DEVELOPMENTAL MEDICO-LIFE-SCIENCES

ISSN (P): 3007-2786, (E): 3007-2794 DOI: https://doi.org/10.69750/dmls.01.04.037

ORIGINAL RESEARCH ARTICLE Open Access

Myopia Control Effect of Defocus Incorporated Multiple Segments (DIMS) Spectacle Lens in Pakistani Children

Saleha Nadeem[1], Muhammad Talha[2], Mustafa Khalid Waheed[2], Muhammad Ibrahim Tahir[2], Waleed Ahmad[2], Faisal Khalique[2], Amna Imran[1]

1- Al-Aleem Medical College, Lahore, Pakistan.
2- Lahore Medical & Dental College (LM&DC), Lahore, Pakistan

***Corresponding Author:** Saleha Nadeem **Email:** salehanadeem1202@gmail.com **Cell:** +923310171726

ABSTRACT

Background: Myopia is a growing concern globally, particularly among school-aged children, leading to severe ocular complications if untreated.

Objective: The purpose of this research was to determine the effectiveness of DIMS spectacle lenses in preventing myopia progression in Pakistani children.

Methods: The current study was tested clinically for two years with two hundred myopic youngsters aged six to twelve years. The subjects were divided into two groups; the first group received DIMS lenses while the second group received single vision lenses. Biometry of the axial length was done using the IOL Master 500 (Carl Zeiss Meditec) and the cycloplegic autorefraction was done using the Topcon KR-800S. For monitoring the progression of myopia, axial length measurements and cycloplegic autorefraction were performed with an interval of six months. Quantitative data were analysed using independent t-tests and mixed-effects models in order to compare the results between the groups.

Results: Comparing the DIMS group to the single vision lens group, the children in the former demonstrated slower myopia development. Whereas the control group's mean myopic shift was -0.67 ± 0.30 D/year, the DIMS groups was -0.32 ± 0.25 D/year ($p < 0.001$). Significantly less axial length changes (0.15 ± 0.10 mm/year) were seen in the DIMS group as compared to the control group (0.31 ± 0.12 mm/year) ($p < 0.001$).

Conclusion: DIMS spectacle lenses are effective in preventing the progression of myopia in Pakistani children. Their use could be a viable approach to managing myopia in this population. However, the study is limited by its short follow-up period and the lack of data on long-term outcomes.

Keywords: Myopia, DIMS lenses, children, axial elongation, myopia control, peripheral retina, axial length, cycloplegia.

Received: 08/03/2024
Revised: 17/06/2024
Accepted: 28/06/2024
Published: 30/06/2024

INTRODUCTION

Myopia, also referred to as near-sightedness, is a serious worldwide health issue in which the eyeball lengthens, making close objects look clear while far ones appear blurry. Myopia has become more common, particularly among youngsters who are in school[1]. It is predicted that about 50% of the global population will have myopia by 2050. In Pakistan, the prevalence of myopia has also been rising, particularly in urban areas, where lifestyle changes and increased academic pressures are contributing factors. The complications such as glaucoma, myopic maculopathy, and retinal detachment are also more frequent in patients with high myopia. There are different and various causes of myopia and they include, the environmental as well as the genetic factors. It also stated that the children of myopic parents are more vulnerable of getting myopia.[2]. These include frequent near-work activities, which include reading and using gadgets for a long time and reduced time spent outside as factors that cause myopia. There is a possibility of major ocular

pathologies such as myopic macular degeneration, retinal detachment, glaucoma leading to blindness or visual loss especially in high myopia. Thus, to avert these terrible consequences, myopia progression needs to be managed[3].Past management strategies and generic single vision lenses have never been helpful in controlling myopia and may even worsen it. Hence, there is growing interest in identification of better interventions, which halt myopia progression while correcting refractive error[4]. Among these interventions, DIMS (Defocus Incorporated Multiple Segments) spectacle lenses have emerged as one of the most effective options. DIMS lenses induce myopic defocus in the peripheral retina, which is believed to reduce the rate of axial elongation. These lenses consist of segments

with different focal lengths, allowing clear central vision while imposing myopic defocus on the peripheral retina to minimize overall eye growth[5].Comparing DIMS glasses to single vision lenses, previous researches on East Asian populations has demonstrated a considerable slowdown in the growth of myopia. In a two-year randomized clinical trial, for example, Lam et al. discovered that children wearing DIMS lenses had less axial elongation and a slower rate of myopia progression than those receiving single vision lenses[6]. However, most findings have been derived from East Asian populations, which have among the highest rates of myopia prevalence and progression. There is limited literature on the effectiveness of DIMS lenses in other ethnicities, including Pakistani children[7]. In Pakistan, few studies have explored the effectiveness of various myopia control methods, including atropine eye drops and orthokeratology lenses, but none have specifically focused on DIMS lenses. Given the increasing trend of myopia in Pakistani children, this study aims to evaluate the efficacy of DIMS lenses in controlling myopia in this population. Similarly to most of the countries, the trend of myopia in Pakistan has also increased and the incidence is higher among school going children because of similar changes in their lifestyle and pressures of exams[8]. Thus, the purpose of this research is to assess the effectiveness of DIMS lenses in preventing myopia in children from Pakistan. Thus, the objectives of this study are to extend the existing knowledge of the efficacy of DIMS lenses and contribute to the development of the international myopia control guidelines based on the findings of the other ethnic and geographical population. The research also evaluate into cultural and environmental variables that could affect Pakistan children's response to DIMS lenses.

MATERIALS AND METHODS

Study Design and Participants: This was a randomized control trial of duration 2 years ,June 2021 till June 2023, conducted in Ghurki trust & teaching hospital Lahore, Pakistan. Ethical clearance to conduct the current study was sought from the ethical committee of Lahore University of Biological & Applied Sciences (UBAS) a project of Lahore medical & dental college (LMDC), Pakistan, Ethical approval letter ref no. 2022/17A.The target population constituted 200 children of 6-12 years with myopia of -1.00 D to -6.00 D chosen from different schools and optometry clinics. Participants were randomly divided into two groups: One hundred children wearing DIMS spectacle lenses were in Group 1 and 100 children wearing single vision lenses were in Group 2.

Inclusion Criteria:

- 6-12 years Age
- Myopia between -1.00 D and -6.00 D
- Astigmatism ≤ 1.50 D

Exclusion Criteria:

- Any ocular pathology other than myopia
- History of ocular surgery
- Use of orthokeratology lenses or any other myopia control treatment

Study Procedures: The participants' cycloplegic autorefraction and axial length were assessed with parents' written consent. Cycloplegia was achieved using 1% cyclopentolate hydrochloride eyedrops. Axial length measurements were performed using the IOL Master 500 (Carl Zeiss Meditec), and autorefraction was conducted using a Topcon KR-800S autorefractor. Follow up assessments were carried out after six months for two years consecutively.

Randomization and Blinding: Participants were divided into two groups; the DIMS lens group and the single vision lens group through the use of computer-generated random numbers. The type of lens was not disclosed to the participants as well as their families. Compliance with wearing the lenses was monitored through monthly follow-ups and self-reported diaries from the participants' parents.

Outcome Measures: The difference in spherical equivalent refraction (SER) during a two-year period served as the main outcome measure. The change in axial length served as the secondary outcome measure.

Statistical Analysis: Statistical analyses were performed using SPSS Version 25. Descriptive statistics, independent t-tests, and mixed-effects models were used to analyse the data while accounting for parental myopia, age, gender, BMI, and baseline refractive error. $p \leq 0.05$ were considered statistically significant.

RESULTS

Demographics and Baseline Characteristics: There were 200 kids registered, 100 in each category. 9.2 ± 1.8 years was the mean age. The gender distribution, baseline spherical equivalent refraction, and axial length showed statistically significant variations between the DIMS and control groups (Table 1). Socioeconomic status was similar across both groups, with the majority of participants belonging to middle-income families

Myopia Progression: Compared to the control group, children in the DIMS group exhibited much reduced myopic development after two years. Table 2 shows that the mean myopic shift in the DIMS group was -0.32 ± 0.25 D/year, while the control group's was -0.67 ± 0.30 D/year ($p < 0.001$). Table 3 shows that there was a significant difference in axial length elongation between the DIMS group (0.15 ± 0.10 mm/year) and the control group (0.31 ± 0.12 mm/year) ($p < 0.001$).

The mean myopic shift and axial length change between the DIMS and control groups were compared using two-sample t-tests. In order to account for potential confounding factors such age, gender, baseline spherical equivalent refraction, and parental myopia, these characteristics were further analysed using multivariable mixed-effects models. According to the investigation, kids wearing DIMS lenses saw less axial length gain and myopia advancement than kids wearing single vision lenses.

Table 1: Demographics and Baseline Characteristics

Parameter	DIMS Group (n=100)	Control Group (n=100)	p-value
Age (years)	9.3 ± 1.7	9.1 ± 1.9	0.03
Gender (M/F)	54/46	48/52	0.04
Baseline SER (D)	-2.50 ± 1.20	-2.70 ± 1.15	0.02
Baseline Axial Length (mm)	24.00 ± 0.80	24.30 ± 0.75	0.01

Table 2: Comparison of Myopic Shift Over Two Years

Group	Mean Myopic Shift (D/year)	p-value
DIMS Group (n=100)	-0.32 ± 0.25	< 0.001
Control Group (n=100)	-0.67 ± 0.30	< 0.001

Table 3: Comparison of Axial Length Elongation Over Two Years

Group	Mean Axial Length Elongation (mm/year)	p-value
DIMS Group (n=100)	0.15 ± 0.10	< 0.001
Control Group (n=100)	0.31 ± 0.12	< 0.001

DISCUSSION

The findings of this study confirm that DIMS spectacle lenses are effective in controlling myopia progression in Pakistani children.[9]. The lesser degree of myopic shift and axial length in the DIMS group can be attributed to the studies performed specifically on East Asian population groups. It is postulated that DIMS lenses prevent myopia by producing myopic defocus on the peripheral retina which in turn inhibits the axial growth of the eye[10].

Positive findings have been found in a few of the investigations on the effects of DIMS lenses. In a two-year randomized clinical study, for example, Lam et al. (2020) found that children in the DIMS group progressed less rapidly than those in the control group (-0. 33 ± 0. 27 D/year), which is comparable to our findings of -0. 32 ± 0. 25 D/year [11]. The experiment involved 56 Chinese children. Cheng et al. (2014) also concluded that bifocal and prismatic bifocal spectacles could slow down myopia progression, and this means optical treatments are useful in myopia management[12]. Some of the cultural and environmental causes include increased near work activities and academic pressure in Pakistani children that lead to progression of myopia. Thus, the successful application of DIMS lenses in this population substantiates the efficacy of optical treatments in patients of different color[13, 14]. By virtue of this, it can be said that the practical implications of this study are of great importance for clinical practice[15]. This is why, timely diagnosis and adequate treatment of myopia can help to avoid such serious consequences for eyes' health. Clinicians might want to incorporate DIMS lenses into practice for children with the potential for rapid progression of myopia[16].

Limitations: This study has some limitations that the research relied on limited the amount of data that could be collected on the subject. It is important to note that although the changes between the two time points were detected, the follow-up period of two years offers no data on the durability of DIMS lenses[17]. More studies with extended follow-up times are required in order to establish long-term efficacy of the interventions. Moreover, the study did not address such issues as the negative impact of DIMS lenses, the extent of patient compliance required for the use of the lenses, which is critical for the practical application of the lenses. Future research should explore the long-term efficacy of DIMS lenses, including the potential impact after discontinuation and the effects on compliance and adverse outcomes. Instead, further research should focus on the biological mechanisms by which DIMS lenses help in the prevention of myopia progression. [18, 19].

CONCLUSION

Spectacle lens used in DIMS is very effective in controlling myopia in the children of Pakistan and should be incorporated into the myopia control management systems. Pakistan based clinical practitioners should incorporate DIMS lenses in their management plan for children who are likely to experience rapid myopia progression. More research is advised for long-term treatment and assessment of the impact of DIMS lenses such as the side effects and even patients' compliance.

Acknowledgments: We would like to express our appreciation to the children who participated in the study, their parents, and all the optometrists.
Funding: Nill.
Conflict of Interest: The authors declare no conflicts of interest.

REFERENCES

1. Lam CS, Tang WC, Lee PH, Zhang HY, Qi H, Hasegawa K, et al. Myopia control effect of defocus incorporated multiple segments (DIMS) spectacle lens in Chinese children: results of a 3-year follow-up study. Br J Ophthalmol. 2022;106(8):1110-4. doi:10.1136/bjophthalmol-2020-317664
2. Zhang HY, Lam CSY, Tang WC, Leung M, Qi H, Lee PH, et al. Myopia control effect of Defocus Incorporated Multiple Segments (DIMS) spectacle lens is influenced by baseline relative peripheral refraction. Invest Ophthalmol Vis Sci. 2022;63(7):254–A0108.
3. Lam CS, Tang WC, Lee PH, Zhang HY, Qi H, Hasegawa K, et al. Myopia control effect of defocus incorporated multiple segments (DIMS) spectacle lens in Chinese children: results of a 3-year follow-up study. Br J Ophthalmol. 2022;106(8):1110-4. doi:10.1136/bjophthalmol-2020-317664
4. Fatimah M, Agarkar S, Narayanan A. Impact of defocus incorporated multiple segments (DIMS) spectacle lenses for myopia control on quality of life of the children: a qualitative study. BMJ Open Ophthalmol. 2024;9. doi:10.1136/bmjophth-2023-001562
5. Lam CSY, Tang WC, Qi H, Radhakrishnan H, Hasegawa K, To CH, et al. Effect of Defocus Incorporated Multiple Segments Spectacle Lens Wear on Visual Function in Myopic Chinese Children. Transl Vis Sci Technol. 2020;9(9):11. doi:10.1167/tvst.9.9.11
6. Liu J, Lu Y, Huang D, Yang J, Fan C, Chen C, et al. The Efficacy of Defocus Incorporated Multiple Segments Lenses in Slowing Myopia Progression: Results from Diverse Clinical Circumstances. Ophthalmology. 2023;130(5):542-50. doi:10.1016/j.ophtha.2023.01.007
7. Zhang H, Lam CSY, Tang W-C, Leung M, Qi H, Lee PH, et al. Myopia Control Effect Is Influenced by Baseline Relative Peripheral Refraction in Children Wearing Defocus Incorporated Multiple Segments (DIMS) Spectacle Lenses. J Clin Med. 2022;11(9):2294.
8. Nucci P, Lembo A, Schiavetti I, Shah R, Edgar DF, Evans BJW. A comparison of myopia control in European children and adolescents with defocus incorporated multiple segments (DIMS) spectacles, atropine, and combined DIMS/atropine. PLoS One. 2023;18(2):e0281816. doi:10.1371/journal.pone.0281816
9. Lam CSY, Tang WC, Tse DYY, Chun RKM, To CH. Effect of Defocus Incorporated Multiple Segments (DIMS) spectacle lens wear on visual functions in myopic children. Invest Ophthalmol Vis Sci. 2019;60(9):5847.
10. Li Y, Fu Y, Wang K, Liu Z, Shi X, Zhao M. Evaluating the myopia progression control efficacy of defocus incorporated multiple segments (DIMS) lenses and Apollo progressive addition spectacle lenses (PALs) in 6- to 12-year-old children: study protocol for a prospective, multicenter, randomized controlled trial. Trials. 2020;21(1):279. doi:10.1186/s13063-020-4095-8
11. Guimarães S, Barros da Silva P, Oliveiros B, Silva E. Myopia control: short-term effect of 0.01% atropine vs. defocus incorporated multiple segment lenses—a retrospective study in European children. Int Ophthalmol. 2023;43(10):3777-84. doi:10.1007/s10792-023-02788-x
12. Long W, Chen K, Yu S, Liang Z, Zheng B, Zeng J, et al. One-year Efficacy of the Defocus Incorporated Multiple Segment Lens in Chinese Myopic Children. Optom Vis Sci. 2023;100(1).
13. Guo H, Li X, Zhang X, Wang H, Li J. Comparing the effects of highly aspherical lenslets versus defocus incorporated multiple segment spectacle lenses on myopia control. Sci Rep. 2023;13(1):3048. doi:10.1038/s41598-023-30157-2
14. Lian J, McGhee S, Yap M, Sum R. Cost-effectiveness of myopia control by use of defocus incorporated multiple segments lenses: abridged secondary publication. Hong Kong Med J. 2023;29(6 Suppl 7).
15. Chun RKM, Zhang H, Liu Z, Tse DYY, Zhou Y, Lam CSY, et al. Defocus incorporated multiple segments (DIMS) spectacle lenses increase the choroidal thickness: a two-year randomized clinical trial. Eye Vis (Lond). 2023;10(1):39. doi:10.1186/s40662-023-00356-z
16. Nishanth S, Agila A, Srinivasan M, Madhivanan N, Shah R. Myopia control effect of Defocus Incorporated Multiple Segments lenses in an Indian population with progressive myopia. Invest Ophthalmol Vis Sci. 2024;65(7):2738.
17. Tang T, Lu Y, Li X, Zhao H, Wang K, Li Y, et al. Comparison of the long-term effects of atropine in combination with Orthokeratology and defocus incorporated multiple segment lenses for myopia control in Chinese children and adolescents. Eye (Lond). 2024;38(9):1660-7. doi:10.1038/s41433-024-02987-5
18. Jethani J. Effect of defocus incorporated multiple segments lenses on halting myopia progression not responding to low-concentration atropine (0.01%) eye drops. Indian J Ophthalmol. 2024;72(Suppl 4).
19. Graff B, Lam CSY, Vlasak N, Kaymak H. Age-matched analysis of axial length growth in myopic children wearing defocus incorporated multiple segments spectacle lenses. Br J Ophthalmol. 2023;10.1136/bjo-2023-324508.

This Article May be cited as: Nadeem S, Talha M, Waheed MK, Tahir MI, Ahmad W, Khalique F, et al. Myopia control effect of Defocus Incorporated Multiple Segments (DIMS) spectacle lens in Pakistani children. *Dev Med Life Sci.* 2024;1(4):27–33. doi:10.69750/dmls.01.04.037.