New spectacles for myopia control

Martín De Tomas[a], Carlos Kotlik[b], Abel Szeps[c], Ricardo Impagliazzo[d], Rafael Iribarren[e]

[a] *International Optics & Ophthalmology, Buenos Aires, Argentina.*
[b] *Centro Oftalmológico Dr. Kotlik, Mendoza, Argentina.*
[c] *Centro Oftalmológico Liniers, Buenos Aires, Argentina.*
[d] *Ópticas La Pirámide, Mendoza, Argentina.*
[e] *Consultorio Dres. Iribarren, Buenos Aires, Argentina.*

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Corresponding author
Dr. Rafael Iribarren
Arenales 981
(1061) Buenos Aires, Argentina
54-911-5147-9312.
rafairibarren@gmail.com

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Abstract

Two recent randomized clinical trials have shown good results slowing myopia progression in children with DIMS (Defocus Incorporated Multiple Segments) and HALT (Highly Aspherical Lenslet Target) spectacles. In these spectacles, the lenslets are located around a clear 9 mm central zone for distance vision. These sophisticated eyewear designs require complex industrial production, which makes them more expensive than simple single vision aspherical lenses. In countries like Argentina, the costs of these glasses would mean that few children with myopia could have access to them, and therefore they would not be able to slow down myopic progression, something that today is considered essential.

The authors propose that these special glasses can be replaced by simpler lenses carved in conventional optical laboratories which have the possibility of generating multi-faceted or high aspherical optical surfaces. It would only be necessary to generate lenses with a clear central section of "distance visión" for the necessary myopic correction, a small transition zone and a peripheral plus-add or hyper aspheric zone that produces a myopic blur similar to that produced by the design of the special glasses previously tested. Also, different spectacles could be developed that produce blurring of the peripheral retina through laser dots that simulate the Bangerter foils effects. Testing the progression of refractive error with these devices could easily be done if non-governmental organizations, or even governments concerned about the myopia

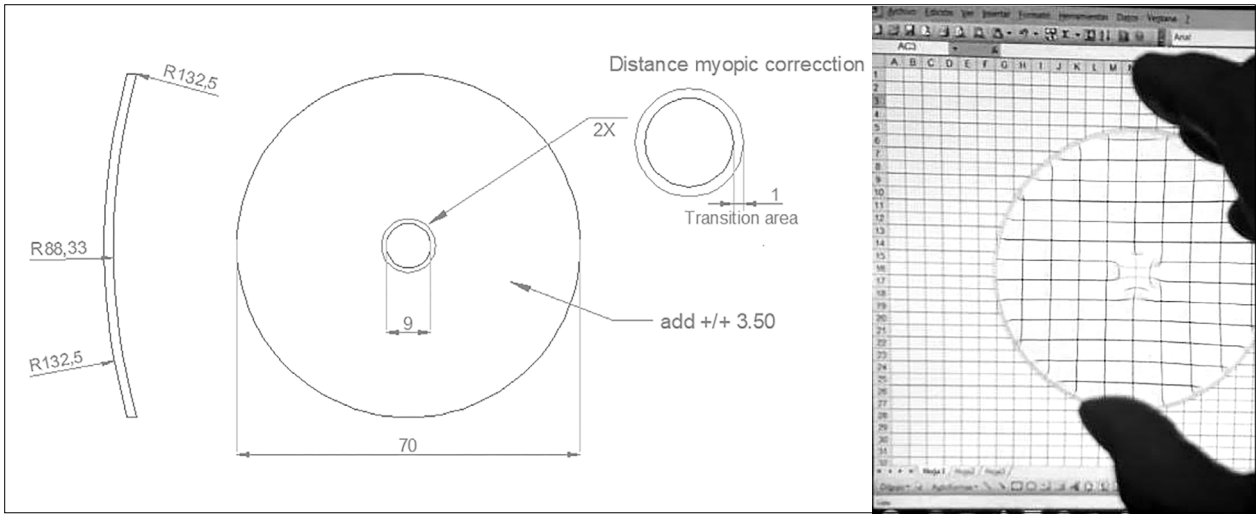

Figure 1. To the left, graphical design of the proposed special spectacles (Rx spherical -3.50 D for distance correction, material index 1.499). The design is feasible in all types of materials, although MR8 resin is recommended for safety and quality. To the right, image of such a lens (-0.50 D central 9mm, +3.00 D periphery) held in front of a rectangular grid.

epidemic in Asia, participated in randomized clinical trials of these less expensive glasses for myopia control.

Key words: myopia, plus add spectacles.

Short report

Lag of accommodation was proposed as a causative mechanism linking myopia development with reading habits in 1993 by Jane Gwiazda[1]. Since that time, much has been done in refractive error research. For one, the retina was discovered to regulate ocular growth at the posterior pole, even after ablation of the macular area with argon laser (Earl Smith III, experiments in monkeys in the early 2000s)[2]. After this, Anstice and Philips in 2011 arrested myopia progression in children by treating them for 8 months with special contact lenses, designed with peripheral plus-add annular rings that produced myopic defocus at the posterior pole[3]. Then, several spectacles with peripheral plus-add were developed by myopia researchers[4-7]. Nowadays, two randomized clinical trials have shown good results slowing myopia progression in children with these spectacles with "defocus incorporated multiple segments" located around a central diameter of 9 mm for clear distance vision[4-5]. These multiple lenslets usually have +3.50 D add and probably produce a myopically defocussed image in the peripheral macula. This has been the suggested mechanism of their action for controlling myopia progression, as restricting the image plane to focus in front of the retinal photoreceptors slows ocular growth in primates, rodents, birds and fish. But we have not yet discovered everything about the precise mechanism responsible for myopic progression when reading. Schaeffel in his laboratory has discovered that reading black letters on a white background is also a possible factor in myopia development[8-9].

Today we cannot leave a myopic child without the possibility of slowing down the progression of his myopia and for this it may not be necessary to depend on sophisticated and expensive spectacle designs. Authors wish to communicate here a possible alternative solution to the challenge of designing and developing myopia-retarding spectacles, which offers the added advantage of their being more affordable. Spectacle lenses can be surfaced with the machinery available in any conventional optical laboratory, to create multi-faceted optical surfaces having a central 'distance-viewing' section for the myopic distance correction, with a small transition zone and a

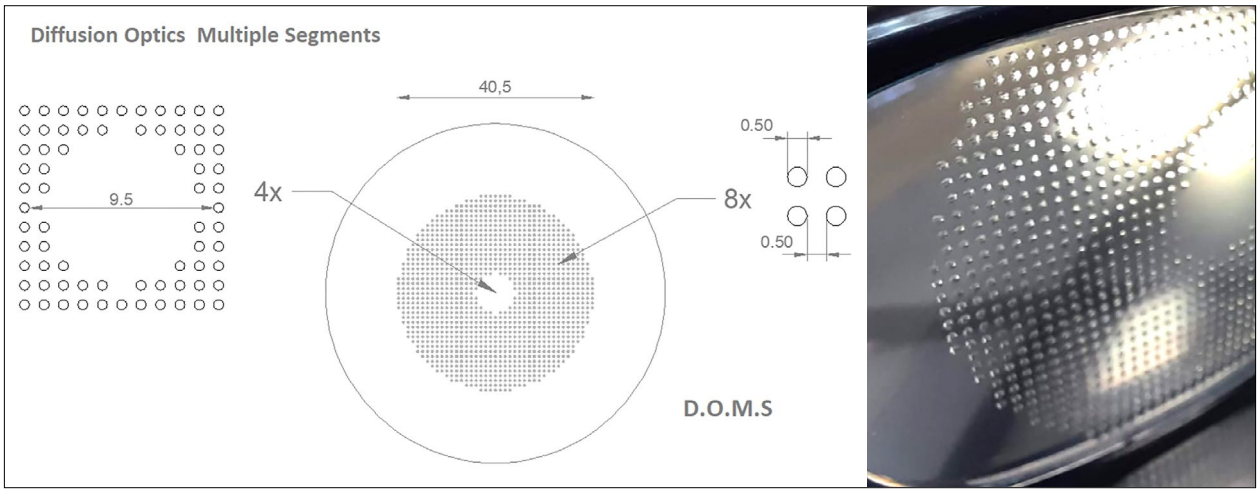

Figure 2. Multiple segments with diffusion optics following a combination of the principle of multiple segments and the Bargenter foils.

peripheral plus-add zone that would produce myopic defocus similar to that of the multiple defocus segments of the previously-tested special spectacles[4-5]. This type of design is shown in Figure 1. These type of spectacles for myopia control could be also produced with more developed machinery and digital designs with different optical zones and peripheral adds.

This type of lens would produce blurred distance images when viewing off-axis (not looking through the central part), so they must be tested to see whether children, who have great neural plasticity, can adapt themselves looking through the center of the spectacles turning the head instead of the gaze like happens with multifocals when reading. Testing refractive error progression, changes in choroidal thickness and axial length, visual fields, and tolerance and compliance for different plus-adds could be easily performed, if non-governmental organizations —or even governments concerned about the epidemic of myopia in Asia— were to become involved in randomized clinical trials of these spectacles for myopia control. This would be similar to previous experience with superdiluted atropine drops, which were tested in clinical trials for slowing myopia progression in Singapore after year 2000 when authorities became aware of the myopia epidemics (ATOM Studies)[10]. These designs could be useful in slowing progression in children at a low cost.

On the other hand, following a different principle of peripheral contrast modulation, spectacle lenses with Bangerter foils in the periphery leaving a central hole for distance vision (8 mm diameter) have been developed by Neitz & Neitz. The company SightGlass vision is in charge of these spectacles of which little information on the mechanism of action, compliance, visual fields and effectiveness are available (Patents US 2011/0313058, WO 2018/026697, US 2020/02717955). Following this idea, instead of a full peripheral foil to decrease contrast, it is here proposed that annular rings of difussion dots are presented in the spectacles with probable benefits in the peripheral visual field vision testing as there is clear vision around the dots. This type of spectacle could be easily developed treating surfaces with lasers at a low cost (Fig. 2). Much has to be done to test progression of myopia in children with these type of spectacles.

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