New Optical Approaches to Improve Myopia Control in Children

Novas Abordagens Ópticas para Melhorar o Controlo da Miopia em Crianças

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Myopia is a growing global health concern, with an increasing prevalence - in 2000 1.4 billion people were myopic and it is estimated that this number will reach 4.8 billion by 2050.[1] It appears that both genetic predisposition and environmental factors exhibit an association with myopia, particularly the increased exposure to screens and near activities from an early age, the digital projection under brighter classroom and a low outdoor activity.[1,2]

Nowadays there are no widely used methods, considered safe and effective for long-term use, to slow myopia progression. The recommendation for lifestyle and behaviour change are not enough; progressive addition spectacles have shown insignificant effect[3]; orthokeratology has showed certain effect on slowing axial elongation but that implies sleeping with lenses overnight which bares the risk of infective keratitis[4]; low-dose (0.01%) atropine proved to induce clinically significant reduction in myopia progression, however it is a minimally invasive treatment and implies a good compliance to the treatment.[5] So other optical approaches for myopia control in children have been developed, including dual-focus (DF) concentric soft contact lenses (CLs)[6] and multifocal spectacles with defocus segments or aspherical lenslet technology, attempting to reduce peripheral hyperopic defocus (HD), and induce myopic defocus (MD) at the central retina.[7,8]

Since I started my professional activity in France, at the end of 2020, I came across a large number of children and teenagers with myopia at risk of progression. At that time, in addition to treatment with low-dose atropine or orthokeratology, the prescription of new multifocal spectacles was

already part of current clinical practice. So I started to prescribe this type of spectacles, intending to slow the myopia progression.

The rationale is that this kind of optical devices might slow prolonged accommodation, by reducing the amount of HD.[6] Recent animal studies suggest that the peripheral visual field plays a critical role in the regulation of ocular growth. It has been demonstrated that peripheral optical blur, supplants those originating from the central retina, and imposed peripheral MD, by using dual-power or multifocal lenses, oppose the stimulus for axial elongation.[9,10] Therefore, the aim behind this design is to provide good central visual acuity, while inducing peripheral MD during both distance and near viewing.[10]

The design of DF concentric soft CLs consists in a small distance optic zone in the centre, surrounded by alternating defocusing (less negative) and distance correcting zones.[6,8,11]

Modest myopia control effects of 30%–50% reduction in myopia progression, compared to single vision (SV) CLs correction over two years, have been reported.[11] Likewise, Lam C *et al*,[12] showed a significantly reduction on myopia progression by 25%-31% less axial elongation, in schoolchildren wearing defocus incorporated soft contact lenses, compared with those wearing the SV contact lenses, over 2 years. Similarly, Anstice *et al*,[13] reported less axial myopia progression in eyes wearing DF CLs, without prejudice of visual acuity, accommodation or contrast sensitivity.

MiSight (CooperVision) is a daily disposable DF soft CLs, available for prescriptions from -0.25 to -6.00D. A three-year clinical evaluation of this lens, including 144 children aged 8-12 years, showed a 59% effectiveness in slowing myopia progression.[14,15]

One of the available MD spectacle lens is the HOYA MiYOSMART, with Defocus Incorporated Mutliple Segment (DIMS) technology. It was launched in 2018, and developed in cooperation with The Hong Kong Polytechnic University (HKPU). It's available for prescriptions until -10.00D sphere and -4,00D cylinder. The DIMS lens is a DF spectacle lens that comprises a central optical zone (9 mm in diameter) for correcting distance refractive error, and an annular multiple focal zone (33 mm in diameter) with a relative positive power of 3.50 D.[16]

The results of a two-year double-blind randomised trial[16] conducted on children aged 8-13 years, showed that MiYOSMART spectacle lens wear slowed myopia progression in 52% of children and axial elongation in about 62%, compared with SV wearers. It also suggested that there were no rebound effects for those who stop wearing the MiYOSMART spectacle lens. Later, a three-year data[17] corroborated the results, showing that the lens continued to slow myopia progression. Recently, the six-year follow-up study results were announced at the Association for Research in Vision and Ophthalmology (ARVO) 2022 conference in Denver, Colorado in the U.S., by Professor Carly Lam from the Centre for Myopia Research at the HKPU, who conducted the research.[18] The findings sustained what the two and three-years results already reported[16,17] - demonstrating that the MiYOSMART spectacle lens myopia control effect is sustained over time and that there was no rebound effects for those who stop wearing these lens.

Essilor Stellest spectacle lenses are another option for the treatment of myopia in children. It uses a highly aspherical lenslet target (HALT) lens technology, which consists of 11 rings of aspherical lenslets. The power of lenslets on each ring has been determined to guarantee a MD, and consequently to slowdown myopia progression. Such as with MiYOSMART, Stellest is also available for prescriptions until -10.00D sphere and -4,00D cylinder. In a two-year clinical trial, the amount of myopia progression and axial length increase was significantly less in groups wearing these type of lenses, when compared with the SV spectacle lenses group.[19]

Finally, there is also ZEISS MyoVision,[20] a spectacle lens that applies the principles of peripheral defocus management, inducing a peripheral MD. It is available for prescriptions until -10.00D sphere and -6,00D cylinder. However its effectiveness in reducing the rate of myopia progression has not yet been demonstrated.[20]

During the last year and a half, I was able to follow the evolution of some patients wearing MiYOSMART and Essilor Stellest, and a large part of them presented no evolution of the refractive error. Similar to what has been described, inspite of the adaptation time, it seems that the majority of the children do not have difficulties in wearing these novel designs.[7] However, the older they are, the more diffi-

culties they have to support the new lenses. Regarding DF soft CLs, it is not always possible to prescribe it at an early age, due to fear of its handling. Nevertheless, it is an optical alternative that I always try to present, at the time of therapeutic discussion.

The emerging reports from recent studies show that optical strategies that take into account the peripheral retina, appear to produce larger decline in myopia progression than those that do not. Accordingly, dual-focus contact lenses and multifocal spectacles with defocus or aspherical lenslet technology, may be an ideal alternative option to myopia treatment, as they are minimally invasive and prevent the long-term effects of atropine, and the risk of noncompliance associated with orthokeratology. However, additional studies and longer treatment periods will be necessary to prove clinical efficacy of these lenses on myopia progression prevention.

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