Original Article

Patient satisfaction and acceptance of spherical equivalent spectacles correction wear in rural India

B Sandeep Reddy, Taraprasad Das, Ghansyam S Mirdha, Nagavardhan Reddy

Purpose: The aim of this study was to explore the possibilities of acceptance of a ready-to-dispense spherical equivalent (SE) of spherocylindrical (SC) correction spectacles in rural India. **Methods:** Snellen visual acuity with SE power of refracted SC lenses was prospectively collected from all individuals visiting vision centers in Phase 1 (vision correction accuracy) of the study conducted in two South Indian districts. The satisfaction level was recorded by asking one standard question. The SE spectacles were dispensed in vision centers of one district in Phase 2 (SE acceptance) with a suggestion to return, if unsatisfied, for free exchange of spectacles within a month of dispensing. **Results:** In Phase 1, 929 of 3529 patients were refracted and it was found that 320 patients and one eye of one patient (641 eyes) had astigmatism. The average age was 41 (±16; range: 7–84) years. There was no reduction of visual acuity in SE of 0.25 Dcyl (100% satisfaction) and progressive decrease in satisfaction to 43%, 26%, and 19% with SE correction of 0.50, 0.75, and 1.00 Dcyl, respectively. In Phase 2, 988 of 6168 patients needed refraction and 240 had astigmatism. A total of 103 patients (206 eyes) accepted SE equivalent spectacles. No client returned for the free exchange of spectacles. **Conclusion:** Dispensing SE power up to 1 Dcyl in ready - made spectacles could be considered in remote rural populations in resource-poor economic conditions.

Access this article online

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_819_16

Quick Response Code:

Key words: India, rural, spherical equivalent

The Global Burden of Disease reported that 32.4 million blind people and 191 million moderate to severe visually impaired (MSVI) people lived in the world in 2010.[1] Uncorrected refractive error (URE) was the first cause of MSVI and the second cause of blindness. It has been estimated that the global productivity loss in 2007 (when the MSVI was at 158.1 million) was USD 427.7 billion.[2] In Southeast Asia, the URE was 42.8% cause of MSVI and 13% cause of blindness. The URE and blindness were comparatively higher in India compared to other surrounding South Asian countries such as Bangladesh, Bhutan, and Nepal.[3] The URE accounted for 45.8% of moderate visual loss in the population-based Andhra Pradesh Eye Disease Study in South India.[4] A pair of spectacles is the most frequent, the simplest, and the cheapest solution. Compliance with wearing spectacles in rural India increases when the delivery time is short.[5]

The first level fixed facility in the eye health pyramid is the vision center that caters to 50,000 people in rural areas. The skilled person, the vision technician, in this center is trained for refraction and comprehensive eye screening.[6] The vision centers are equipped to deliver only stock lenses. Inability to deliver the spectacles in less than a week's time has been a major challenge in these centers. This is due to multiple factors such as distance from the nearest town with edging and fitting facilities and limited transport/courier delivery options in rural India. In these situations, dispensing spherical equivalent (SE) spectacles is one of the solutions. Ready-made spectacles are available for both distance and near use in spherical powers only. We evaluated the possibility of vision correction (Phase 1) and the rate of acceptance (Phase 2) of SE spectacles over spherocylindrical (SC) correction spectacles.

Methods

Phase 1 of the study was done in 19 vision centers in two rural districts (Khammam and Krishna) in South India for 1 month. Following the general demographic data for registration (age, gender, and place of residence), all participants received undilated refraction as part of the routine care, in addition to recording of presenting vision (and with spectacles in those who were wearing spectacles) and slit lamp examination. Objective refraction was done using a streak retinoscope, followed by subjective refraction with trial frame and Snellen chart placed at 6-M distance. After arriving at the best-corrected SC power, the vision technician recorded the best spectacle-corrected visual acuity with the SC power and SE power in the trial frame. The SE of a SC was arrived at by adding half of cylindrical power to full spherical power (this addition was 0 when cylindrical correction was 0.25 D and it was 0.5 when the cylindrical correction was 0.75 D). The participant was not informed of the type of correction, "SC correction," or "SE correction," in the trial frame. Each participant was asked one standard question: "Are you happy with this glass?" with the SC and

Optical Division, L V Prasad Eye Institute, KAR Campus, Hyderabad, Telangana, India

Correspondence to: Dr. Taraprasad Das, L V Prasad Eye Institute, Road No. 2, Banjara Hills, Hyderabad - 500 034, Telangana, India. E-mail: tpd@lvpei.org

Manuscript received: 24.10.16; Revision accepted: 30.06.17

Cite this article as: Reddy BS, Das T, Mirdha GS, Reddy N. Patient satisfaction and acceptance of spherical equivalent spectacles correction wear in rural India. Indian J Ophthalmol 2017;65:729-32.

SE correction separately. The participant's response was noted as "comfortable" or "not comfortable" with SE correction. In Phase 1, the SE spectacles were not prescribed to participants; instead, customized SC spectacles were prescribed. Visual acuity recorded in Snellen was converted into logarithm of the minimum angle of resolution (logMAR) for statistical analysis. The authors were not involved in examination or medical treatment of the patients. The vision technicians were aware of the SE lenses in the trial frame though there was no change in the technique of subjective correction and administering the satisfaction questionnaire.

In Phase 2, the vision technicians prescribed the SE spectacles to patients who were comfortable with SE correction. These patients were different from the patients in Phase 1. All patients were explained the need for constant wear, and the some of the common side effects such as eyestrain and headache were discussed. Irrespective of SC or SE correction, all patients were assured of a free exchange should they experience any discomfort within the 1st month of spectacle wear. This was offered to all patients (both SC and SE) to remove any bias.

All tests were done after obtaining informed written consent, and the study adhered to the tenets of the Declaration of Helsinki. Refraction is part of routine eye examination. In this study, an auto refractometer was used in addition to refraction using a streak retinoscope. Similar to a streak retinoscope, autorefractor does not touch any part of the eye, does not emit any harmful rays of light. Because it is a part of routine care, it was not necessary to obtain a specific Institutional Review Board approval.

Results

In the first phase of the study, 3529 patients attended the vision centers. This included 929 (26.32%) patients (1858 eyes) that needed refraction. The mean age of the patients who received refraction was 41(±16; range: 7–84) years and included 398 females (43%). Spherical correction was needed in 1215 eyes (65.4%), and the remaining 643 eyes (34.6%) required SC correction. Patients with SE + 10.00–−10.00 D were considered for analysis and two eyes with SE more than ± 10.00 D were excluded from the study. In this phase, all patients were prescribed only customized SC spectacles. The mean best-corrected visual acuity logMAR (BCVA logMAR) with SC correction was 0.06 (Snellen equivalent 20/20p) (±0.12, range: 0.00–0.78), and mean BCVA logMAR with SE correction was 0.21 (Snellen equivalent 20/25p) (±0.16, range: 0.00–1.00); thus, there was a reduction of 0.15 logMAR (1 line 3 L) with SE correction. This reduction in vision was gradual, nil reduction in cylindrical error of 0.25 D and gradually increasing to >1 line with 1 Dcyl and >2 lines with more than 1 Dcyl. There was reduction of subjective satisfaction at par with reduction with vision [Table 1]. Reduction of vision was nearly similar with both simple and compound astigmatism [Table 2 and Fig. 1].

In Phase 2, the SE spectacles were dispensed to the willing patients as per their agreement after subjective correction. They were ignorant of the type of spectacles (SE or SC). In this phase, 6168 people attended the vision centers for a study period of 3 months. Spectacles were prescribed to 988 patients (16%). Of these patients, 24.3% (240 of 988) had simple and/or compound astigmatism and 103 of 240 (42.9%) patients (206 eyes) were comfortable with SE correction. A little over 50% had astigmatism of 0.50 Dcyl. The range of accepted SE was −3.75–+0.75 DSph [Table 3]. No client returned for exchange of spectacles. The median time for dispensing the SE spectacles was 6 days.

Discussion

Two kinds of spectacle lenses are available for dispensing: the stock lenses and custom-made lenses. Stock lens includes single vision lenses in the range of +2.00–−6.00 DSph and up to −2.00 Dcyl; the Kryptok bifocal lenses have a distance from 0 to +3 DSph and near addition up to +3 DSph. Spectacles with >2.00 Dcyl in single vision and any amount of cylindrical power for distance in bifocals are always custom-made. Stock lenses are always in spherical power where half of the cylindrical correction, if any, is added to the spherical power to create SE lens.

A vision center in the base of the Eye Health Pyramid is located in a village and serves a cluster of villages with

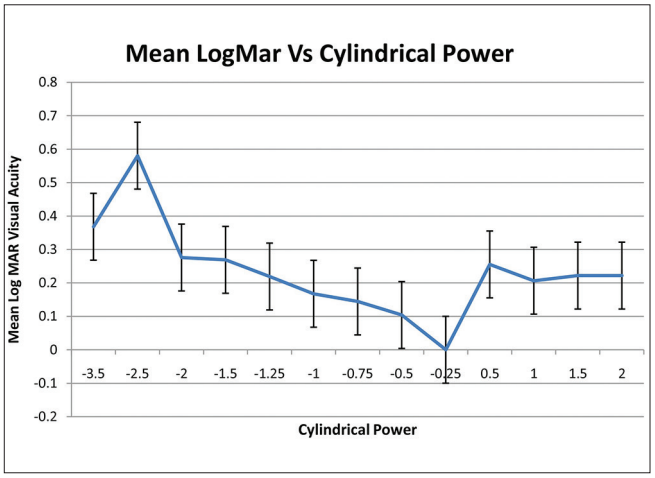

Figure 1: Reduction in mean logarithm of the minimum angle of resolution visual acuity in relation to cylindrical power. To the left of 0 is the minus cylindrical power and the right of 0 is the plus cylindrical power

Table 1: Vision and satisfaction level with spherical equivalent

Cylinder range (D)	Sample (*n*)	Average reduction in logMAR vision with SE	Average reduction of lines with SE	Response with SE correction
0.25	6	0	0	100% comfortable
0.50	299	0.1	1	43% comfortable, 56% not comfortable
0.75	81	0.14	>1	26% comfortable, 73% not comfortable
1.00	165	0.17	>1	19% comfortable, 81% not comfortable
>1.00	90	0.28	>2	100% not comfortable

SE: Spherical equivalent, logMAR: Logarithm of the minimum angle of resolution

Table 2: Change in visual acuity in types of astigmatism

Sample (*n*)	Cylindrical power	BCVA		SE VA		*P*	logMAR reduction in VA		Number of lines
		Mean	SD	Mean	SD		Mean	SD	
Simple astigmatism									
6	−0.25	0.00	0.00	0.00	0.00	-	0.00		0
125	−0.50	0.01	0.04	0.10	0.07	0.0001	0.09	0.06	<1
44	−0.75	0.03	0.09	0.19	0.10	0.0001	0.15	0.07	>1
55	−1.00	0.10	0.14	0.27	0.12	0.0001	0.18	0.09	>1
51	>−1.00	0.08	0.13	0.37	0.19	0.0001	0.29	0.18	>2
Compound astigmatism									
176	−0.50	0.05	0.12	0.16	0.13	0.0001	0.11	0.08	>1
37	−0.75	0.13	0.18	0.27	0.17	0.0016	0.13	0.09	>1
108	−1.00	0.09	0.13	0.25	0.15	0.0001	0.16	0.09	>1
39	>1.00	0.14	0.20	0.41	0.20	0.0001	0.27	0.07	>2

SD: Standard deviation, BCVA: Best corrected visual acuity, SE: Spherical equivalent, logMAR: Logarithm of the minimum angle of resolution

Table 3: Visual acuity level in spherical equivalent prescription in phase 2

Eyes (%)	Cylinder	BCVA logMAR		Average letter score reduction (Snrellen vision)
		SC	SE	
21 (10.3)	−0.25	0.00 (Snellen 6/6)	0.00	0 letters (6/6)
112 (53.9)	−0.50	0.00	0.06	3 letters (6/6 P)
52 (25.5)	−0.75	0.00	0.13	6 letters (6/9 P)
21 (10.3)	−1.00	0.00	0.18	7 letters (6/9 P)

BCVA: Best corrected visual acuity, SC: Spherocylinder, SE: Spherical equivalent, logMAR: Logarithm of the minimum angle of resolution

a population of 50,000. The urban facilities, including fast communication, are less than adequate in rural India. Hence, a pair of custom-made spectacles takes a much longer time, usually 10–14 days; it depends on a variety of factors that include the type of lens, the time for surfacing required power lens, edging, and fitting to the selected frame and finally shipping to the center. In comparison, a pair of stock lenses stored in a secondary eye center located 50–60 km away in a town usually takes less than a week, the time taken for shipping to the center. Storing the stock lenses in the center is an option, but the opportunity cost of storing a large stock, usually ten pairs to sell one, is high.

Some of the earlier studies done in India and other countries have shown good acceptance of ready-made spectacles. A study in New Delhi (adults with any degree of refractive error and astigmatism) reported 90% acceptance in their community outreach program.[7] A study in the rural USA (excluded anisometropia and cylinder >1 D) recorded visual acuity improvement by 4.2 lines in the better eye and 4.1 lines in the worse eye.[8] A study in China (school children) reported good acceptance of ready-made spectacles even though the corrected vision was better with custom-made spectacles.[9] A study of the Australian urban population showed reduction in refractive error morbidity with the off-the-shelf ready-made spectacles.[10] Finally, a study in Florida, USA showed an improvement of 3.9 lines with ready-made spectacles.[11] Our study showed that over 43% of eligible patients finally accepted the SE spectacles.

Conclusion

Considering that the compliance with spectacle use improves significantly when it is dispensed immediately in rural Indian adults,[5] that there is good compliance to wearing ready-made lenses in resource-poor locations[12] and that an investment of high-end machinery at the village level is not remunerative, dispensing SE ready-to-wear spectacles to the willing patients with <1 Dcyl is both scientific and cost-effective.

Financial support and sponsorship

This study was financially supported by Hyderabad Eye Research Foundation, Hyderabad.

Conflicts of interest

There are no conflicts of interest.

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