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Application of Multiple Segments of Spectacle Lenses for Effective Myopia Control in Adolescent: A Study in the Chongqing Population, China

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Abstract	Article Info
This study explores into the intricate factors shaping employee performance within Libyan public higher education institutions. Utilizing both empirical evidence and theoretical constructs, it pinpoints key influencers such as leadership approach, organizational ethos, employee welfare, training initiatives, job structuring, compensation strategies, and technological integration. Results underscore the essential role of supportive leadership, fostering a positive organizational climate, and prioritizing employee well-being in cultivating an environment conducive to optimal performance. Moreover, strategic job design, equitable compensation, and acknowledgment practices emerge as instrumental drivers of employee motivation and commitment. The research emphasizes the significance of investing in employee development to bolster skill acquisition and career advancement opportunities. Furthermore, embracing technological innovations is deemed essential for enhancing operational efficiency and promoting collaborative efforts among staff members. Implementation of these findings can catalyze the establishment of a culture characterized by excellence, engagement, and employee welfare, thereby fueling sustainable performance outcomes. This study makes a valuable contribution to existing literature by shedding light on the dynamics of employee performance within Libyan higher education settings and furnishing actionable insights for organizational leaders and policymakers.	*Keywords:* Employee performance, Leadership style, Organisational culture, Employee well-being, Training and development, Job design, Compensation practices, Recognition practices, Technological innovation, Libya

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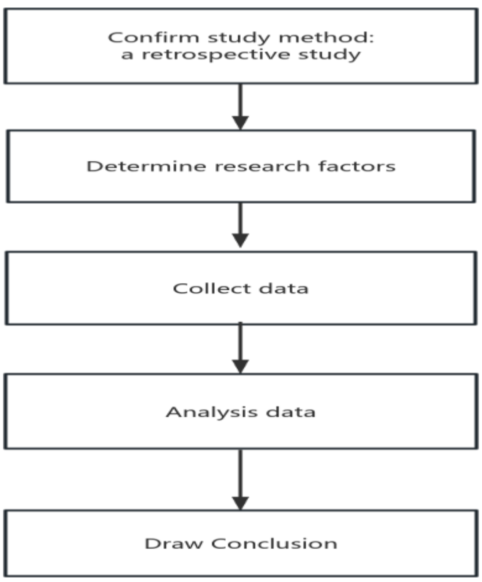
INTRODUCTION

At present,myopia is a global public health problem affecting quality of life and work productivity(Dutheil, F., et al, 2023). Initial studies have suggested that multiple segment (MS) spectacle lenses can reduce the progression rate of childhood myopia and axial eye growth (Radhakrishnan, H.et al., 2023). Myopia is reaching epidemic proportions. It is estimated that half of the world's population will be myopic by 2050 unless new strategies to fight myopia are developed. Our high-level mathematical description of myopia
is translated into clinical applications involving effective treatment and prevention （Medina A., 2022).
Myopia and high myopia estimates from 2000 to 2050 suggest significant increases in prevalence globally, with implications for planning services, including managing and preventing myopia-related ocular complications and vision loss among almost 1 billion people with high myopia(Holden, B. A., et al, 2016).
Myopia, also known as short-sightedness or near-sightedness, is a very common condition that typically starts in childhood. Severe forms of myopia (pathologic myopia) are associated with a risk of other associated ophthalmic problems (Nucci P, et al., 2023). This disorder affects all populations and is reaching epidemic proportions in East Asia, although there are differences in prevalence between countries. Myopia is caused by both environmental and genetic risk factors(Baird, P. N.,et al, 2020). Near work conditions, including occupational exposure in adults, could be associated with myopia. Targeted prevention should be implemented in the workplace(Dutheil, F., et al, 2023).
A multi-point defocus lens is an optical element that allows light to pass through the lens and reach different focal points(Lam, C. S. Y. et al., 2020). It is composed of multiple circular optical lenses, each with a different curvature radius, so that after passing through lenses at different positions, the focus of light is also different, thus completing the function of multi-point defocusing (Zhang J.F. ,2023). Multiple segment spectacle lenses offer a valuable new approach to the control of myopia progression in children. Further work is required to clarify their mechanism of action and to optimise their design parameters(Radhakrishnan, H.et al., 2023).
Some researcher found that daily wear of the DIMS(Hoya) lens significantly slowed myopia progres sion and axial elongation in myopic schoolchildren as compared with wearing single-vision(SV) spectacle lenses. They provided good vision while presenting simultaneous MD to the eyes. This intervention is simple to use and is the least invasive method compared with pharmacological or contact lens treatments. The DIMS spectacle lens offers an alternative treatment modality for myopia control(Lam, C. S. Y., et al, 2020
).
In this study, 4 multiple segment (MS) lenses including DIMS (Hoya) and single-vision (SV) lenses, normal vision (without lenses) were compared to investigate the effect of different multiple segment (MS) lenses on myopia control.

LITERATURE REVIEW

Study design



Data from the clinical trials in which changes in mean spherical equivalent refraction (SER) and axial length (AL) for matched groups of myopic children wearing either MS or single-vision (SV) spectacle corrections, recorded per months, and the trials were located in Chongqing. The MS lenses examined were DIMS (Hoya) and Stellest (Essilor) and C.A.R.E.（Zeiss）, Aura(Fruitland).

Sampling method, duration and interval

Collect monthly growth data on the axial length of myopia in adolescents aged 6 to 15 at Maylook eye hospital Hospital in Chongqing, China. The data (axial length) is selected from the same instrument, the Zeiss IOL-700 model and the tracking time last at least 6 to 24 months.

The files of 547 (1094 eyes) who followed the medical advice to see their children on a regular monitored basis were categorized and the groups were divided into 6 groups according to their status, which were:Group A (normal refraction) 272 cases (544 eyes),Group B (myopia without intervention) 86 cases (172 eyes),Group C (Stellest) 90 cases (180 eyes),Group D (C.A.R.E.) 58 cases (116 eyes), Group E (DIMS) 35 cases (70 eyes),Group F (Aura) 10 cases (20 eyes). Each group was divided into 3 groups according to age, group 1 was 6-9 years old, group 2 was 10-12 years old, and group 3 was 13-15 years old, and the monthly growth of the eye axis was counted separately.

Comparing with no lenses, we use multiple segment (MS) lenses including DIMS (Hoya)， Stellest (Essilor)， C.A.R.E.（Zeiss）, Aura(Fruitland). In addition, during the age range of 6-15, we divided into three intervals: 6-9, 10-12, and 13-15.

Inclusion criteria and Exclusion criteria

1. **Inclusion criteria**

1. The participants are all Chinese children, and the experiment was conducted in China to make the results more in line with the genetic genes and lifestyle habits of Chinese children today, which has more reference value for parents of Chinese children of the same age.\

2. **Exclusion criteria**
    1. The subjects have a history of using other myopia control products and are concerned about other interfering factors to ensure the objectivity of the experimental results.

Results

We categorized different lenses into different age groups based on monthly growth of the eye axis to compare the effectiveness of different designs/brands of multiple segmental spectacle lenses in adolescent myopia intervention.

Eye Axis growth in normal vision eyes

The eye axis of minors grows 0.2-0.6mm per year, depending on the age stage; the length of the eye axis of adults is basically fixed, and there may be different degrees of growth if myopia exists, but the specific growth value is variable. When a person is born, the general length of the eye axis is 16mm, before the age of 2 years old, it grows about 0.6mm per year; between the ages of 2-3 years old, it grows about 0.5mm per year; between the ages of 3-12 years old, it grows about 0.3mm per year; between the ages of 12-15 years old, it grows about 0.2mm per year; after the age of 15 years old, the growth of the eye axis slows down, and it normally grows at a rate of 0.1-0.2mm per year until about the age of 18 years old, and then grows at a rate of 0.1-0.2mm per year. After the age of 15, the growth rate of the eye axis slows down, normally at a rate of 0.1-0.2mm per year, until the age of 18, the length of the eye axis can be up to 24mm. if the vision is normal, there is no eye disease, the eye axis of the adult no longer grows, but if there is myopia may continue to grow, and every 1mm of the eye axis length, the myopia will increase by 250 to 300 diopters (CSOPM, 2022). We statistics the data as follows.

In the present study, the annual eye-axis growth of adolescents in the Chongqing area generally matched the theoretical.Monthly effectiveness of Different Lenses for Eye Axis Control in 6 to 9 Years Old. After summarizing the data from this study, we found that the average monthly axial growth in 6-9 year olds without myopia was 0.03 mm, while in myopic 6-9 year olds with single-vision (SV) lenses, the monthly axial growth was the highest at 0.035 mm. In 6-9 year olds who were also nearsighted and wore multiple segment (MS) lenses, axial growth was significantly lower than in those who wore single-vision lenses, and the lowest monthly axial growth was in Stellest, with a growth of 0.002 mm/month.In addition, among adolescents aged 6-9 years old wearing C.A.R.E., DIMS, and Aura, the monthly axial growth was 0.025mm, 0.01mm, and 0.018mm, respectively.

Monthly effectiveness of Different Lenses for Eye Axis Control in 10 to 12 Years Old

Among the 10-12 year old adolescents in this study, the average monthly axial growth of the non- myopic adolescents was 0.016 mm, while the myopic subjects wearing single-vision (SV) lenses had the largest monthly axial growth of 0.024 mm. Among the myopic adolescents of the same age wearing multiple segment (MS) lenses, the axial growth was significantly lower than that of the subjects wore single-vision (SV) lenses, with the lowest monthly growth being in Stellest, with 0.007 mm/month. In addition, among adolescents wearing C.A.R.E., DIMS, and Aura, the monthly axial growth was 0.015mm,0.010mm,0.010mm, respectively.

Monthly effectiveness of Different Lenses for Eye Axis Control in 13 to 15 Years Old

Among the 13-15 year old adolescents in this study, the average monthly axial growth of the non- myopic adolescents was 0.013 mm,which equal to the myopic subjects wearing single-vision (SV) lenses. Among the myopic adolescents of the same age wearing multiple segment (MS) lenses, the axial growth was significantly lower than that of the subjects wore single-vision (SV) lenses, with the lowest monthly growth being in Stellest, with 0.007 mm/month. In addition, among adolescents wearing C.A.R.E. and Aura, the monthly axial growth was 0.012mm and 0.010mm.

Summary

In the present study, we found that myopic adolescents between the ages of 6 and 15 years generally showed faster monthly axial growth than those without myopia. Among the nearsighted adolescents, those with multiple segment (MS) lenses generally showed less monthly axial growth than those with single vision lenses, which indirectly proved the significant effect of multiple segment (MS) lenses in myopia prevention and control. And among the four multiple segment (MS) designed lenses, the effect of Stallest showed the smallest monthly eye axis growth in different age subgroups, indicating that the myopia prevention and control effect of Stellest was better compared to the myopia prevention and control effect of single-vision (SV), C.A.R.E., DIMS, and Aura in this study.

Discussion and limitation

In order to ensure the accuracy of the results, the eye axis measuring instrument was Zeiss IOL- master 700, but in this study the number of people in different groups was different, which may affect the analysis. In addition Aura, Stellest , Single-vision , C.A.R.E. lenses 13 to 15 years old the sample size of the study were less than 40, the data may not represent generalization.

In this study, all subjects lived in Chongqing, China, which excludes regional differences. However, the effectiveness of myopia prevention and control needs to be considered in many ways, not only excluding the influence of lenses, but also other factors such as diet, genetics, and eye habits.

In this study, we did not strictly control the lens wearing time of each adolescent, and the wearing time may also affect the myopic development process, which further affects the development of the eye axis.Stellest and MiyoSmart also showed small effects on relative peripheral refraction (RPR) but had broader double-pass point-spread-functions (PSF) for all participants, indicating reduced retinal contrast. Reduction in peripheral retinal contrast might thereby play a role in slowing myopia progression even when the peripheral refraction does not turn more myopic(Papadogiannis P et al., 2023).

Multiple segment (MS) lenses as manufactured were found to match most of the design specifications provided by their manufacturers, although some apparent small discrepancies were found. The focimeter-measured power of the lenslets was approximately +3.50 D for the MiyoSmart and +4.00 D for the highly aspheric lenslets of the Stellest design. For both lens designs, image contrast would be expected to become modestly reduced in the focal planes of the distance-correcting carrier lenses. Images become much more degraded in the combined carrier-lenslet focal plane, due to the generation of multiple laterally displaced images formed by adjacent lenslets within the effective pupil. The exact effects observed depended on the effective pupil size and its location with respect to the lenslets, as well as the power and arrangement of the lenslets (Radhakrishnan H et al., 2023).The myopia control effect of multiple segment (MS) lenses is also related to the amount of defocus, and among the 4 multiple segment (MS) lenses in this case, both Stellest and DIMS defocused at +3.50 D, C.A.R.E. defocused at +4.00 D, and Aura defocused at the highest level of +4.50 D. In addition to the amount of defocus, the control effect of multiple segment (MS) lenses is also related to the area of defocus and the design of the defocus.

RESULTS

Among all participants, 62% were aged 6 to 9, 29% were aged 10 to 12, and 9% were aged 13 to 15. Out of 1094 eyes, the average range of axial growth in Group A： A1 is (0.03 ± 0.01/month), A2 is (0.016 ± 0.01/month), A3 is (0.013 ± 0.01/month). The average range of axial growth in Group B: B1 is (0.035 ± 0.01/month), B2 is (0.024 ± 0.01/month), B3 is (0.013 ± 0.01/month). The average range of axial growth in Group C: C1 is (0.002 ± 0.01/month), C2 is (0.007 ± 0.01/month), C3 is (0.007 ± 0.01/month). The average range of axial growth in Group D:D1 is (0.025 ± 0.01/month), D2 is (0.015 ± 0.01/month), D3 is (0.012 ± 0.01/month). The average range of axial growth in the group E: E1 is (0.010 ± 0.01/month), E2 is (0.010 ± 0.01/month). The average range of axial growth in the group F: F1 is (0.018 ± 0.01/month), F2 is (0.010 ± 0.01/month), F3 is (0.010 ± 0.01/month).

CONCLUSION

Multiple segment spectacle lenses intervention for myopia prevention and control in adolescents is effective in slowing axial length (AL).

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