Research Article
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Comparison between degree of hyperopia and iridocorneal angle, cross-sectional study

Abstract

Objectives: To determine whether there is a correlation between the degree of hyperopia and the presence of a narrow iridocorneal angle (ICA) in the general population.

Methods: Cross-sectional study, period December 2022 - June 2023 at the Instituto de la Visión, Chile. Sample size of 177 patients (353 eyes). Hyperopes are classified as mild (less than 3 dioptres), moderate (3 to 6 dioptres), or high (greater than 6 dioptres). The AIC, assessed by gonioscopy (4-mirror gonioscope), according to Shaffer in 4 degrees, dichotomised from 0 to 2 as narrow angle, and 3 to 4 as open. An emmetropic "control" group was maintained, with a range of +/- 0.5 spherical dioptres.

Statistical analysis: The chi-square test was used for the association between the two variables.

Results: Of the total number of patients, 65% had mild hyperopia (n=229), 13% moderate (n=47), 0.6% high, while 21% corresponded to the "control" group (n=75). Of the total, 41% had narrow angle (n=146) and 59% open (n=207). In the analysis by group, mild hypermetropes showed 46% (n=105) of narrow angles compared to 27% (n=20) of the 'control' group. This difference was statistically significant ($p<0.05$). When comparing the moderate hyperopia group, which had 40.4% (n=19) of narrow angles, significant differences were observed compared to the 'control group', but not compared to the mild hyperopia group (p=0.2).

Conclusion: There is a significant association between hyperopia and narrow AIC measured by gonioscopy, independent of the degree of severity of hyperopia. It is therefore advisable to screen for narrow angles in these patient groups.

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Introduction

Glaucoma is the leading cause of irreversible blindness worldwide and is classified into two main groups: primary open-angle glaucoma (POAG) or narrow-angle glaucoma (NAG).[1,2] Multiple risk factors have been recognised for the development of NAG, such as race, first-degree family history, short axial length (AL), the shallow anterior chamber (AC), and hyperopia.[3] According to some studies, hyperopia, as a refractive error across its various degrees, increases the likelihood of having a narrow iridocorneal angle (ICA), particularly among Asian populations. However, the literature remains limited in determining the relationship between the severity of hyperopia and the degree of narrowness in the iridocorneal angle clinically assessed through gonioscopy.[4–6] This is why we propose to carry out a cross-sectional study, in order to assess whether there is a relationship between lower/greater degree of hypermetropia and the probability of finding a narrow iridocorneal angle.

Materials and methods

Objective

To determine whether there is a correlation between the degree of hypermetropia and the presence of a narrow iridocorneal angle (ICA) in the general population.

Type and design of study

Cross-sectional study, period December 2022 - June 2023 at the Instituto de la Visión, Chile.

Study population

Patients consulting in the ophthalmology department of the eye institute who met the inclusion criteria.

Sample size

177 patients (354 eyes).

Inclusion criteria

Patients over 18 years of age, with hyperopia in its different degrees, and emmetropic control group.

Exclusion critera

Patients with a history of refractive ocular surgery, phaco-refractive surgery, ocular trauma, previous diagnosis of angular closure spectrum, iridotomy or with corneal opacities that generate difficulties in the evaluation.

Measurement

Hyperopes are classified according to degree as mild (< 3 dioptres), moderate (3 to 6 dioptres), high (> 6 dioptres) (Table 1). The width of the iridocorneal angle (ICA) was determined by gonioscopy (4-mirror gonioscope) measured by an ophthalmologist with expertise in glaucoma, following the Shaffer classification into 4 degrees. It was dichotomized into 0 to 2 as narrow angle and 3 to 4 as open angle (Table 2, Figure 1).

Table 1 Classification of hypermetropia according to diopters

Hyperopia classification	Diopters
Mild	0,5- 3.0 D
Moderate	3.0 – 6.0 D
Severe	>6.0 D

Table 2 Iridocorneal angle (ICA) according to "Shaffer"

Shaffer (dichotomized)	Degrees
Closed	0 – I – II
Open	III-IV

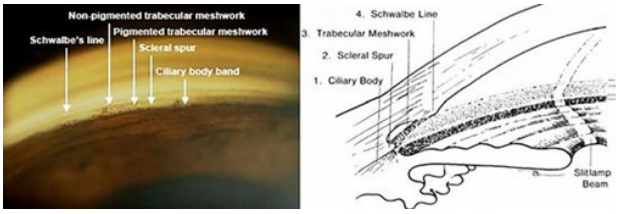


Figure 1 Grades according to Shaffer's classification.[7]

An emmetropic "control" group is maintained, with a range of +/- 0.5 spherical dioptres.

Statistical analysis

Descriptive and inferential statistics were employed to achieve the study objective. In the descriptive phase, frequencies and percentages were calculated for categorical variables, while summary measures were obtained for continuous variables. For inference purposes, a significance level of 5% was considered, and the association between the two variables was assessed using the chi-square test for the categories of hypermetropia and Shaffer's gonioscopic classification. Statistical calculations were performed using JASP, Jamovi, and SPSS software.

Ethical procedures

The information was collected and tabulated during clinical measurements, with prior documentation in an electronic clinical record. Confidentiality of personal data was strictly maintained, and all procedures were conducted in accordance with the ethical standards outlined by the institution's ethics committee. Patients provided informed consent before participation, and their rights and privacy were protected throughout the study.

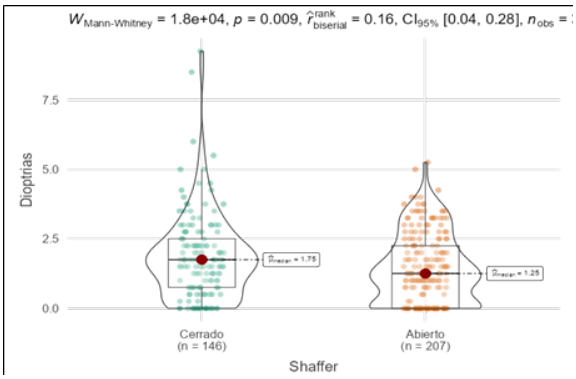
Results

Demographically, the study population comprised 177 patients (353 eyes), with 71% being female and 29% male. The mean age of the participants was 60 years (±14 years), ranging from 19 to 87 years. Notably, 50% of the participants fell within the age range of 52 to 69 years (Table 3).

Table 3 Population demographics, refraction and AIC (Shaffer)

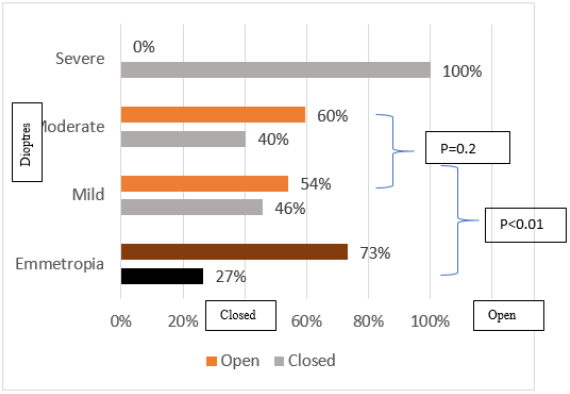
		Stadigraphs	
Factor	**Categories**	**Frequencies**	**%**
Sex	Women	251	71
	Men	102	29
Age	Media +/- SD	59.6 +/- 13.8	
	Mediana (Q1-Q3)	63 (52-69)	
	Min/Max	19-87	
Refraction (diopters)	Media +/- SD	1.6 +/- 1.4	
	Mediana (Q1-Q3)	1.5 (0.5-2.5)	
	Min/Max	0 - 9.25	
Diagnostics	Emmetropia	75	21
	Mild hyperopia	229	65
	Moderate hyperopia	47	13
	Severe hyperopia	2	1
Shaffer	Closed	146	41
	Open	207	59

Regarding refraction, the mean refractive error was 1.6 dioptres (±1.4 dioptres), ranging from 0 to 9.25 dioptres. Graph 1 illustrates the distribution of refractive errors using the Mann-Whitney test to assess the heterogeneity of two ordinal samples. Among the participants, 65% exhibited mild hyperopia (n=229), 13% had moderate hyperopia (n=47), and 0.6% had high hyperopia. Additionally, 21% of participants were assigned to the control group (n=75). Furthermore, of the total population, 41% had a narrow angle (n=146), while 59% had an open angle (n=207) (Table 3).



Graph 1 Mann-Whitney test for diopters and AIC by Shaffer.

Graph 2 displays the frequencies and percentages of refractive distribution within the study population, along with the results of the chi-square association test. Upon analysis by group, it was observed that individuals with mild hyperopia exhibited a significantly higher proportion of narrow angles, accounting for 46% (n=105) compared to 27% (n=20) in the control group, with this difference being statistically significant (p<0.05). Conversely, when comparing the moderate hyperopia group, which showed 40.4% (n=19) with narrow angles, significant differences were observed when compared to the control group, but no significant differences were found compared to the mild hyperopia group (p=0.2).



Graph 2 Percentage distribution by hypermetropia subgroup and control.

Discussion

Based on our results, a statistically significant relationship exists between the presence of hypermetropia, particularly mild hypermetropia, which constitutes the majority of our sample, and narrow angles when compared to the 'emmetropic' control group. This highlights the importance of screening patients with mild hyperopia for narrow angles, as they are at increased risk, potentially leading to glaucoma. Our findings suggest that the degree of hyperopia does not directly correlate with the presence of narrow angles, as no differences were observed between hyperopia subgroups classified by severity.

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Clinically, our results underscore the need for a comprehensive evaluation to detect the possibility of narrow angles, either through indirect methods of iridocorneal angle assessment or, if necessary, through gonioscopy. Early detection and intervention in patients with mild hyperopia can help prevent potential complications associated with narrow angles and reduce the risk of developing glaucoma.

Conclusion

In conclusion, our study provides evidence of a significant association between hypermetropia and narrow angles. This underscores the importance of conducting careful evaluations, including gonioscopy, as a screening method for narrow angles, irrespective of the degree or severity of hypermetropia. However, further research with larger and more representative samples, spanning diverse demographic groups, is warranted to validate and expand upon our findings. Such investigations will contribute to a deeper understanding of the relationship between hypermetropia and narrow angles, informing more targeted and effective screening and management strategies in clinical practice.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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