Tropical Journal of Pharmaceutical Research March 2024; 23 (3): 625-632
ISSN: 1596-5996 (print); 1596-9827 (electronic)

Available online at http://www.tjpr.org
http://dx.doi.org/10.4314/tjpr.v23i3.18

Original Research Article

Neodymium-yttrium aluminum garnet (Nd: YAG) laser vitreolysis versus oral iodized lecithin tablets for the management of symptomatic vitreous opacities

Mochi Yang, Zichang Chen, Jinxing Wang, Hongli Zhang, Xuemin Tang, Yaling Ma*

Department of Ophthalmology, General Hospital of Ningxia Medical University, Yinchuan 750004, China

For correspondence:* ***Email:* *myleye@163.com*

Sent for review: 30 August 2023 *Revised accepted: 24 February 2024*

Abstract

Purpose: *To evaluate the comparative therapeutic effectiveness and safety of neodymium-yttrium aluminum garnet (Nd: YAG) laser vitreolysis and oral iodized lecithin tablets in treating symptomatic vitreous opacities caused by posterior vitreous detachment.*

Methods: *111 patients admitted to the General Hospital of Ningxia Medical University China were enrolled and randomly assigned to study and control groups. The study group comprised 56 patients (58 eyes) undergoing YAG laser treatment while control group comprised 55 patients (60 eyes) taking oral iodized lecithin tablets. Visual acuity, contrast sensitivity, intraocular pressure (IOP), macular central fovea thickness, retinal nerve fiber layer thickness, efficacy rates, and vitreous opacity scores were assessed in both groups before and after treatment, with follow-up at intervals.*

Results: *No significant changes were seen in best-corrected visual acuity (BCVA) and intraocular pressure (IOP) within or between groups after treatment. Contrast sensitivity in the study group improved significantly ($p < 0.05$), while control group showed no improvement. The study group also exhibited significantly higher post-treatment contrast sensitivity compared to control group ($p < 0.05$). Furthermore, laser group displayed a significantly higher effectiveness in subjective scores ($p < 0.01$), while objective vitreous opacity scores differed significantly before and after treatment in both groups ($p < 0.01$), with intergroup differences also significant ($p < 0.01$). Furthermore, the study group reported better subjective outcomes and objective vitreous opacity scores after treatment ($p < 0.01$). There were no significant adverse reactions in either group.*

Conclusion: *The findings show that Nd: YAG laser vitreolysis demonstrates superior efficacy compared to oral iodized lecithin tablets for treating symptomatic vitreous opacities, with no significant adverse effects. Future studies should employ a larger sample size with long-follow-up periods.*

Keywords: *Vitreolysis, Nd-YAG laser, Iodized lecithin tablets, Vitreous floaters, Contrast sensitivity*

Tropical Journal of Pharmaceutical Research is indexed by Science Citation Index (SciSearch), Scopus, Web of Science, Chemical Abstracts, Embase, Index Copernicus, EBSCO, African Index Medicus, JournalSeek, Journal Citation Reports/Science Edition, Directory of Open Access Journals (DOAJ), African Journal Online, Bioline International, Open-J-Gate and Pharmacy Abstracts

INTRODUCTION

Symptomatic vitreous opacity, commonly known as floaters is categorized into physiological and pathological types. Physiological floaters are more common and usually do not affect vision significantly. In the past, a wait-and-see approach or the use of medication, such as

iodized lecithin tablets (ILT), has been utilized as a treatment option for vitreous opacities [1]. However, with improvements in living standards and increasing demand for visual quality, more effective treatments are being studied to alleviate symptoms [2,3]. In recent years, neodymium-yttrium aluminum garnet (Nd: YAG) laser vitreolysis has gained popularity in clinical practice. Nevertheless, there is still controversy surrounding its safety and efficacy [4,5].

The objective of this study was to investigate the efficacy of Nd: YAG laser vitreolysis when compared to ILT in the treatment of symptomatic vitreous opacities.

METHODS

Patients

This retrospective study included 111 patients with symptomatic vitreous opacity (118 eyes) who visited the ophthalmic outpatient Department of the General Hospital of Ningxia Medical University between May 2020 and May 2021. A total of 56 cases (58 eyes) were treated with Nd: YAG laser vitreolysis designated the study group and 55 cases (60 eyes) treated with ILT and designated control group.

Ethical maters

This study was approved by the ethics committee of the General Hospital of Ningxia Medical University (approval no. 20201002). Protocol for this study was done according to the guidelines of Declaration of Helsinki [6] and written informed consent was obtained from the patients and/or guardians.

Inclusion criteria

Patients above 30 years of age with symptomatic vitreous opacities due to posterior vitreous detachment (PVD), including Weiss rings, for at least 6 months; urgent desire for treatment due to the main complaint of symptomatic floaters, and patients whose vitreous floaters were located in the center of the vitreous cavity over 3 mm away from the retina and lens, detected by fundus examination after mydriasis. All patients were informed of the risks, benefits, and purpose of the treatment and signed informed consent forms.

Exclusion criteria

A history of intraocular surgery, vitreous proliferation, uveitis, acute PVD, fundus disease, and other ocular diseases that may affect treatment or cause complications; patients with retinal peripheral lesions, tears, retinal degeneration, and tractional pathology in the vitreoretinal interface; cornea, aqueous humor, or lens opacity that affects laser penetration, and those lost to follow-up.

Baseline examination

Baseline examination included patient's family, ocular, and clinical history. Snellen best-corrected visual acuity (BCVA), non-contact intraocular pressure (IOP), Pelli-Robson contrast sensitivity test at a distance of 1 m, anterior segment assessment (using a slit lamp), dilated fundus examination (using an indirect ophthalmoscope), slit-lamp biomicroscopic ophthalmoscopy using Goldmann 3-mirror lens and double aspheric lens (90D) were investigated. Additionally, thickness of the macular central fovea (FT) and the retinal nerve fibers layer (RNFL) were measured using macular optical coherence tomography (OCT) (Cirrus 4000 HD OCT, Zeiss, Dublin, CA).

The patient's vitreous opacity in the optical zone in front of the posterior retina was objectively scored using a masking system: A score of "0" indicated no visible vitreous floater. A score of "1" indicated dotted vitreous floaters or vitreous cortical floats less than 1/2 PD. A score of "2" indicated filamentous or gauzy vitreous floats or vitreous cortical floats measuring 1/2 to less than 2 PD. A score of "3" indicated vitreous cortical floats larger than 2 PD.

Procedures

After being fully dilated with 1 % compound tropicamide, patients in the YAG laser group underwent Nd: YAG laser vitreolysis with Ultra Q-Reflex technology (Ellex Medical PTY, Adelaide, South Australia) under the care of an experienced clinician. The eye was anesthetized with proparacaine hydrochloride eye drops, and a contact lens was applied to the eye. The YAG laser was set to a spot diameter of 8 µm, with a pulse duration of 4 ns, and an initial energy of 1.5 mJ. Only one pulse per burst was performed. The laser illumination tower was used in a coaxial manner to create energy in a uniform and homogeneous way, aligning the surgeon's vision, laser beam, and vitreous opacities along the same optical beam. Laser parameters were adjusted by gradually increasing the energy and number of pulses until the floaters were completely vaporized and fragmented.

Safety distance was approximately 3 mm for the lens and 3 mm for the retina. The total number of

impacts per laser session for one patient was 500, and pulse energy did not exceed 5.5 mJ to avoid damaging the retina. If the vitreous opacities did not significantly improve after the first treatment due to the large area, a second session of laser intervention was performed following the same procedure at an interval of 1 month. The intraocular pressure (IOP) was measured 30 min after the intervention ended. Patients in the control group were treated using oral iodized lecithin tablets (Daiichi Yakuhin Sangyo Co. Ltd, Specification: 1.5 mg/piece) 3 mg three times per day, for 3 months.

Follow-up

Follow-up visits for study group were scheduled for 1 day, 2 weeks, 1 month, and 3 months after the procedure. During these visits, the best-corrected visual acuity (BCVA) and intraocular pressure (IOP) were measured. Anterior segment assessment was conducted using a slit lamp, and mydriatic fundus examination was performed using an indirect ophthalmoscope and slit-lamp biomicroscopic ophthalmoscopy to rule out ocular inflammation or any other conditions that may impact the study. On the other hand, follow-up visits for the control group were scheduled after 3 months of treatment.

At the last 3-month visit, BCVA, IOP, and contrast sensitivity were recorded for all patients. Additionally, the thickness of macular central fovea and retinal nerve fiber layer was measured and recorded. Patients were also asked to fill out questionnaires to quantify the improvement of floaters after treatment. The scale used for self-rated visual disturbance had 5 grades namely; limited, pronounced, complete, no improvement, and aggravated. The total effective rate (E) of treatment was calculated using Eq 1.

$$E = (En/N)100 \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where En represents the number of eyes with complete disappearance or significant improvement and N is the total number of eyes treated.

Furthermore, during final follow-up visits 3 months later, the vitreous opacity in the optical zone in front of the posterior retina was objectively scored. This score was used to evaluate the final curative effect, which involved a comprehensive analysis of the patient's subjective evaluation and the objective vitreous opacity score. Therapeutic effects of the two methods were compared based on this evaluation.

Statistical analysis

Statistical Package for Social Sciences (SPSS) 23.0 software (IBM, Armonk, NY, USA) was used for data analysis. Measurement data were presented as mean ± standard deviation (SD). Differences in variances were tested using a paired t-test within a group before and after treatment. Inter-group statistical significance of the differences in means was tested by unpaired t-test and Chi-squared test, respectively. Associations of rank data were tested using the Wilcoxon Rank test. $P < 0.05$ was considered statistically significant.

RESULTS

Baseline characteristics of patients

There was no significant difference in age, gender composition, and proportion of patients with myopia between study and control groups ($p > 0.05$; Table 1).

Subgroup analysis

There was no significant difference in Snellen BCVA, IOP, thickness of macular central fovea, and retinal nerve fiber layer between study and control groups before and after treatment ($p > 0.05$). However, the contrast sensitivity of study group was significantly higher after surgery compared to before surgery ($p < 0.05$). In contrast, there was no significant difference in contrast sensitivity in control group before and after treatment ($p > 0.05$). After treatment, the contrast sensitivity of study group was significantly higher compared to control group before surgery ($p < 0.05$; Table 2).

Table 1: Baseline patient characteristics

Characteristic	Study (N = 56)	Control (N = 55)	t/χ^2	*P*-value
Sex				
Male	26(46.4%)	21(38.2%)		
Female	30(53.6%)	34(61.8%)	0.05	0.71
Age (mean ± SD)	46.3±17.9	47.8±16.5	1.87	0.44
High myopia (%)	9 (16.7%)	11(20.0%)	0.04	0.65

Table 2: Characteristics of YAG laser group and control group

Variable	Study group		*P*-value	Control group		*P*-value	Difference between study and control group (3 mo)	*P*-value
	Before	After		Before	After			
BCVA (Mean ± SD)	0.73±0.10	0.72±0.18	0.432	0.72±0.79	0.71±0.86	0.441	0.02	0.854
Sensitivity (Mean ± SD) (%)	2.8±1.2	1.9±1.2	0.029	2.7±1.6	2.6±18	0.397	-0.82	0.036
IOP (mmHg)	15.8±3.6	15.4±5.1	0.539	16.3±3.3	16.7±3.8	0.554	-1.09	0.67
FT (mm)	212.61±5.83	214.45±7.06	0.287	213.59±4.27	211.68±5.41	0.301	2.59	0.326
Thickness of RNFI								
Superior (μm)	129.88±15.03	130.24±14.87	0.491	130.21±14.18	130.39±12.62	0.523	1.34	0.628
Inferior (μm)	133.01±14.92	133.20±14.73	0.480	133.14±14.29	132.98±15.02	0.509	2.51	0.474
Temporal (μm)	75.39±11.77	75.42±12.10	0.544	75.57±13.01	75.61±12.21	0.473	2.68	0.620
Nasal (μm)	82.45±12.89	83.11±13.00	0.322	82.29±13.23	82.37±12.93	0.536	1.75	0.480

Note: BCVA: Snellen best corrected visual acuity; SD: standard deviation; IOP: non-contact intraocular pressure; Sensitivity: contrast sensitivity; FT: thickness of macular central fovea; RNFL: retinal nerves fibers layer

Table 3: Subjective feeling evaluation after treatment N (%)

Degree	Study	Control	χ^2	Wilcoxon Z-score	*P*-value
	N = 56	N = 55			
No improvement	0	5(9.1%)	44.010	3.506	< 0.01
Limited	18(32.2%)	29(52.7%)			
Pronounced	27(48.2%)	18(32.7%)			
Complete	11(19.6%)	3(5.5%)			
Aggravated	0	0			

Table 4: Subjective feeling evaluation after treatment N (%)

Score	Study group		χ^2	Control group		Wilcoxon Z-score	χ^2	*P*-value
	Before	After		Before	After			
0	0	13(23.2%)	40.116	0	1(1.8%)	2.981	59.969	< 0.01
1	9(16.1%)	36(64.3%)		11(20.0%)	16(29.1%)			
2	21(37.5%)	7(12.5%)		24(43.6%)	24(43.6%)			
3	26(46.4)%	0		20(36.4%)	14(25.5%)			

Effectiveness/efficacy

According to the rank sum test, there was a significant difference in subjective feeling evaluation between study and control groups ($p < 0.01$). The total effective rate of treatment in study group (67.9 %) was significantly higher compared to control group (38.2 %, $p < 0.01$; Table 3).

Subjective feeling evaluation

The results of the rank sum test analysis indicated that there were significant differences in objective scores of vitreous opacities before and after treatment in both groups ($p < 0.01$). Also, there was a significant intergroup difference after treatment ($p < 0.01$; Table 4).

Adverse effect

In the study group, 24 h after the operation, there were 3 cases of anterior retinal hemorrhage, in which 1 case after the first session and other 2 cases after the secondary session, and all were absorbed 1 month after laser operation. After the intervention, no patients in the study group had treatment-related complications such as higher IOP, serious lens damage, retinal tears, iridocyclitis, and abnormal vitreous changes. No serious adverse effects were observed in both groups.

DISCUSSION

The vitreous humor is a transparent, gel-like substance that occupies almost 80 % of the volume of the eye and is composed of 99 % water, collagen fibers, mucopolysaccharide and hyaluronic acid. When the vitreous liquefies, patients generally notice the appearance of “floaters” which are described as spots, lines, hairs, or cobwebs suspended or moving in the visual field. These visual disturbances such as a Weiss ring or other solitary vitreous opacities are common and have been underestimated as symptoms with little significance and without the need for therapeutic intervention, especially in areas where the economy is underdeveloped in China. People with ocular disorders not only have a higher prevalence but also face a greater risk of developing depression and anxiety compared to those without such conditions [2,3]. This finding goes beyond what was initially expected [4]. Individuals with ocular disorders may perceive limitations in their visual abilities, which may have a significant impact on their overall well-being. These limitations affect various aspects of daily life, including reading, driving, and recognizing faces [7,8].

With advancements in modern surgery, pars plana vitrectomy has emerged as an economical and effective technique for treating floaters. One potential risk is the development of progressive cataracts within a relatively short period after the surgery. Cataract refers to the clouding of the natural lens of the eye, which causes blurry vision and visual disturbances. Although the occurrence of cataracts post-vitrectomy is a possibility, the exact incidence and severity may vary among individuals [9]. Another risk to consider is the possibility of retinal detachment as a complication of the surgical procedure. Retinal detachment occurs when the retina, the light-sensitive tissue at the back of the eye, separates from its normal position, however, the occurrence of this complication is relatively rare [10]. While pars plana vitrectomy is an effective treatment option for floaters, it is essential to weigh the potential risks, such as progressive cataracts and the possibility of retinal detachment, against the expected benefits in each case [9-10].

Iodized lecithin tablets (Daiichi Yakuhin Sangyo Co. Ltd) contain soy lecithin and iodine, which stimulates the thyroid gland to increase the production of thyroid hormones, leading to an overall increase in metabolism throughout the body, including the retina. The active ingredient is efficiently absorbed and has been shown to improve the function of the retina epithelial pigment. This facilitates the removal of foreign bodies in the vitreous and promotes the recovery of vision function in patients [11]. The effectiveness of iodized lecithin tablets for treating vitreous opacities varies, with different studies reporting different rates of effectiveness [1,12]. While the curative effects of this medication may be limited, it remains a commonly used oral medication in clinical practice. The laser Ultra-Q Reflex Nd: YAG (Ellex) has been specifically designed for the vaporization of floaters. Furthermore, the laser for vitreolysis is a less invasive technique when compared with vitrectomy [10,13]. According to the results of several studies, vitreolysis with Nd: YAG laser has shown a high rate of improvement in many cases, with no significant complications associated with the procedure [14,15]. Few studies have directly compared the efficacy and safety of the Ultra Q-Reflex Nd: YAG laser and ILT in common clinical practice. Therefore, this study aimed to investigate the effects of vitreolysis using Nd: YAG laser and ILT in patients with symptomatic vitreous opacities.

The findings from this study indicated that there was no significant difference in best-corrected

visual acuity (BCVA) between the study and control groups. However, the contrast sensitivity of study groups (subjects who underwent YAG laser vitreolysis) showed a better significant improvement in a short period compared to control groups (those treated with oral ILT). These results suggest that the severity of vitreous opacity in the subjects was not enough to impact BCVA after either treatment method. Furthermore, contrast sensitivity was supposed to have a greater impact on patients' visual function with vitreous opacity than BCVA. The findings are in tandem with earlier studies [16]. Another study conducted by Ludwig *et al* [13] reported no difference in contrast sensitivity before and after laser treatment using a Zeiss device. It is important to note that their treatment involved only a single session of laser treatment, which differs from the one or two sessions used in this study. Additionally, there is still evidence suggesting a noticeable reduction in contrast sensitivity following posterior vitreous detachment [17,18]. This highlights the importance of considering contrast sensitivity in patients with vitreous floaters.

The study group showed better curative effectiveness compared to control group. Preoperative fundus examination revealed the presence of obvious single, flaky, circular vitreous opacities, which significantly decreased or disappeared after the operation. A large majority of the patients in the study group experienced improvement after the intervention, characterized by dotted vitreous floaters or vitreous cortical floats less than 1/2 PD. Only one patient in the study group had a size of more than 2 PD vitreous cortical floats. Also, total effective rate was significantly higher in study group compared to control group. It is important to note that there were no cases where patients felt aggravated after treatment with either method. During the study, a slight discrepancy emerged between patients' subjective evaluations and the objective evaluation. For instance, 48.2 % of study group reported pronounced improvement, whereas 64.3 % of patients were evaluated as having dotted vitreous floaters or vitreous cortical floats less than 1/2 PD. This suggests that although the simple dispersion of vitreous opacities did not completely clear away, patients considered their symptoms to have improved. This difference may be attributed to varying levels of patient expectations and demands, and these findings are consistent with previous studies [13,19]. The present study reported a significant improvement in floaters' symptoms after YAG laser vitreolysis. This finding agrees with those of Lugwig *et al* [13] and Shah *et al* [19].

Also, this study showed that a minimum number of patients experienced IOP spikes after the procedure by an Ultra Q Reflex system [7,15]. Patients experienced an increase in IOP which may be due to a dysfunction in the trabecular meshwork in older patients which is treated with eyedrops [7]. Some researchers hypothesized that treatment might obstruct the trabecular meshwork by floating debris, macrophages, or other inflammatory cells [20]. In this study, there was no increase in IOP in study group compared to control group before and after the procedure, and this agrees with previous studies [13,20]. Furthermore, the thickness of macular central fovea and retinal nerve fiber layers were not significantly different after the intervention. However, it has been reported that several retina complications occurred after YAG laser vitreolysis which might be due to high myopia [19-22]. Therefore, monitoring IOP should still be emphasized. No patients in the two groups had treatment-related complications such as serious lens damage, retinal tears, iridocyclitis, and abnormal vitreous changes.

Limitations of the study

The small sample size and short follow-up period limit the results of this study.

CONCLUSION

Neodymium-yttrium aluminum garnet laser vitreolysis is more effective, improves symptoms of vitreous floaters, and is safe in treating symptomatic vitreous opacities compared to traditional treatment with iodized lecithin tablets. Future studies should employ a larger sample size with long-follow-up periods.

DECLARATIONS

Acknowledgements

This work was supported by Ningxia Natural Science Foundation (no. 2021AAC03403), China.

Funding

None provided.

Ethical approval

None provided.

Availability of data and materials

The datasets used and/or analyzed during the

current study are available from the corresponding author on reasonable request.

Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by them.

Open Access

REFERENCES

1. *Kohno H, Terauchi R, Watanabe S, Ichihara K, Watanabe T, Nishijima E, Watanabe A, Nakano T. Effect of lecithin-bound iodine treatment on inherited retinal degeneration in mice. Transl Vis Sci Technol 2021; 10(13): 8.*
2. *Souza CE, Lima LH, Nascimento H, Zett C, Belfort RJ. Objective assessment of YAG laser vitreolysis in patients with symptomatic vitreous floaters. Int J Retina Vitr 2020; 6: 1.*
3. *Heesterbeek TJ, Van Der Aa H, Van Rens G, Twisk J, van Nispen R. The incidence and predictors of depressive and anxiety symptoms in older adults with vision impairment: a longitudinal prospective cohort study. Ophthal Physl Opt 2017; 37(4): 385-398.*
4. *Katsanos A, Tsaldari N, Gorgoli K, Lalos F, Stefaniotou M, Asproudis I. Safety and efficacy of YAG laser vitreolysis for the treatment of vitreous floaters: An overview. Adv Ther 2020; 37(4): 1319-1327.*
5. *Milston R, Madigan MC, Sebag J. Vitreous floaters: Etiology, diagnostics, and management. Surv Ophthalmol 2016; 61(2): 211-227.*
6. *World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA 2013; 310(20): 2191-2194.*
7. *Ivanova T, Jalil A, Antoniou Y, Bishop PN, Vallejo-Garcia JL, Patton N. Vitrectomy for primary symptomatic vitreous opacities: an evidence-based review. Eye 2016; 30(5): 645-655.*
8. *Garcia BG, Orduna MC, Alvarez-Peregrina C, Villa-Collar C, Sanchez-Tena MA. Nd: YAG laser vitreolysis and health-related quality of life in patients with symptomatic vitreous floaters. Eur J Ophthalmol 2021: 484508708.*
9. *Chen X, Yang L, Han J, He Y. Effect of combined use of sodium hyaluronate and rhEGF on xerophthalmia in the elderly after cataract surgery. Trop J Pharm Res 2023; 22(1): 151-157 doi: 10.4314/tjpr.v22i1.21*
10. *Sommerville DN. Vitrectomy for vitreous floaters: analysis of the benefits and risks. Curr Opin Ophthalmol 2015; 26(3): 173-176.*
11. *Milston R, Madigan MC, Sebag J. Vitreous floaters: Etiology, diagnostics, and management. Surv Ophthalmol 2016; 61(2): 211-227.*
12. *Kakulavarapu S, Kiryakoza L, Sridhar J. Complications Int Ophthalmol Clin 2022; 62(3): 131-155.*
13. *Ludwig GD, Gemelli H, Nunes GM, Serracarbassa PD, Zanotele M. Efficacy and safety of Nd: YAG laser vitreolysis for symptomatic vitreous floaters: A randomized controlled trial. Eur J Ophthalmol 2021; 31(3): 909-914.*
14. *Nguyen JH, Nguyen-Cuu J, Yu F, Yee KM, Mamou J, Silverman RH, Ketterling J, Sebag J. Assessment of vitreous structure and visual function after neodymium: yttrium-aluminum-garnet laser vitreolysis. Ophthalmol 2019; 126(11): 1517-1526.*
15. *Singh IP. Modern vitreolysis-YAG laser treatment is now a real solution for the treatment of symptomatic floaters. Surv Ophthalmol 2020; 65(5): 581-588.*
16. *García BG, Orduna Magán C, Alvarez-Peregrina C, Villa-Collar C, Sánchez-Tena MÁ. Nd: YAG laser vitreolysis and health-related quality of life in patients with symptomatic vitreous floaters. Eur J Ophthalmol 2021; 11206721211008036.*
17. *Garcia GA, Khoshnevis M, Yee K, Nguyen-Cuu J, Nguyen JH, Sebag J. Degradation of contrast sensitivity function following posterior vitreous detachment. Am J Ophthalmol 2016; 172: 7-12.*
18. *Sebag J, Yee K, Nguyen JH, Nguyen-Cuu J. Long-term safety and efficacy of limited vitrectomy for vision degrading vitreopathy resulting from vitreous floaters. Ophthalmol Retina 2018; 2(9): 881-887.*
19. *Shah CP, Heier JS. YAG laser vitreolysis vs sham YAG vitreolysis for symptomatic vitreous floaters: A randomized clinical trial. JAMA Ophthalmol 2017; 135(9): 918-923.*
20. *Cowan LA, Khine KT, Chopra V, Fazio DT, Francis BA. Refractory open-angle glaucoma after neodymium-yttrium-aluminum-garnet laser lysis of vitreous floaters. Am J Ophthalmol 2015; 159(1): 138-143.*
21. *Liu X, Wang Q, Zhao J. Acute retinal detachment after Nd: YAG treatment for vitreous floaters and posterior capsule opacification: a case report. BMC Ophthalmol 2020; 20(1): 157.*
22. *Shah CP, Heier JS. Long-term follow-up of efficacy and safety of YAG vitreolysis for symptomatic Weiss ring floaters. Osli Retina 2020; 51(2): 85-88.*

23. Rangchian A, Hubschman JP, Kavehpour HP. Time-dependent degradation of vitreous gel under enzymatic reaction: Polymeric network role in fluid properties. J Biomech 2020; 109: 109921.