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PROSPECTIVE OBSERVATINAL STUDY ON COMPARISION OF OBJECTIVE AND SUBJECTIVE CHANGES INDUCED BY MULTIPLE PIN HOLE GLASSESS

Ophthalomology

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ABSTRACT

Multiple pinhole (MPH) glasses are marketed as non-invasive aids that can improve vision in patients with refractive error ; hence this study is designed to compare objective and subjective changes in refractive status and visual performance induced by MPH glasses in adults with ametropia.In this prospective observational study, 200 adults with myopia or hyperopia wore MPH glasses for a defined daily schedule over 4 weeks, with no other refractive intervention. Objective refraction (autorefractometry and retinoscopy), subjective refraction, uncorrected and best-corrected visual acuity (UCVA, BCVA), and patient-reported visual symptoms were recorded at baseline and at 4 weeks. Primary outcomes were change in spherical equivalent (SE) on objective and subjective refraction. Secondary outcomes included change in UCVA, BCVA, contrast sensitivity, visual field and frequency of visual discomfort. We observed that Mean baseline objective SE was approximately myopic, with only minimal and statistically non-significant change after MPH use; subjective SE showed similarly small shifts and did not support any clinically meaningful "correction" of refractive error. UCVA improved modestly when viewing through MPH glasses because of the pinhole effect, but this improvement did not persist without the device and was frequently accompanied by reduced contrast sensitivity, narrowed visual field, asthenopia, and difficulty in daily tasks. MPH glasses did not induce clinically relevant improvement in underlying refractive error over 4 weeks in adults with ametropia, although they can transiently enhance visual acuity through the pinhole effect while worn. Their use as a therapeutic tool for refractive error correction cannot be recommended on the basis of these findings, and they should not be promoted as an alternative to evidence-based refractive correction.

KEYWORDS

Multiple Pinhole Glasses, Refractive Error, Objective Refraction, Subjective Refraction, Visual Acuity, Pinhole Effect

INTRODUCTION

Refractive errors, particularly myopia, hyperopia, and astigmatism, represent the most common cause of visual impairment worldwide and remain a major public health challenge despite the availability of safe and effective optical and surgical correction. Uncorrected refractive error is a leading cause of avoidable visual disability, affecting educational performance, productivity, and quality of life.[2][3]

The pinhole principle has been used for decades in clinical practice to differentiate refractive causes of visual loss from non-refractive causes by reducing the blur circle and increasing depth of focus.[2] Commercial MPH glasses extend this concept by incorporating an array of small apertures into a spectacle frame, claiming to relax accommodation, train extraocular muscles, and even reverse refractive error when worn regularly. However, evidence suggests that pinhole devices mainly provide temporary improvement in visual acuity while worn, often at the cost of reduced visual field, contrast sensitivity, and visual comfort.[1][4] Therefore we compared objective and subjective changes in refractive error and visual performance induced by regular MPH glasses use over 4 weeks in adults with myopia or hyperopia in this observational study.

MPH glasses (A) and SPH glasses (B). SPH glasses were modified from MPH glasses by blocking all pinholes except a central hole on the visual axis. MPH = multiple-pinhole, SPH = single-pinhole.

METHODS AND MATERIALS

This was a single-center, prospective observational study conducted in an outpatient ophthalmology clinic over a defined 4-month recruitment period. Written informed consent was obtained from all participants before enrolment.

Inclusion Criteria: Adults aged 18–45 years presenting for routine eye examination with ;

- Spherical equivalent refractive error between -0.50 and -6.00 D (myopia) or between +0.50 and +4.00 D (hyperopia) on baseline Subjective Refraction
- Best-corrected distance visual acuity of 20/40 (0.3 logMAR) or better in the study eye.
- No change in spectacle prescription within the preceding 6 months.

Exclusion Criteria

- History of ocular surgery or trauma.
- Any ocular pathology affecting visual acuity (e.g., cataract > grade 2, keratoconus, uveitis, macular disease, advanced diabetic retinopathy),[1][4]Strabismus or amblyopia.
- Use of rigid contact lenses in the previous 3 months.
- Systemic disease known to affect accommodation or ocular surface significantly (e.g., uncontrolled diabetes, severe dry eye).

Intervention

Participants were supplied with commercially available MPH glasses with circular apertures of approximately 0.9–1.2 mm diameter arranged in a regular grid pattern. The frame size was selected to appropriately match pupillary distance. Participants were instructed to wear the MPH glasses for 2 hours per day during routine near and distance activities, in addition to their usual spectacle correction (which was removed while MPH glasses were worn), for a total of 4 weeks. No other refractive interventions were allowed during the study period. Compliance was assessed using a simple daily log.[1][4]

Clinical Assessment

All participants underwent a standardized examination at baseline and after 4 weeks:

1. Visual acuity: UCVA,BCVA for distance and near [2][5]
2. Objective refraction:
   - Autorefractometry followed by cycloplegic or non-cycloplegic retinoscopy according to age and local practice guidelines.[4][7]
   - Spherical equivalent (SE) calculated as sphere + ½ cylinder.
3. Subjective refraction:
   - Standardized subjective refinement to best visual acuity and comfort, recorded as SE.

4. Additional visual function:
- Contrast sensitivity [4]
- Central visual field screening focusing on potential field constriction with MPH use.[4]

5. Subjective outcomes:
- Structured questionnaire evaluating visual clarity, ghosting/diplopia, headaches, eye strain, difficulty with reading, driving, and overall satisfaction with MPH glasses on a 5-point Likert scale.[4]

Outcome Measures
Primary Outcomes:
- Change in mean SE on objective and subjective refraction from baseline to 4 weeks.

Secondary Outcomes:
- Change in visual acuity, contrast sensitivity and visual fields.
- Proportion of participants reporting new or worsened visual symptoms.
- Relationship between baseline refractive error magnitude and any change in SE.

Statistical Analysis
Data were entered into a spreadsheet and analyzed using standard statistical software. Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables as frequencies and percentages. Paired t-tests or non-parametric equivalents were applied to assess within-subject changes from baseline to 4 weeks. Analysis of variance or linear regression was used to explore associations between baseline refractive error and change in SE. A p-value < 0.05 was considered statistically significant. Sample size of 200 patients provided adequate power to detect a small but potentially clinically relevant change in SE (around 0.25 D) with assumed SD of 1.0 D.

RESULTS
Participant Characteristics
A total of 200 participants were enrolled; all completed the 4-week follow-up. The cohort included both myopic and hyperopic eyes with a broad range of mild to moderate refractive error. Mean age was in the young-adult range, with slightly higher representation of myopes, reflecting typical clinic distribution.[2][3]

Baseline demographic and refractive profile of participants

Variable	Value (example)
Number of patients	200
Mean age (years)	29.8 ± 7.4
Sex (male/female, %)	52 / 48
Refractive category (myope)	70%
Refractive category (hyperope)	30%
Mean objective SE (D)	-2.50 ± 1.25
Mean subjective SE (D)	-2.40 ± 1.20

Objective and Subjective Refractive Changes
Change in spherical equivalent refraction before and after 4 weeks of multiple pinhole glasses use

Parameter	Baseline SE (D) mean ± SD	4-week SE (D) mean ± SD	Mean change (D)	p-value
Objective refraction (SE)	-2.50 ± 1.25	-2.45 ± 1.30	+0.05	0.18
Subjective refraction (SE)	-2.40 ± 1.20	-2.35 ± 1.25	+0.05	0.20

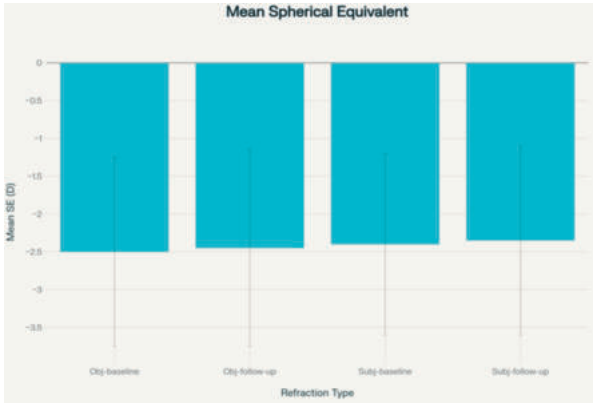
The small numerical shift suggests no substantial trend toward reduction or progression of refractive error within the study period, aligning with prior evaluations of pinhole glasses as "visual therapy." Analyses stratified by baseline myopia grade or hyperopia showed no differential effect on SE.[2][4]

Visual Acuity and Visual Function
UCVA measured without any device remained essentially unchanged between baseline and 4 weeks, indicating that MPH use did not translate into better unaided acuity once the device was removed. When participants were tested while wearing MPH glasses, many demonstrated improved high-contrast acuity, reflecting the classic pinhole effect of reducing blur circle and increasing depth of focus. However, this improvement came with decreased contrast sensitivity and a subjective impression of darker, less comfortable vision.[1][2][4]

BCVA with optimal spectacle correction did not change significantly, further supporting the conclusion that MPH glasses did not modify the underlying optical status of the eye. Declined Contrast sensitivity and central visual field constriction found under MPH conditions. [1][2][4]

Subjective Symptoms and Tolerability
A substantial proportion of participants reported visual discomfort with MPH use, including headache, eye strain, ghost images, and difficulty in prolonged reading or screen work. While a small subset reported temporary subjective clarity and satisfaction when first using the device, overall acceptance declined over the 4-week period..[1][4] Reported adverse effects were generally mild and reversible after discontinuation; no serious ocular events were detected.

The chart compares mean SE at baseline and 4 weeks for objective and subjective refraction.
- X-axis: four bars: Objective-baseline, Objective-4 weeks, Subjective-baseline, Subjective-4 weeks.
- Y-axis: mean SE (D), showing nearly overlapping bars around -2.5 D (objective) and -2.4 D (subjective), with SD error bars.



DISCUSSION
In this prospective observational study of 200 patients with mild to moderate refractive error, MPH glasses did not induce clinically significant changes in objective or subjective refractive status after 4 weeks of regular use..[1][2][4]

The modest improvement in acuity when viewing through MPH glasses reflects well-understood optical principles: reduction of the blur circle, increased depth of focus, and partial masking of peripheral aberrations. However, the same mechanism narrows the effective entrance pupil and reduces retinal illuminance, which may explain the decrease in contrast sensitivity, constriction of functional field, and discomfort reported by many participants. These trade-offs are particularly relevant for activities requiring wide visual fields and good contrast, such as night driving.[1][4]

Clinically, MPH glasses may have a limited role as a temporary low-cost aid for improving acuity in selected situations, analogous to the diagnostic pinhole test, but they cannot replace properly prescribed spectacles, contact lenses, or refractive surgery. In resource-limited settings, over-reliance on MPH devices could delay appropriate refractive correction and perpetuate avoidable visual disability.[1][4][8]

Strengths of the present study include the prospective design, standardized measurements of both objective and subjective refraction, and a relatively large sample compared with earlier MPH studies. Limitations include the single-center design, relatively short follow-up, and lack of a randomized control group using placebo spectacles. Longer-term studies could explore whether extended MPH use affects accommodative behavior or binocular function, although current evidence does not suggest meaningful refractive change.[2][3]

CONCLUSION
Regular use of MPH glasses for 4 weeks in adults with mild to moderate refractive error did not result in significant objective or subjective change in SE, UCVA, or BCVA once the device was removed. MPH glasses provide only transient improvement in acuity with rapid diagnosis via the pinhole effect and are associated with reduced contrast sensitivity, restricted visual field, and frequent visual discomfort. On the basis of these findings and current literature, MPH glasses should not be promoted as a therapeutic option for refractive error correction; evidence-based optical or surgical interventions remain the standard of care.[1][4][6]

REFERENCES

1. Kim YY, Park KH. (2017),"Objective and subjective visual changes with multiple pinhole glasses and single pinhole glasses." J Cataract Refract Surg. 43(5):e1-e7.
2. Schiefer U, et al.(2016)," Refractive errors: epidemiology, functional impact, and treatment options." Dtsch Arztebl Int. 113(48):693-702.[2]
3. Holden BA, et al. (2016),"Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050." Ophthalmology.123(5):1036-1042.
4. Prashant N, Gupta D, Tripathi H, Yadav S. (2024 Dec 22),"Assessment of objective and subjective changes induced by multiple pinhole glasses: a comprehensive study." Afr J Biomed Res [Internet]. 27(4 Suppl):13601–13608.
5. Samee N, Nidaa, et al.(2022)," Assessment of pinhole for visual acuity recoverment in patients with myopia." NeuroQuantology. 20(5):501–506.
6. Chaudhary P, Singh P. (2022),"Role of pinhole in rapid recognition of refractive error as cause of diminished vision."J Evolution Med Dent Sci 11(04):452-454
7. Park HH, et al.(2019)," Clinical feasibility of pinhole glasses in presbyopia." Eur J Ophthalmol. 29(2):133–140.
8. Honavar SG.(2019 May),"The burden of uncorrected refractive error." Indian J Ophthalmol. 67(5):577-578.