DIMS technology spectacles to control Myopia progression -A review

Rama Sharma, Kritika, Rajeev Trivedi, Harshita Pandey, Arbaz

M.Optometry Scholar ,Assistant professor, Assistant professor, Assistant Professor, M.Optometry Scholar.

Galgotias University, Gautam Buddh Nagar UP, India.

Abstract:

Myopia, or short-sightedness, is another name for it, where the retina is in front of parallel rays. There are several non-invasive ways to stop the advancement of myopia. The first category is "non-optical," and the second is "optical method." Outdoor activities and under-correction of myopia are non-optical methods. for optical techniques such as contact lenses, single vision, bifocals, PALs, and DIMS glasses. Defocus integrated multiple segments is referred to as DIMS. The treatment zone is 33 mm in diameter, and the centre clear region is 9 mm in the DIMS spectacles. There is a tiny +3.50 D lenslet. The polycarbonate used to make it has a refractive index of 1.590. It is based on defocus in peripheral hyperopia. There have been a number of studies done based on a single vision and DIMS glasses. According to numerous studies, children fall into two categories: those who wear single-vision glasses and those who wear DIMS glasses. As a result of these studies, axial elongation and single-vision glasses have made less progress in DIMS glasses than in single-vision glasses.

Keywords: *Myopia progression, Myopia control and DIMS.*

Abbreviation: *PAL: Progressive addition lens, DIMS: Defocus incorporated multiple segments, SVn: Single vision spectacles.*

Introduction:

Myopia, or short-sightedness, is another name for it. Myopia can cause vision impairment if it is not totally correct, according to the WHO [1]. According to the (ICD-10) based upon the best corrective visual acuity, the degree of visual impairment is dependent [2]. In myopia parallel light which come from infinity are focussed on front of the retina when accommodation is rest. The prevelance of myopia is greater in US population of 12-54 years age group in 1991 to 2004 as comparision of 1971 to 1972.Myopia is more common in black people (33.5% vs. 13.0%) than in white people (43% vs. 20.3%), according to research [3]. In contrast to wealthy nations, myopia is less common in Pokhara, the capital of Nepal [4].

•Short-sightedness (Myopia) are divided into two groups : 1) Pathogenic myopia and 2)simple myopia (known as low to mild) (caused by any ocular disease). Pathological myopia can sometimes result in blindness, while low to moderate myopia can be treated with optical modality.

Depending upon the magnitude of dioptric power it is classified into three categories:

-Mild myopia= till -1.5 Dioptres

-Moderate= -1.5 to -6.00 Dioptres

-High Myopia = more than -6.00 Dioptres [5]

According to WHO till 2050 fifty percent population turns into myopic population [6]. Numerous close-up tasks and a decrease in outdoor exercise are to blame for the advancement of myopia [7]. The Chinese government made the decision to close the school when the COVID-19 outbreak was going on. A total of 12,335 children are screened in this study. They discovered that the peak incidence of myopia from 2015 to 2019 is lower than the prevalence during the COVID period. It is found that with 6 to 8 years age group rate of myopia 21.5% versus 5.75%, 26.2% versus 16.2%, and 37.2% versus 27.2% [8].

Aristotle (350BC) is the first person who described myopia as muoops (muein to close) and oops (the eye) [9].

Myopia is divided into various groups according to its magnitude [10]:

1. **Primary myopia:** This condition results from axial length elongation. High myopia exceeds -8.00D, and simple myopia is up to -7.75D.

2. **Secondary myopia:** Caused by strong refractive ocular media as well as other pathological disorders such as cataracts, a higher refractive index, cataract dislocation, swollen lenses, steep corneal curvature, and other syndromes.

3. **Pseudomyopia:** This condition is brought on by nocturnal myopia and accommodative spasm.

Different optical methods to control Myopia progression:

Numerous optical techniques, including single vision, bifocals, PALs, contact lenses, and orthokeratology lenses, are available to reduce myopia progression. Kahmeng Chung et al. demonstrate that inadequate myopia repair neither controls nor even slows down myopia growth.

They conducted a 2-year prospective research on 94 myopes kids between the ages of 9 and 14. 93 kids were split into two groups: fully corrected and entirely uncorrected. Monocular visual acuity in the under-corrected group is 6/12 or 20/40, which is achieved by +0.75 D if

they receive full correction. In the under-corrected group, the mean advancement was 1.00 D after two years, while in the completely corrected group, it was 0.77 D [11]. Therefore, under-correction could not aid in the prevention of the progression of myopia.

As you are aware, being close to your place of employment increases your risk of developing myopia. Taiwan promoted outdoor activity during lunchtime in a cohort study (age range: 7–11 years). In total, 521 students participated in the study. They split the class into two groups: the interventional group, which consisted of 333 students who engaged in outside activity during lunch, and the control group, which consisted of the other students. There is no discernible difference in the rate of myopia development between the interventional group, which contains only 8.4% of the group's myopic children, and the control group, which has 17.4% of the myopic children [12].

In Hangzhou, china 46 primary and junior school were participates in the research project called MYOSOTIS. One thousand six hundred eighty five pairs of children with low myopia were involved after one to one propensity score matching (PSM) with a 6-month follow-up. They separated the students into two categories: Group 1—who did not wear glasses in Category one —and Category two—who did—in these two rounds. The rate of myopia advancement is not significantly different, according to the results [13].

Chinese kids between the ages of 9 and 12 were the subject of a 2-year longitudinal study by Brown et al. These kids are broken down into three groups: those who wore SV glasses, those who wore PALs with +1.50D, and the third set of pupils who wore PALs with +2.00D. According to the results of this study, progressive lenses are more effective at stopping myopia from progressing. In comparison to +1.50 D, +2.00 myopia progression management is more successful [14].

Chinese Canadian children were the subjects of a three-year, random study by Desmond Cheng et al. (age group 8–13 years). There are three groups of children with near phoria who wear single-vision glasses, executive bifocals, or executive bifocals with a 3-PD prism base. Bifocal eyewear was found to slow the progression of myopia after three years. When compared to single-vision glasses, both bifocal groups have reduced axial length elongation (0.25 mm and 0.28 mm, respectively). The advancement rate was comparable in children with significant lags of accommodation (1.01 D), although prismatic bifocals work better with smaller lags of accommodation. It is determined by the proximity of theorising [15].

Numerous alternative techniques, such as atropine eye drops, are successful in slowing the growth of myopia. However, high doses of atropine can produce blurred vision and photophobia. Atropine is more effective and has fewer negative effects when used at low concentrations (0.01%) [16].

There are many options for contact lenses, including multifocal and orthokeratology lenses, which reduce the progression of myopia. Orthokeratology lenses are worn overnight, eliminating the need for daily contact lens wear. Microbial keratitis and conjunctivitis are brought on by contact lenses [17].

DIMS Technology in spectacles:

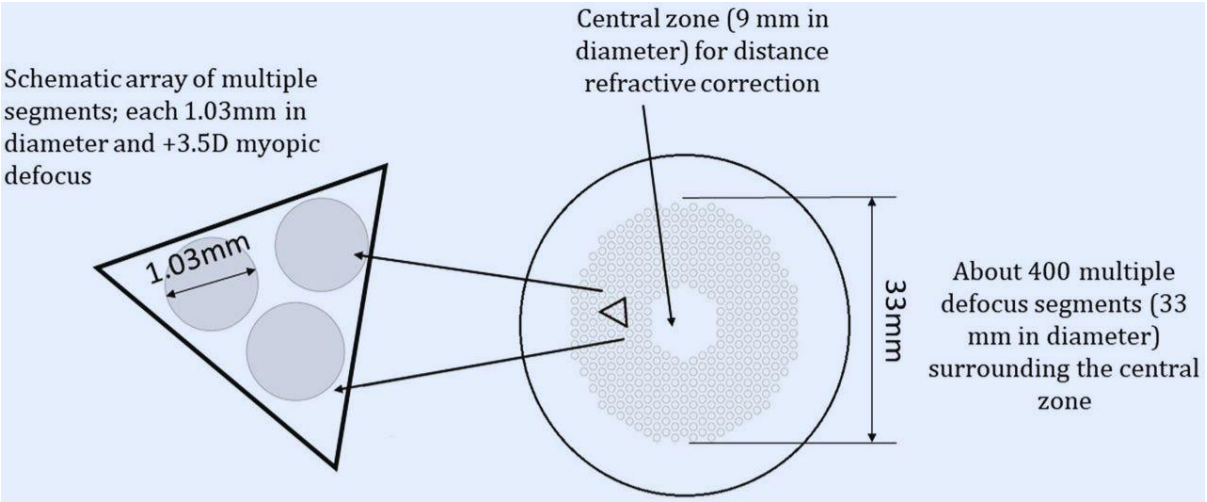
The DIMS (Defocus Incorporated Multiple Segments) systems slows down the rate at which myopia develops. The idea behind it is called peripheral hyperopic defocus. When we prescribe

single-vision glasses to a patient, we cause their eye to behave like an emmetropic eye because the central retinal palladium is
focused. Since peripheral rays are focused behind the retina, axial advancement is caused by the biochemistry of the eye, which stimulates choroid and sclera thinning [18].

Optics of DIMS technology spectacles.

-It features a 9-mm clean zone in the centre. It consists of several tiny, little circles, each of which has +3.50D power. utilising a central 9mm. Clear vision is provided by the central 9-mm zone, while continual myopic defocus is provided by the periphery zone [19].

Fig[25]



-A polycarbonate index of 1.590 makes up its composition. There are 396 tiny lenslets in it.

-The Myosmart DIMS technology is produced by the Hoya company. The maximal astigmatism is -4.00 D for myopia and -6.50 D for astigmatism. Additionally, prismatic rectification is possible in 3D [20].

Some Studies: Numerous studies have demonstrated the impact of DIMS spectacles in the decrease in the progression of myopia. owing to the fact that it is based on peripheral hyperopic defocus, which regulates axial elongation.

Carly Siu, Yin Lam, and colleagues conducted a guided two years study. The criteria of this study were kids aged lies between 8 to 13 and myopia between one 5 D to five dioptres and astigmatism between 1 and 4 D enrolled. One group has single vision, whereas the other group includes those who wear DIMS glasses. After two years of research, it was shown that DIMS eyewear slows the increasement of myopia by 52% compared to SV lenses. In sixty-two per cent of the children, axial length elongation has effectively decreased. Children in this group exhibit no axial elongation. Within two years, 21% of children showed no myopia progression. In the first 6 months, the treatment effect is high and in the rest time period, the treatment is stable. 13% of children show myopia progression with DIMS lens approx.1D [21]

In a six-year study, Carly SY Lam, Wing Chun Tang, et al. examined the pace at which myopia progressed with DIMS eyewear. There are four groups of kids. Children in Group 1 wore DIMS glasses for 6 years, while those in Group 2 continued to wear SV glasses after wearing DIMS

for 3.5 years. Children in Group 3 used SV glasses for the first two years of the RCT before switching to DIMS glasses. Group 4: Those who wore SV glasses for the first two years of the RCT switched to DIMS glasses for the third year and then back to SV glasses for the final six years.

Six years were spent on cycloplegic refraction and axial length measurements. Results from the last six years were analysed. Myopia advancement and axial length elongation for group 1 were -0.92 to 1.15 D and 0.60 to 0.49 milimeters. Progression of myopia and axial elongation in group 2 were on average 0.02 D and 0.07 mm different from group 1, respectively. When youngsters wear DIMS glasses, myopia growth in groups 3 and 4 is slower than when they wear SV glasses during those years [22].

A year of follow-up was recommended for students who had previously actually participated in the Carly Siu Yin Lam et al. program. The DIMS group reported changes in axial elongation and SER of 0.52 to 0.69 D and 0.31 to 0.26 mm, respectively, after a period of three years. 3 years from now The spherical equivalent refraction (0.04 0.38D) and AL (0.08 0.12 mm) altered in the 3rd year were significantly lower than the first (mean) difference of 0.45 to 0.30D, 0.21 to 0.11 mm, and the second (0.34 0.30D, 0.12 0.10 mm) years in the control to DIMS group. By the third year, more than 80% of the Control-to-DIMS children had myopia progression less than 0.5D, and almost 70% had progression less than 0.25D. All of these findings suggested that the myopia control effect would still be experienced even if the subjects began wearing DIMS glasses later in life [23].

Children who had already participated in the Carly Siu Yin Lam et al. programme were instructed to undergo a year of follow-up. After three years of research, the DIMS group detected changes in axial elongation and SER of 0.52 to 0.69 D and 0.31 to 0.26 mm, respectively. 3 years hence When compared to the first (mean) difference of 0.45 to 0.30D, 0.21 to 0.11 mm, and the 2nd (0.34 0.30D, 0.12 0.10 mm) years in the control to DIMS group, the spherical equivalent refraction(0.04 0.38D) and AL (0.08 0.12 mm) altered in the 3rd year were fewer. Over eighty percent of the Control-to-DIMS kids had myopia advancement less than 0.5D by the third year, and about 70% had progression less than 0.25D. All of these results suggested that even if the subjects started wearing DIMS lenses later in life [23], the myopia control effect would still be realised.

Zhang et al. also examined the shifts in relative peripheral refraction (RPR) in myopic children with DIMS and SV spectacle lenses in order to evaluate changes in retinal shape brought on by the usage of myopic defocus. The central and peripheral refractions across horizontal retinal eccentricities were computed using the straight-ahead position (centre) and the nasal (10 N, 20 N, 30 N) and temporal (10 T, 20 T, 30 T) retinal eccentricities, respectively. The children's peripheral spherical equivalents significantly changed after receiving myopia treatment with DIMS lenses at all retinal eccentricities, indicating a continual myopic movement along the horizontal retina. This may indicate that children in the SV group expanded their axial skeleton more quickly than those in the equatorial zone, whereas the DIMS group may have developed their eyes more gradually and uniformly. The RPR adjustments varied between the two groups as well. While the temporal retina displayed no significant alterations in the SV group, the nasal retina displayed a substantial hyperopic RPR shift, indicating an asymmetric development. The DIMS group, however, showed a myopic RPR tendency in all sectors, even though this tendency was not statistically significant. The increased hyperopia in the SV group may

indicate a steeper retinal shape, whereas the DIMS group was characterised by a flatter retinal shape, as RPR can be used to define the retinal shape indirectly[26].

Excluded criteria of DIMS: The patients who met the following criteria were not included in any of the studies on DIMS spectacles:

1)Squint patient or binocular vision anomaly.
2) Any eye condition other than myopia-related refractive error.
3) Patients who have undergone a modality for myopia progression are also excluded.

Steps for prescribing DIMS spectacles: Prior to prescribing DIMS eyewear, we should keep the following in mind:

1) Perform a thorough cycloplegic refraction eye exam.
2) Employ a gold standard machine to measure axial length.
3)The target age range is 6–13 years.
4) Anisometropia is up to 1.5D, and spherical power ranges from -1.00 to -5.00.
5) 6/6 is the best corrected visual acuity.
6) Advise to the wearer DIMS spectacles at least 15 hours a day for better result[24].

Conclusion:

There are various modalities to control myopia progression such as outdoor activity, under-correction, Single vision spectacles, Bifoca, Pal, orthoK and DIMS spectacles. DIMS is the best modality to control myopia progression and slow down the axial elongation. Various studies are conducted which shows that DIMS slow down the spherical equivalent and axial elongation. Another competitor technology is HALT.
HALT spectacles is produced by Essilor name as stellest.That is work on volume of myopic defocus.The no of myths that peoples follow in urban area such as walking on grass and eating chocolate reduce myopia progression.

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