Best practice in myopia control: insights and innovations for myopia prevention and control – a round table discussion

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In August 2023, *BJO* and the Zhongshan Ophthalmic Center co-hosted a round table discussion on Best Practices in Myopia Control. This gathering provided a platform for the exchange of insights and discussion of evidence-based strategies to respond to the rapid increase in myopia prevalence. Participants from China, Hong Kong, the UK and Australia met in Guangzhou, China, to discuss the global status and challenges associated with myopia control (see the 'Acknowledgements' section for the list of panel members). The event included panel discussions on (1) prevention and public education for myopia control and (2) individualised myopia control. This report summarises the topics in myopia prevention and control discussed.

PREVENTION AND PUBLIC EDUCATION FOR MYOPIA CONTROL

Over the past 50 years, there has been a striking increase in the prevalence of myopia, raising questions about its causes and potential future impact.[1] Early data indicate that the advent of the COVID-19 pandemic and associated lockdowns has accelerated the myopia trend.[2 3] It is not clear whether a reduction in the time spent outdoors during lockdowns has led to longer-term behavioural changes favouring indoor lifestyles and hence impacted myopia prevalence.

It was noted that some countries have taken proactive measures to address the rising prevalence of myopia. Taiwan started a programme in 2010 that advocates 2 hours of daily outdoor activities at schools, yielding encouraging results.[4] Singapore initiated a national myopia prevention programme that included the promotion of outdoor activities, vision screening and teacher training programmes.[5] Mainland China, in recent years, has undertaken nationwide initiatives aimed at educational reform to alleviate academic pressures including homework burden.[6] A press release from the National Health Commission of China announced a slight decrease of 0.9% in myopia prevalence in China following the implementation of government policies.[7] Further research is necessary to evaluate the effectiveness of national policy implementation.

Reduction of the impact of myopia centres on two crucial elements: education intensity and outdoor activities. Strategies that merely broadcast knowledge about myopia have shown limited effectiveness. Singapore's efforts, including teacher training and promoting good eye care habits in schools, yielded marginal reductions in myopia prevalence.[5] Though the use of social media, such as WeChat messages, may result in some noteworthy reduction in myopia incidence,[8 9] this effect may be diminished by the effect of parental myopia. Compared with children with myopic parents, online family health education was more effective in children with non-myopic parents. A more compulsive strategy to increase time outdoors may be more effective. The Taiwanese school-focused strategy allocated 2 hours of supervised time, unlike in Singapore, during which children engaged in outdoor activities. It led to a significant decrease in the prevalence of myopia[4] and has generated an L-shaped decline after 10-year promotion of outdoor activities in kindergartens.[10]

In China, safety concerns commonly arise in the implementation of outdoor activities during school hours. For instance, from 2016 to 2018 in Shanghai, an additional 40 min of outdoor activity classes was introduced to primary schools, but teachers expressed apprehensions about potential accidents when students were outdoors. However, experiences in Australia and Taiwan have shown that, with necessary safety measures such as teacher supervision and wearing hats, the risks associated with outdoor activities at school are minimal. An alternative solution considered for schools in China is to consolidate short 10 min breaks between classes into longer periods. Based on evidence from Taiwan, a clear implementation strategy led by the government coupled with an adapted education programme is likely to be a successful implementation of outdoor activities during school time.

INDIVIDUALISED MYOPIA CONTROL

For children already affected by myopia, the primary focus is on controlling its progression. Myopia is a condition that physically alters the shape of the eye. The concept that every dioptre of myopia matters significantly holds true; even a one-diopre increase comes with a substantial 67% higher risk of myopic macular degeneration.[11] Consequently, reducing myopia by even one dioptre can be significantly beneficial. Myopia control encompasses a range of established interventions, including orthokeratology and low-dose atropine eye-drops.[12] The effect on myopia of atropine is recognised to be concentration-dependent and age-dependent, which itself exemplifies the individualisation of myopia prevention and control. A history of myopia in one or both parents is known to have a significant influence on development of myopia. Is ethnicity important? Comparatively few high-quality trials have been reported outside East Asia. One of the largest such trials from the USA, in which only 11% of children were East Asian, reported no benefit of atropine 0.01% drops in low to moderate myopia compared with placebo.[13]

Additional emerging interventions, including defocus incorporated multiple segments spectacle lenses,[14 15] high-add power multifocal contact lenses,[16] spectacles with highly aspherical lenses[17] and repeated low-level red light (RLRL) therapy,[18 19] are showing promise. These diverse interventions offer hope for effective myopia control.

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However, it is important to acknowledge that available interventions come with their own advantages and disadvantages. For instance, specially designed spectacles may have limitations related to wearing time and the patient's age.[14 15] The use of orthokeratology demands comprehensive support from both clinics and parents. RLRL, although effective with a low rate of complications, carries the potential risk of retinal damage that necessitates close monitoring. Thus, success in myopia control lies in individualisation, recognising that different parents have varying requests, capabilities and expectations. For young children or those with highly myopic parents, a more robust intervention may be advisable, such as a higher concentration of atropine drops, a greater magnitude of myopic defocus or red-light therapy.

In regions with limited resources, strategies for myopia prevention and control must be tailored to factors such as affordability and accessibility. While 0.05% atropine has shown the potential to prevent myopia onset by 50%,[20] and RLRL therapy boasts a 54% reduction rate,[21] the cost–benefit analysis for large-scale implementation of these interventions in myopia prevention still requires further research. Spectacle lenses, being relatively more accessible, cost-effective and effective in slowing myopia progression,[15] present an alternative for low-income areas, although their effectiveness in reducing incident myopia also warrants further investigation.

In conclusion, the escalating prevalence of myopia represents a greater challenge than previously anticipated. However, there is recent clear evidence of effective myopia control on a national level in some countries taking proactive measures through interventions and educational reforms. While the effectiveness of myopia control interventions has been extensively explored, the focus must now shift towards individualised strategies in clinical practice to achieve better outcomes. Significant challenges persist, particularly concerning the large-scale implementation of myopia interventions in resource-constrained areas. These challenges remain an essential area for ongoing research and development.

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REFERENCES

1 Morgan IG, French AN, Ashby RS, *et al*. The epidemics of myopia: aetiology and prevention. *Prog Retin Eye Res* 2018;62:134–49.
2 Luo Z, Guo C, Yang X, *et al*. Comparison of myopia progression among Chinese schoolchildren before and during COVID-19 pandemic: a meta-analysis. *Int Ophthalmol* 2023;43:3911–21.
3 Hu Y, Zhao F, Ding X, *et al*. Rates of myopia development in young Chinese schoolchildren during the outbreak of COVID-19. *JAMA Ophthalmol* 2021;139:1115–21.
4 Wu P-C, Chen C-T, Chang L-C, *et al*. Increased time outdoors is followed by reversal of the long-term trend to reduced visual acuity in Taiwan primary school students. *Ophthalmology* 2020;127:1462–9.
5 Karuppiah V, Wong L, Tay V, *et al*. School-based programme to address childhood myopia in Singapore. *Singapore Med J* 2021;62:63–8.
6 Jan CL, Congdon N. Chinese national policy initiative for the management of childhood myopia. *Lancet Child Adolesc Health* 2018;2:845–6.
7 China NHCo. Transcript of the national health Commission's press conference on July 13, 2021(in Chinese). 2021. Available: http://www.nhc.gov.cn/xcs/s3574/202107/2fef24a3b77246fc9fb36dc8943af700.shtml
8 Li Q, Guo L, Zhang J, *et al*. Effect of school-based family health education via social media on children's myopia and parents' awareness: a randomized clinical trial. *JAMA Ophthalmol* 2021;139:1165–72.
9 Li S-M, Ran A-R, Kang M-T, *et al*. Effect of text messaging parents of school-aged children on outdoor time to control myopia: a randomized clinical trial. *JAMA Pediatr* 2022;176:1077–83.
10 Yang YC, Hsu NW, Wang CY, *et al*. Prevalence trend of myopia after promoting eye care in preschoolers: a serial survey in Taiwan before and during the coronavirus disease 2019 pandemic. *Ophthalmology* 2022;129:181–90.
11 Bullimore MA, Brennan NA. Myopia control: why each diopter matters. *Optom Vis Sci* 2019;96:463–5.
12 Brennan NA, Toubouti YM, Cheng X, *et al*. Efficacy in myopia control. *Prog Retin Eye Res* 2021;83:100923.
13 Repka MX, Weise KK, Chandler DL, *et al*. Low-dose 0.01% atropine eye drops versus placebo for myopia control. A randomized clinical trial. *JAMA Ophthalmol* 2023;141:756–65.
14 Liu J, Lu Y, Huang D, *et al*. The efficacy of defocus incorporated multiple segments lenses in slowing myopia progression: results from diverse clinical circumstances. *Ophthalmology* 2023;130:542–50.
15 Lam CSY, Tang WC, Tse DY-Y, *et al*. Defocus incorporated multiple segments (DIMS) spectacle lenses slow myopia progression: a 2-year randomised clinical trial. *Br J Ophthalmol* 2020;104:363–8.
16 Walline JJ, Walker MK, Mutti DO, *et al*. Effect of high add power, medium add power, or single-vision contact lenses on myopia progression in children: the BLINK randomized clinical trial. *JAMA* 2020;324:571–80.
17 Li X, Huang Y, Yin Z, *et al*. Myopia control efficacy of spectacle lenses with aspherical lenslets: results of a 3-year follow-up study. *Am J Ophthalmol* 2023;253:160–8.
18 Jiang Y, Zhu Z, Tan X, *et al*. Effect of repeated low-level red-light therapy for myopia control in children: a multicenter randomized controlled trial. *Ophthalmology* 2022;129:509–19.
19 Chen Y, Xiong R, Chen X, *et al*. Efficacy comparison of repeated low-level red light and low-dose atropine for myopia control: a randomized controlled trial. *Transl Vis Sci Technol* 2022;11:33.
20 Yam JC, Zhang XJ, Zhang Y, *et al*. Effect of low-concentration atropine eyedrops vs placebo on myopia incidence in children: the lamp2 randomized clinical trial. *JAMA* 2023;329:472–81.
21 He X, Wang J, Zhu Z, *et al*. Effect of repeated low-level red light on myopia prevention among children in China with premyopia: a randomized clinical trial. *JAMA Netw Open* 2023;6:e239612.