MYOPIA CONTROL

Axial Length changes with **Simple Defocus Spectacles** (SDS)

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Table 1. **Lenstar Axial Lengths at Baseline, Monofocal and Defocus Lenses**

	MONOFOCAL LENS		DEFOCUS
	20 min.	60 min.	100 min.
Mean Axial Length (mm)	24.317	24.325	24.314
Standart Devlation (mm)	0.637	0.641	0.641

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Table 2. **Effect of Monofocal and Defocus Spectacles on Axial Length**

	MONOFOCAL	DEFOCUS
Mean change in Axial Length (microns)	+8.1	-10.6
Paired T-Student test	p<0.05	p<0.01

PURPOSE

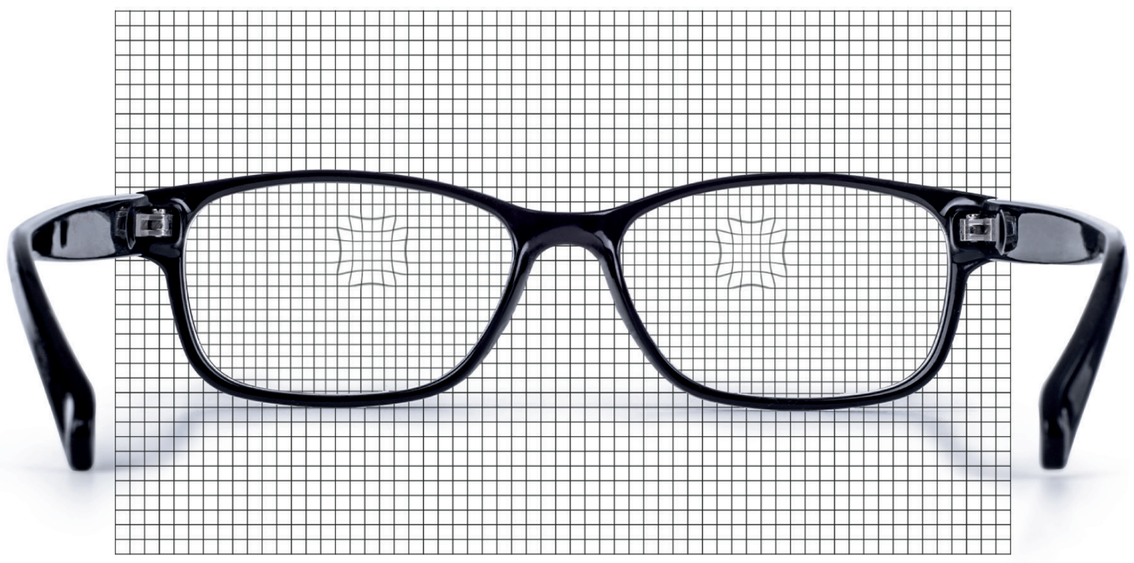
The present study tested axial length changes with Lenstar LS 900 Optical Biometer under the use of a simple peripheral plus add spectacle design (Novar Defocus Prototype) that also can be carved in any conventional or digital optical laboratory. We also tested eye and head movements, tolerance, and visual fields under the use of this spectacle design.

METHODS

Subjects for this study were current users of monofocal glasses aged 15-25 years, with myopic spherical equivalent in the range of -1.00 to -5.00 diopters in both eyes and astigma-tism less than -1.00 diopters in both eyes. They gave verbal consent to participate in the study using a pair of special myopia control spectacles that were free provided for an experiment that lasted approximately two hours. The study was conducted in accordance with the tenets of the Declaration of Helsinki. The Ethics Committee of the Argentinian Council of Ophthalmo-logy approved this study. All myopic subjects had normal ocular exams except for their myopia. After choosing the frame for his glasses, the centering of them was done with a special di-gital centering device (IPD, Novar, Buenos Aires, Argentina)(Fig1). Once the spectacles were ready, the experiments were conducted at 9 o'clock in the morning. Subjects were advised to rest and sleep for about 8 hours the night before and to have a light breakfast.

This experiment consisted in reading an online book with black letters on white background on a desktop computer. The text letters were in Times New Roman and subtended a visual angle of 1 degree, being read at 40 cm distance (20/200 near visual acuity). In the first step of the experiment, the subjects were instructed to read for 20 minutes with their monofocal lenses to adapt to the illumination of the room. Then, without any interval, 10 measurements of the axial length of the right eye were made with the Lenstar 900 device, eliminating and repea-ting measurements outside the standard deviation. These measurements were averaged up to three decimals. Next, the subject continued reading the book on the computer for 40 minutes with his same usual monofocal glasses. After this, during a short pause, a new measurement of the axial length of the right eye was made with the Lenstar 900 (10 measurements again, same procedure). In the second step of the experiment, the subjects were instructed to read for 40 mi-nutes with the special defocus spectacles (Novar Defocus Prototype)(Fig. 1) provided for the re-search study and a third axial length measurement was performed.

After approximately two hours of work, the experimental procedure ended and the subjects took the special glasses home to test their tolerance for 4 weeks, after which they answered a brief questionnaire about their use. The statistical analysis was performed with SPSS 25 softwa-re. The means for baseline, first and second period in each subject's right eyes were recorded and the differences up to 1 micron between pre-and post-spectacle use were calculated. As the distributions of axial length were normal and had similar variances, paired T-Student tests were performed comparing axial length means for baseline, usual spectacles and defocus spectacles. A p value < 0.05 was considered significant for these differences.



RESULTS

For the present study, 17 subjects of both genders were studied with the same protocol. Their mean age was 22.3+/-5.5 years and 13 were women. Their mean spherical equivalent of the right eye was -2.31+/-1.06 diopters. The mean axial length for baseline (after 20 min adaptation), after usual spectacles (40 min more) and after special defocus spectacles (40 min more) are given in Table 1. There was a significant difference of +8.1 microns increased axial length from baseline when reading with the usual prescription. When subjects read in the same situation with the defocus spectacle the axial length significantly returned to baseline measurement shortening by -10.6 microns (Table 2).
After 1 month, the tolerance was assessed in 12 study subject with a new questionnaire. The subjects referred some problems with the use of the defocus spectacles. They were un-comfortable for walking in the streets. The volunteers could use them easily to work or read at the computer at usual desktop working distance but had some trouble reading from a book or cell phone, as they had to tilt down their chin and head. However, they also realized that they had to move their head from side to side to read comfortably at the computer. Fi-nally, they were happy with the idea of using some device for myopia control. Visual fields were tested in one subject with monofocal and defocus spectacles. This visual field testing showed normal visual macular fields in the central 20º diameter. In addition, it also showed a 5% reduction in sensibility around this central macular area up to 60º diameter. (Fig.4).

DISCUSSION

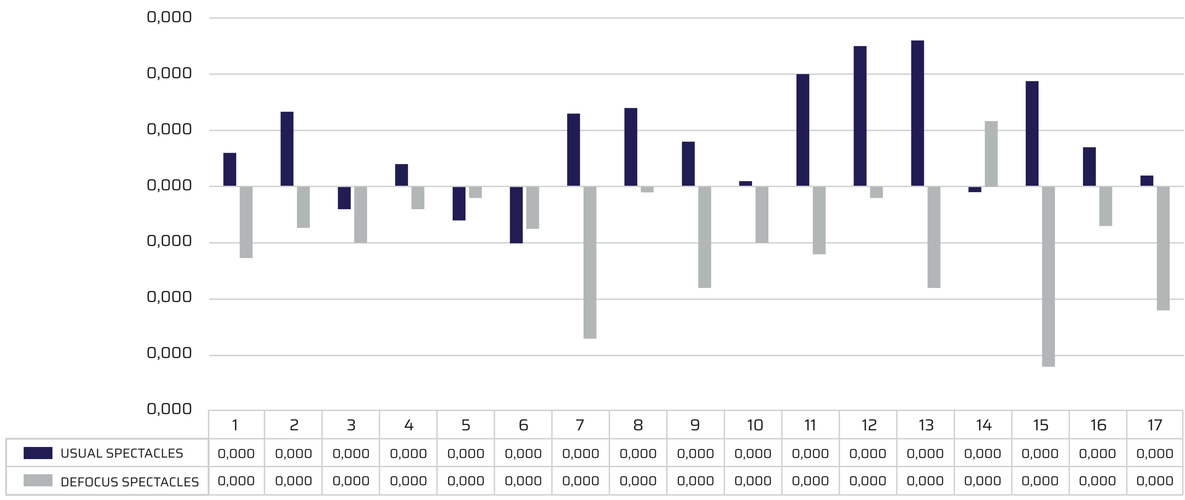
Many randomized clinical trials have shown that peripheral hyperopic defocus spec-tacles or contact lenses have 50-60% effectiveness in arresting myopia progression in schoolchildren.1-3 There is more interest in myopia control spectacles since children aged 6-12 seldom use contact lenses and they are the ones prone do develop high myopia because of their early onset.4-6

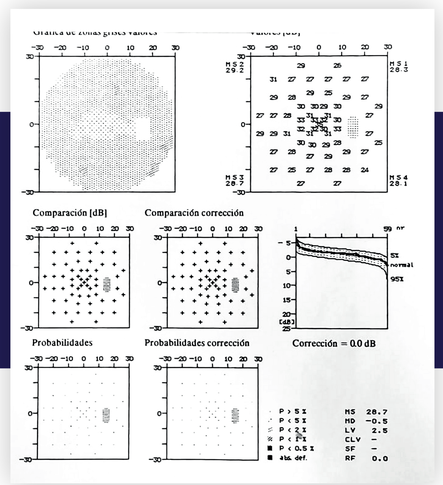
This paper presents evidence of axial length changes after 40 minutes of reading with special defocus spectacles with peripheral plus add +3.50 diopters (Defocus Pro-totype). These changes have been shown with similar methods In human subjects under hyperopic and myopic defocus, 7 under super-diluted atropine drops, 8 while reading with letters in positive or negative contrast 9 and with especial spectacles or contact lenses for myopia control. 10 It is generally believed that these changes in axial length are indirect evidence of corresponding changes in choroidal thickness, and cho-roidal thickening, as has probably been evidenced in this study with defocus specta-cles, is in the line of a possible effect on myopia control with these spectacles.

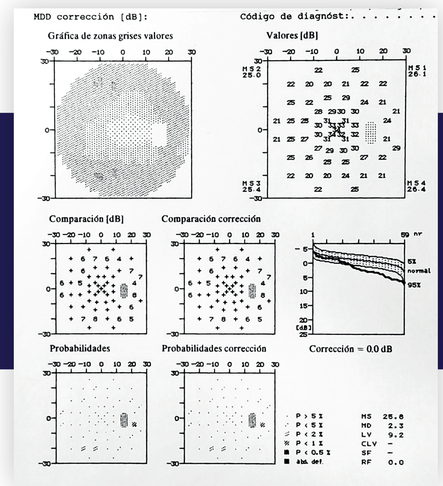
The changes in axial length that we find with simple defocus spectacles (SDS) are very important for countries and populations that cannot access to more sophistica-ted technology. We believe that a clinical trial of long-term tolerance and efficacy in myopia control of this new defocus design would be relevant.

We have observed that in the design of these glasses and other, with peripheral de-focus, the centering of the frames must be optimized. In our experience, tolerance and adaptation to these glasses depends on their correct centering. The effectiveness of different designs and clinical regimens for applying spectacles with peripheral defo-cus treatments is still under study. Research in this area is promising for finding an easy and affordable treatment for myopia control.

CHANGE IN AXIAL LENGHT (mm)







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