The Effect of Swimming Goggles on Intraocular Pressure in Angle Closure Glaucoma Patients.

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Abstract

Background: To study the effect of swimming goggles on intraocular pressure (IOP) in angle-closure glaucoma patients.

Methods: Prospective cohort study, Forty patients with angle-closure without glaucoma were enrolled. IOP was measured by Goldmann applanation tonometry method before wearing goggles, immediately after, 10 min and 30 min post, and after removal: 5 instances in total. We altered regular swimming goggles by removing the plastic lens to permit IOP measurement.

Results: Mean age of the cohort was 61.55 ± 8.55 years, with a 4:6 male:female ratio. The average baseline IOP was 15.25 ± 4.00 mmHg; the average IOP immediately after wearing goggles was 17.43 ± 4.49 mmHg. At 10 min and 30 min post-wearing , was 17.95 ± 4.68 and 19.05 ± 5.87 mmHg, respectively. The final average IOP after goggle removal was 14.8 ± 3.93 mmHg. No statistical significance, using paired t-test (P>0.05), were found when comparing average IOP between each period with the baseline. Patients were divided into two subgroups: confirmedprimary angle-closure and suspected primary angle-closure. No statistically significant differences were found after using paired t-test for both groups (P>0.05).

Conclusion: Wearing goggles causes slight IOP elevation in angle closure patients of about 2-4 mmHg or 25% from baseline; however, the IOP differences achieved did not reach statistical significance. Thus, using goggles is seem to be safe, even in angle closure patients.

Conflicts of interest: Author has no financial interest in this study

Keywords: Swimming goggles, Intraocular pressure (IOP), Angle-closure patients

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Introduction

Glaucoma is the second most common cause of blindness and the most common cause of irreversible blindness. It is chronic progressive atrophy of the optic nerve causing visual field constriction and permanent blindness. Intraocular pressure (IOP) is the most significant risk factor. Lowering the IOP could slow or stop disease progression and preserve the remaining visual field function[1]. IOP is a balance between the production and drainage of aqueous humor. IOP elevation usually occurs with aging due to the imbalance of the production and the outflow[2,3].

There is evidence that aerobic exercise, such as running, bicycling, and swimming, is related to the IOP lowering effects4.

However, wearing goggles to prevent sports-related eye injury might cause IOP to rise. Goggles increased IOP immediately after wearing. IOP elevation was remaining high until removal[5-7].

Nevertheless, other research has stated that goggles did not increase glaucoma prevalence[8].

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Having angle-closure predisposes some patients to developing glaucoma[9]. Angle-closure is defined as iridotrabecular contact (ITC) of > 180 degrees. There are two types of glaucoma: open-angle and closed-angle. There are three types of angle-closure disease. Primary angle closure suspects (PACS) in an eye with an ITC > 180 degrees with normal IOP and without peripheral anterior synechia (PAS). The second type is primary angle closure (PAC) has an ITC > 180 degrees and either high IOP or PAS. The final group is primary angle closure glaucoma (PACG); defined as an ITC > 180 degree, high IOP or PAS, and have developed glaucomatous optic neuropathy.

While there has been significant study on an elevated IOP related to goggles wearing in the general population, there has been a lack of research on PACS and PAC and angle-closure patients,. Angle-closure is more common in Asians than in Europeans and Africans[10, 11]; therefore, we attempted to study whether wearing goggles resulting in IOP rising in patients with the early stages of glaucoma.

Methods

This prospective cohort study involved 40 angle-closure patients (20 with PACS and 20 having PAC).

This study was approved by the Thammasat University Hospital Human Ethics Committee and performed in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants.

Inclusion criteria were ages between 18 - 80 years old, patients with PACS or PAC, and an IOP of < 30 mmHg. We excluded patients with only one functional eye, end-stage glaucoma, and corneal abnormalities.

IOP was measured using Goldmann applanation technique over a 30-min period. There were 5 instances of measurement: at baseline (without goggles), immediately after putting goggles on, at 10 and 30 min while wearing goggles, and immediately after removal of goggles at 30 min. IOP measurements were taken twice at each juncture, and the two consecutive measurements (mmHg) were averaged. We altered regular swimming goggles by removing the plastic lens to permit IOP measurement. Patients were instructed on how to place the goggles on correctly. Goggle strap tightness was determined to be correct if the patient could place two fingers between the strap and the back of head.

Results

The average age was 61.55 ± 8.55 years; the male to female ratio was 4:6.

Table 1 Demographic data

	Total	PACS group	PAC group
Number of participants	40	20	20
Average age ± SD (years)	61.55 ± 8.55	61.05 ± 6.51	62.05 ± 10.35

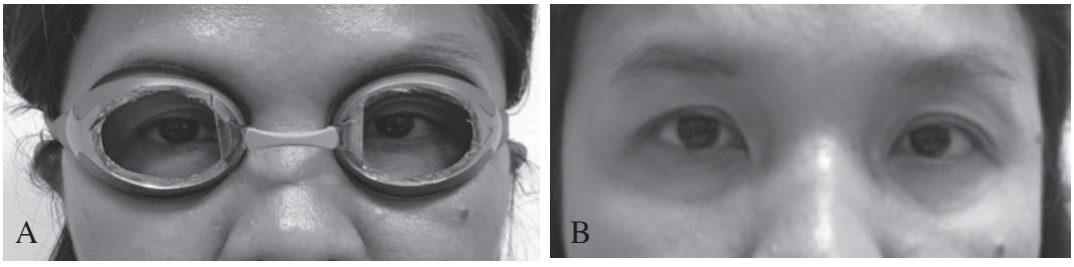

Figure 1A Patient with special altered goggles
Figure 1B Compression markings at periocular tissue after goggle removal

The average IOP in all angle-closure patients at baseline was 15.25 ± 4.00 mmHg, immediately post-wearing was 17.43 ± 4.49 mmHg, and at 10 min and 30 min post-wearing were 17.95 ± 4.68 and 19.05 ± 5.87 mmHg respectively. After goggle removal, it was 14.8 ± 3.93 mmHg. There was no statistical significance, as determined by paired t-test, in comparing average IOP at all points to baseline (P>0.05). (Figure 2.)

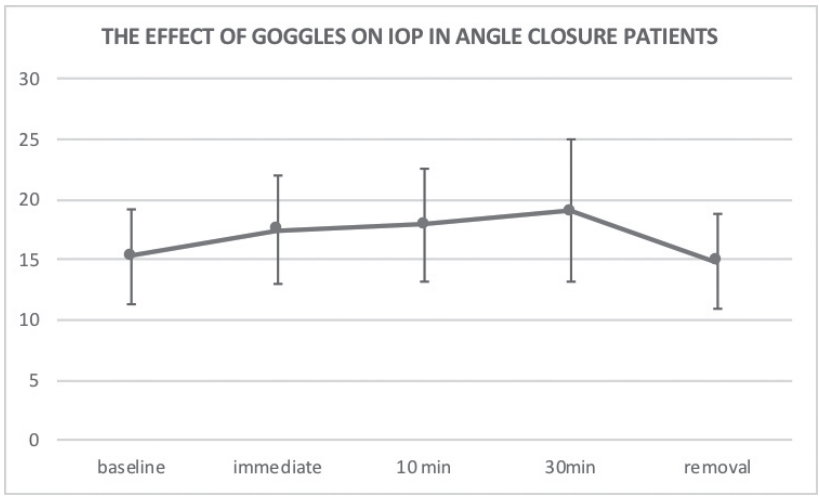

Figure 2. Average IOP over 30 min: no statistically significant difference in average IOP at each point as compared to the baseline (P>0.05).

In a subgroup analysis of the 20 PACS versus 20 PAC patients there was also no statistical significance, as determined by paired t-test, in IOP at each point when compared to baseline (P>0.05) for both groups.

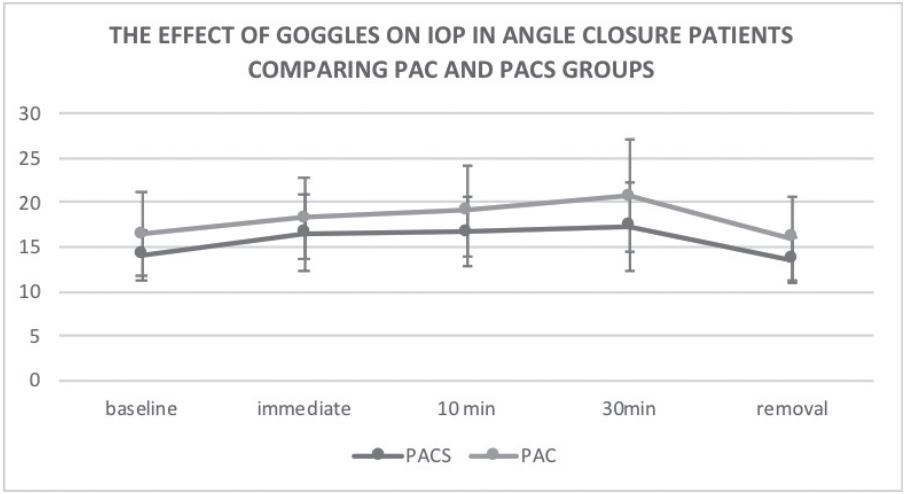

Figure 3. Using the paired t-test, there was no statistically significant difference in average IOP at each point as compared to baseline (P>0.05) for both.

Discussion

In Thailand, the government has promoted various public health initiatives including participation in aerobic activities. As mentioned, this presents somewhat of a challenge. Thailand has an aging population[12,] most of whom are at risk for glaucoma. While doing aerobics may reduce IOP[4], wearing goggles for protective reasons while exercising, i.e. swimming, causes IOP elevation[5-7]. This is likely due to compression on the periorbital tissue. Any increase in IOP may lead to optic nerve damage in glaucoma patients; however, Franchina M et al. demonstrated wearing goggles was not necessarily associated with an increased prevalence of glaucoma[8].

In our study, the highest increase in IOP occurred at 30 min after putting the goggles on: 25% above baseline. This is similar to a study by Kyoung Tak Ma et al. showing a 24% rise from baseline in a normal population[5]. We also noted in our subgroup analysis, PACS patients had a 23% increase, and those with PAC had 26.5%. Thus, we can assume that the rise in IOP was merely a compression effect and not associated with patients' angle status.

The first caveat within our study would be the necessary removal of the goggle lens to facilitate IOP measurement; no doubt, this altered the IOP rise albeit slightly. It would be good to examine this further. In addition, there is potential variability in goggle strap tightness for each patient as this was not independently measured.

Conclusion

Angle-closure patients wearing goggles did experience a slight increase in IOP of about 2-4 mmHg or 25% from baseline, the IOP returned to the baseline after removal. This temporary rise in IOP was not statistically significant. Although wearing goggles appears to be safe, even for angle closure patients, it might be prudent for at-risk patients to intermittently remove their goggles while exercising so that the slight IOP rising could be mitigated.

References

1. Heijl A, Leske MC, Bengtsson B, Hyman L, Bengtsson B, Hussein M; Early Manifest Glaucoma Trial Group. Reduction of intraocular pressure and glaucoma progression: results from the Early Manifest Glaucoma Trial. Arch Ophthalmol. 2002 Oct;120(10):1268-79
2. Toris CB, Yablonski ME, Wang YL, Camras CB. Aqueous humor dynamics in the aging human eye. Am J Ophthalmol. 1999 Apr;127(4):407-12.
3. Gabelt BT, Kaufman PL. Changes in aqueous humor dynamics with age and glaucoma. Prog Retin Eye Res. 2005 Sep;24(5):612-37.
4. Qureshi IA. Effects of mild, moderate and severe exercise on intraocular pressure of sedentary subjects. Ann Hum Biol. 1995 Nov-Dec;22(6):545-53.
5. Ma KT, Chung WS, Seo KY, Seong GJ, Kim CY. The effect of swimming goggles on intraocular pressure and blood flow within the optic nerve head. Yonsei Med J. 2007 Oct 31;48(5):807-9.
6. Morgan WH, Cunneen TS, Balaratnasingam C, Yu DY. Wearing swimming goggles can elevate intraocular pressure. Br J Ophthalmol. 2008 Sep;92(9):1218-21.
7. Paula AP, Paula JS, Silva MJ, Rocha EM, De Moraes CG, Rodrigues ML. Effects of Swimming Goggles Wearing on Intraocular Pressure, Ocular Perfusion Pressure, and Ocular Pulse Amplitude. J Glaucoma. 2016 Oct;25(10):860-864.
8. Franchina M, Yazar S, Booth L, Wan SL, Cox K, Kang MH, Hewitt AW, Mackey DA. Swimming goggle wear is not associated with an increased prevalence of glaucoma. Br J Ophthalmol. 2015 Feb;99(2):255-7.
9. Thomas R, Parikh R, Muliyil J, Kumar RS. Five-year risk of progression of primary angle closure to primary angle closure glaucoma: a population-based study. Acta Ophthalmol Scand. 2003 Oct;81(5):480-5.
10. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. Br J Ophthalmol. 2006 Mar;90(3):262-7.
11. Wong TY, Loon SC, Saw SM. The epidemiology of age related eye diseases

in Asia. Br J Ophthalmol. 2006 Apr;90(4) :506-11.
12. Knodel, J., & Chayovan, N. Population Ageing and the Well-Being of Older Persons in Thailand. Ann Arbor: Population Studies Center, University of Michigan, Institute for Social Research. 2008