

## How often are spectacle lenses not dispensed as prescribed?

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Spectacles are routinely prescribed by the ophthalmologist and dispensed by the opticians. We investigated how frequently the spectacles are not dispensed as prescribed and whether the frequency of inaccurate spectacles would decrease if the patients, at the time of collecting spectacles, ask the optician to verify that the spectacles have been dispensed accurately. We found inaccurate spectacles in about one-third of our patients and incorrect spherocylinders more frequently with an error in the spherical element and cylinder axis. These inaccuracies decreased significantly when patients while collecting spectacles, asked the optician to verify the accuracy of the spectacles dispensed. It is suggested that while prescribing spectacles, the patients should be made aware of the possibility of dispensing errors. To decrease the frequency of incorrect spectacles, the patients while collecting spectacles, should ask the optician to check whether the spectacles have been dispensed accurately.

**Key words:** Spectacles, spectacle dispensing, spectacle dispensing errors

Spectacles are the most widely practiced modality for the correction of refractive errors. Accurate spectacles restore comfortable vision and enhance visual efficiency.<sup>[1]</sup> Spectacles are also often prescribed for treatment of amblyopia and strabismus in young children.<sup>[2]</sup> It is, therefore, important to know whether the spectacles the patient is wearing have been dispensed as prescribed. To our knowledge, there is no report on this subject. The tolerances for spectacle lenses are different for different parameters and different power ranges. These tolerances vary from country to country. In USA, the American National Standards Institute (ANSI) approved ophthalmic standards Z80 in 1964 and revised them from time to time.<sup>[3,4]</sup> The most recently revised ANSI Z80.1-2010<sup>[5]</sup> approved the tolerances for spherical lens powers to  $\pm 0.13$  diopters (D) for powers below  $\pm 6.50$  D and  $\pm 2\%$  for powers above  $\pm 6.50$  D, the tolerances for cylindrical lens powers to  $\pm 0.13$  D for powers  $\leq 2.00$  D,  $\pm 0.15$  D for powers  $> 2.00$  to  $\leq 4.50$  D and  $\pm 4\%$  for powers  $> 4.50$  D, and the tolerances for cylinder

axis to  $\pm 14^\circ$  for powers  $\leq 0.25$  D,  $\pm 7^\circ$  for powers  $> 0.25$  D to  $\leq 0.50$  D,  $\pm 5^\circ$  for powers  $> 0.50$  D to  $\leq 0.75$  D,  $\pm 3^\circ$  for powers  $> 0.75$  D to  $\leq 1.50$  D and  $\pm 2^\circ$  for powers  $> 1.50$  D. In UK, the most recent Europe-approved international standard BS EN ISO 21987: 2009<sup>[6]</sup> has recommended spectacle lens tolerances which are different from those in the ANSI Z80.1-2010. To the best of our knowledge, there are no spectacle lens tolerances in India.

The objectives of this study were to determine (1) how frequently the spectacle lenses are not dispensed as prescribed; (2) which type of spectacle lenses (spherical or spherocylindrical) are more often dispensed inaccurately; (3) in which element (power, axis or both power and axis) of lenses the error is commonly committed; and (4) whether asking the optician to verify that the spectacle lenses have been dispensed as prescribed would decrease the frequency of inaccurate spectacles.

### Materials and Methods

This prospective study, approved by our institutional review board, comprised of 200 patients who were prescribed spectacles at the Squint Centre, Chandigarh, India. Using random numbers, patients were distributed into Group 1 and Group 2 consisting of 100 patients in each. Group 1 patients or their parents were not instructed regarding verification of the spectacles dispensed, whereas Group 2 patients or their parents were instructed that while collecting spectacles, they ask the optician to verify whether the spectacles have been dispensed as prescribed. They were not instructed to observe the verification process. There were no internet dispensings. Group 2 patients or their parents were enquired at next visit whether they actually asked the optician to verify the spectacles. Spectacle prescriptions written were compared with prescription dispensed measured at next visit in both groups. The spectacles were neutralized on lensometer (Vision Instruments, Ambala, India) by one author (KM). We did not look for any unwanted prism. Differences of  $\pm 0.50$  D sphere or cylinder and  $> 5$  degree in cylinder axis were considered inaccurate. We chose these tolerances arbitrarily because we did not find any Indian Standards for spectacle lens tolerances. Our decision to use large tolerances will underestimate the dispensing error rate compared to the ANSI standards. We considered that an error of  $\geq 0.50$  D sphere or cylinder and  $> 5$  degree in cylinder axis would practically be significant enough to affect visual acuity and comfort. However, Miller *et al.*<sup>[7]</sup> and Atchison *et al.*<sup>[8]</sup> have shown that even small focal errors can create problems. The differences between the prescriptions written and actually dispensed in the two groups were analyzed using 'z' test for proportions. A *p* value less than 0.05 was considered statistically significant.

### Results

All 200 patients returned to have their spectacles neutralized at next visit. The mean age of the patients was  $8.49 \pm 4.89$  years (range, 1-26) in Group 1 and  $6.16 \pm 3.12$  years (range, 1-18) in Group 2.

According to our criteria, 32 of 100 (32%) patients in Group 1 and 15 of 100 (15%) patients in Group 2 had inaccurate spectacles, and this difference was statistically significant ( $z = 2.89$ ;  $P = 0.004$ ). Three (3%) patients each in Groups 1 and 2 had the right and left lenses reversed. In the remaining patients [Table 1], in Group 1, the number of inaccurately dispensed spherocylindrical lenses was significantly more compared to

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**Table 1: Inaccurate dispensing in relation with type of lens in groups 1 and 2**

Type of lens	Group 1		Group 2	
	No. of lenses prescribed	Inaccurate dispensing (%)	No. of lenses prescribed	Inaccurate dispensing (%)
Spherical	25	1 (4)	28	1 (4)
Spherocylindrical	169	38 (22)	166	15 (9)

**Table 2: Inaccuracies in spherocylinder lenses in groups 1 and 2**

	No. of lenses prescribed	Inaccurate dispensing*			
		Sphere (%)	Cylinder		
			Power (%)	Axis (%)	Both (%)
Group 1	169	12 (7)	6 (4)	24 (14)	2 (1)
Group 2	166	4 (2)	2 (1)	7 (4)	4 (2)

\*Six lenses in Group 1 and 2 lenses in Group 2 had inaccurate both spherical and cylindrical elements of spherocylinder.

that of spherical lenses ( $z = -3.65$ ;  $P = 0.0001$ ). In Group 2, there was no significant difference in the number of inaccurately dispensed spherical versus spherocylindrical lenses ( $z = -1.32$ ;  $P = 0.19$ ).

There was no statistically significant difference in the number of inaccurately dispensed spherical lenses between Groups 1 and 2 ( $z = 0.08$ ;  $P = 0.94$ ). Inaccuracies in spherocylinder lenses were seen in a significantly higher number of lenses in Group 1 than in Group 2 ( $z = 3.34$ ;  $P = 0.001$ ).

The number of spherocylindrical lenses with inaccurate spherical element was significantly higher in Group 1 than that in Group 2 ( $Z = 2.03$ ;  $P = 0.04$ , Table 2). An error in cylinder axis of spherocylinder lenses was found in a significantly higher number of lenses in Group 1 than in Group 2 ( $z = 3.22$ ;  $P = 0.001$ ). There was no statistically significant difference in the number of spherocylinder lenses with an inaccurate cylinder power, and both power and axis between Groups 1 and 2 ( $z = 1.42$ ;  $P = 0.16$  and  $z = -0.84$ ;  $P = 0.40$ , respectively).

## Discussion

Unless a patient complains of non-tolerance to spectacles, the ophthalmologists presume that the spectacles the patient is wearing have been dispensed as prescribed. Also the patients while collecting spectacles from the optician often believe that the spectacles have been dispensed accurately and do not ask for verification. About one-third of our patients, who did not ask the optician to verify the dispensed spectacles, had inaccurate spectacles. They had more frequently an incorrect spherocylinder lens than the spherical and an error in the spherical element and cylindrical axis of the spherocylinders. The frequencies of inaccurate spectacles, incorrect spherocylinder lenses and an error in spherical element and cylinder axis of the spherocylinders decreased significantly in the patients who had asked the optician to verify whether their spectacles have been dispensed accurately. We assume that the opticians rectified the dispensing errors found in some spectacles on rechecking, and this resulted in a significant decrease in the frequencies of incorrect spectacles and dispensing errors in spherocylinder lenses.

After a dispensing optician has already dealt with any dispensing problems, two to three percent of the patients present with non-tolerance to spectacles.<sup>[9-11]</sup> Dispensing related problems account for it in about 25% of these patients.<sup>[9,11]</sup> The older children and adults can state their non-tolerance to spectacles but young children are often unable to express that their spectacles are inaccurate. As spectacles are often prescribed as a part of treatment for amblyopia in young children, incorrect spectacles may cause permanent visual loss. It is, therefore, important that in children, we should measure the spectacles shortly after dispensing to avoid the development of amblyopia due to inaccurate spectacles.

In India, majority of the opticians do not have personnel certified in spectacle dispensing. Most of the personnel employed for this job have learnt spectacle dispensing just from their seniors most of whom also do not have any certified training. There is a dire need for training and regulation of opticians' practice in spectacle dispensing.

A limitation of this study is that prisms was not considered in the dispensing tolerances. This can be especially significant in young children who have binocular vision problems.

We suggest that while prescribing spectacles to patients, they should be told about the possibility of inaccurate spectacle dispensing, especially if the prescription is for spherocylinder lenses. They should also be advised that while collecting spectacles, they should ask the optician to verify whether the spectacle lenses have been dispensed as prescribed. This would decrease the frequency of incorrect spectacles in India.

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