.5X)</td>
<td>2</td>
</tr>
<tr>
<td>Stand Magnifier (6X)</td>
<td>1</td>
</tr>
</tbody>
</table>

Reading speed was recorded for 18 subjects and was found to be good for 16 and moderate in 2. Visual acuity of N10 or better was achieved with near LVA in 31 subjects (81.58%) Computer settings were modified for 29% of the patients. 57.8% of patients benefitted from contrast enhancing measures while 36.8% improved with color enhancing measures. 4 patients preferred the modifications done to improve their activities of daily living. 11 subjects felt improvement with task illumination. Tints such as ET 28, ET 38, ET 15, ET 40 and clip on filters were preferred by 18 patients.

DISCUSSION

The low vision issues needing to be addressed in cone dystrophy patients include reduced distance acuity, some reduction in near acuity, reduction in color perception, photophobia in many and reduced field of vision in some. Temel et al. in their study of 185 low vision patients found a success rate of 77% with LVA. In our study distance vision improved in 68% of patients with optical devices which ranged from change in glasses to use of telescopes. Temel studied patients with various diagnoses and the number of patients with retinal dystrophy was very small. In another study done by Pal et al. in North India, 35% of the children attending a blind school showed improvement in visual acuity of the better eye with spectacles alone. Gothwal
et al. studied 219 pediatric low vision population in a private eye hospital in India and found that carefully determined distance spectacle prescription was the most common LVA (39%). Our study showed improvement in visual acuity of the better eye with spectacles in 47.37% of the subjects. Four patients in the study by Gothwal et al. were dispensed magnifiers as compared to 22 in our study. This difference may be due to the older age of our subjects. 30 children (22.6%) improved to N10 with spectacle magnifiers in study done by Pal et al. 36.8% patients preferred wearing tints for outdoor activities in our study as compared to 4% in the study by Gothwal et al. 57.8% of patients benefitted from contrast enhancing measures in our study whereas 6% of the patients improved with contrast enhancement in the study of Gothwal et al. These differences were because of inclusion of patients with various eye diseases in their study.

REFERENCES


Spectacle Correction and Optical Devices in Visually Challenged Patients

Dr. Virender Sachdeva, Dr. Vaibhev Mittal, Dr. Merle Fernandes, Dr. Avinash Pathengay

According to WHO (1993), a person with low vision is defined as one who has impairment of visual functioning even after treatment and/or standard refractive correction, and has a VA of less than 6/18 (20/60) to light perception or a visual field of less than 10 degree from the point of fixation, but who uses, or is potentially able to use vision for the planning and/or execution of a task.

Depending upon their patterns vision loss can be sub classified into following three types:

- Overall vision loss (overall blur): Diminished ability to perceive sharpness of detail. Person faces difficulty in performing his/her daily living activity (DLA).
• Central vision loss: Total or partial loss of the central field of vision. This makes it difficult for him/her to read and recognize faces.

• Peripheral vision loss: Total or partial loss of peripheral field of vision. Such patients tend to have a central island of vision so that they may not have a difficulty in recognizing objects straight ahead but may have a difficulty in recognizing things in their peripheral field.

A large number of the patients with end stage ocular diseases such as corneal scars, anterior segment dysgenesis and incurable advanced retinal degeneration, glaucoma and neuro-ophthalmological disorders suffer from a permanent impairment of visual acuity or visual fields. Such patients may not have a definite cure but may benefit from use of various Low vision Aids comprising of various magnifying devices and/or non-optical devices.

Possible ways to improve functional vision in such patients are:

• Appropriate refractive correction
• Low Vision Devices (LVDs): optical and non optical
• General measures like lifestyle management, counseling, etc.

In a recent retrospective study by Sunness et al. they studied in 799 low vision patients to determine how frequently and to what extent visual acuity is improved by refraction. They concluded that a significant improvement in visual acuity was attained by refraction in 11% of the new Low-vision patients. In their study, improvement was seen across diagnoses and the range of presenting visual acuity.

However, according to their study a large majority of the patients could not be improved with refraction alone, thereby emphasizing the importance of the Low vision devices.

In a study by Shah M et al. they reported that patients with Stargardt’s disease responded well to magnification. They suggested while simple bifocal glasses may be used in the early stages, patients with an advanced disease require various magnifying devices which may help achieve further improvement.

In a study by Fröhlich et al. they studied the improvement in BCVA patients with Age-related macular degeneration (AMD) and with Diabetic retinopathy (DR). They concluded that with optical aids 94% of Diabetics and 85.2% of patients with AMD improved reading ability. Electronic aids were required in 6% of diabetics and 14.8 % AMD patients. This was attributed to the effect of the negative scotomas seen in patients with AMD.

In another study, Bier et al. studied the spectrum of appropriate magnifying devices for various hereditary retinal dystrophies. They found that the most prescribed optic magnifying aids were distance spectacles and magnifying
glasses (each 20 %), monocular telescopes, contrast enhancing filters (each 13 %) and reading glasses (8 %). Electronic magnifying aids were prescribed in only 8 %.

So, with this background we decided to study the impact of combined optical correction, low vision devices in the improvement in BCVA and visual disabilities of the patient according to the particular disease.

Objectives:

1) To determine how much improvement in Visual acuity can be achieved with the Low vision Devices in patients with various ocular diseases.

2) To determine which kind of the Low vision devices are best suited for a given ocular disease.

Study Design: Prospective, interventional, case-series.

Study Location: Bob Ohlson Centre for Sight Enhancement, LV Prasad Eye Institute, GMR Varalakshmi Campus, Visakhapatnam, India

MATERIALS AND METHODS

We selected for our study the patients referred to our centre for sight enhancement between Jan 2009 and December 2010. We included patients with age 6 years-65 yrs; BCVA of less than 6/12 or 20/40 to 3/60; and < N10 in the better eye; patients able to co-operate with various clinical testing, and patients/ their parents willing to give informed consent. We excluded patients with BCVA < 3/60; Patients with Visual fields affecting the central 50; patients who did not undergo a complete Low vision evaluation and illiterate patients or those who did not require LVDs for reading or near work. All patients underwent a complete ophthalmic evaluation and a detailed CSE evaluation concentrating on visual disabilities; difficulty with various tasks, appropriate refractive correction; High contrast and low contrast visual acuity with and without LVDs; improvement in visual acuity perceived with spectacle correction and LVDs.

RESULTS

During this period we examined 134 patients who met the inclusion and exclusion criteria. Mean age of the patients was 31.52 years. There were 92 males and 42 females. Amongst all causes, retinal disease was the most common cause (42.9%) followed by optic neuropathy (20.4%); glaucoma (12.7%); oculocutaneous albinism (11.3%), corneal disease (3.52%) and others (9.2%).

Improvement in BCVA for distance ≥ 2 Log MAR lines was seen with Glasses in about 10.86% of patients across all diagnosis. Improvement in BCVA ≥ 2 Log MAR lines was most commonly seen in patients with Glaucoma (51%
followed by optic nerve diseases (33.33%) of patients, retinal disease in 9% of the patients. None of the patients with foveal hypoplasia showed an improvement in BCVA more than 2 lines.

On the contrary, an improvement in BCVA for distance ≥ 2 Log MAR lines was seen with telescopes in 52.46% of patients. Improvement in BCVA was more than ≥ 2 Log MAR lines in 100% of patients with Oculocutaneous albinism and foveal hypoplasia; 88% of patients in optic neuropathies and glaucoma and 82.3% of patients with retinal disease.

Mean pre-treatment BCVA was 0.92 ± 0.42 Log MAR and 0.94 ± 0.44 Log MAR lines for right and left eye. Mean post-treatment BCVA was 0.90 ± 0.42 Log MAR with spectacle correction and 0.52 ± 0.39 Log MAR lines for all patients with distance telescopes. This was statistically significant (p-value < 0.001, CI: 0.31 to 0.51). Mean post-treatment BCVA was 0.37 ± 0.32 Log MAR lines; 0.49 ± 0.37 Log MAR lines; 0.54 ± 0.41 Log MAR lines for the patients with glaucoma, optic nerve diseases, retinal disease respectively.

Improvement in Near vision > 2 lines with bifocals alone was seen in 50% of patients with optic nerve disease and 33.32% of patients with glaucoma. Remaining patients did not show a clinically significant improvement of more than 2 lines across various diagnosis.

Improvement in Near vision > 2 lines with Low vision devices was seen in 80.48% of the patients with retinal disease, 64.5% of patients with optic nerve diseases, 66% of patients with corneal disease, 57.06% of patients with glaucoma and 50% of patients each with Oculocutaneous albinism and others.

Most preferred LVDs for near work were stand/ hand-held/dome magnifier followed by camera mouse and spectacle magnifiers. Pocket magnifiers were the least preferred across all diagnosis.

**DISCUSSION**

As reported in the previous studies, we found that both distance spectacle correction and near glasses led to improvement in BCVA in only about 10.8% of patients. These were most useful for the patients with Glaucoma and least useful for patients with foveal hypoplasia and retinal diseases affecting the macular area.

However, distance telescopes and the near vision stand magnifiers led to improvement in near BCVA in patients across all diagnosis. Patients with macular diseases and foveal hypoplasia, who, did not show any improvement in the BCVA with spectacle correction alone had a significant improvement in the BCVA > 2 lines. Optic neuropathy patients showed improvement in only 33% of patients with spectacle correction but in about 88% of patient with telescopes suggesting greater optical magnification may be required to
overcome the effect of scotomas produced by optic neuropathies.

In conclusion Patients with different etiologies may respond to different kind of LVDs. Spectacle correction alone may be useful in patients with a preserved central visual function while Telescopes and Stand magnifiers shall be particularly useful for patient with foveal and optic nerve lesions that cause central visual function.

REFERENCES