Original Article

Nd: YAG laser of Weiss Ring for the Treatment of Symptomatic Vitreous Floaters in Patients with Posterior Vitreous Detachment

PJO – Official Journal of Ophthalmological Society of Pakistan

Muhammad Kaunain Ghoghari[1], Hunain Razzak[2]
Zeeshan Kamil[3], Syed Fawad Rizvi[4], Ali Afsar[5]
[1-5]LRBT Tertiary Teaching Eye Hospital, Korangi, Karachi

ABSTRACT

Purpose: To assess the effect of Nd: YAG laser vitreolysis of the Weiss ring in the management of symptomatic vitreous floaters in patients with posterior vitreous detachment in the outpatient department of a tertiary care hospital.

Study Design: Quasi-experimental study.

Place and Duration of Study: This quasi-experimental trial was conducted in the out-patient department (OPD) of The Layton Rahmatullah Benevolent Trust (LRBT) Tertiary Teaching Eye Hospital, Korangi, Karachi from February 2023 to July 2023.

Methods: In this study, 75 eyes of 75 patients were selected using non-probability purposive sampling technique. Dilated fundus examination was performed and The National Eye Institute Visual Function Questionnaire 25 (NEI VFQ-25) was used and compared pre and post Laser Floater Treatment (LFT).

Results: Out of 75 eyes, 65 patients were included in final analysis. Mean age was 54.63±4.1 years. Out of these, 69.2% were 48–56 years old and 56.9% were females. Mean number of shots were 160±15.53. Mean Pre-LFT, VFQ was 56±5.89 and post-LFT was 74±13.2. The mean difference pre versus post treatment was -18 units with p<0.001. Twenty patients complained of blurring of vision and one patient suffered mild retinal hemorrhage which resolved spontaneously, two patients were lost to follow up.

Conclusion: Nd: YAG laser vitreolysis of the Weiss ring can be a quick, and effective treatment option in patients suffering from symptoms of vitreous floaters after a posterior vitreous detachment. However, more trials with large number of patients and longer follow up durations are required for generalization of results.

Keywords: Nd: YAG vitreolysis, Weiss ring, Vitreous Floaters, Posterior Vitreous Detachment (PVD), National Eye Institute Visual Function Questionnaire 25 (NEI VFQ-25), Laser Floater Treatment.

How to cite this Article: Ghoghari MK, Razzak H, Kamil Z, Rizvi F, Afsar A. Nd: YAG laser of Weiss Ring for the Treatment of Symptomatic Vitreous Floaters in Patients with Posterior Vitreous Detachment. 2024;40(4):364-368. **Doi:10.36351/pjo.v40i4.1848**

Correspondence to: Muhammad Kaunain Ghoghari
LRBT Tertiary Teaching Eye Hospital, Korangi Karachi.
Email: krghoghari@gmail.com

Received: April 29, 2024
Accepted: August 31, 2024

INTRODUCTION

Floaters in vision, when present in the visual axis can interfere with visual perception, presenting as moving dark spots and annoy the patient both physically and mentally.[1,2] Senile structural and molecular changes in vitreous cause liquefaction of the vitreous gel and condensation of hyaluronan and collagen macromolecules resulting in these entoptic floaters.[3] A significant volume of patients visit retina clinics with complaints such as glare, hazy vision and blurring in daily activities for several months due to symptomatic vitreous floaters after posterior vitreous detachment (PVD).[4,5] A PVD, often clinically evident as a Weiss ring, is present in 65% of patients over 65 years. Weiss

ring is an annular, remnant peri papillary fibro-glial tissue which may be visible clinically floating freely over the optic nerve after vitreo-papillary separation. This ring casts circular or semicircular shadows onto the retina which the patient perceives as bothersome floaters especially when close to the macula in the visual axis.[6,7]

Most of the patients adapt to the condition due to neuroadaptation or gravitational displacement but some patients especially myopes, pseudophakic and smartphone users consider them disturbing and seek treatment.[8,9] Existing management solutions are 1) observation, 2) Nd: YAG laser vitreolysis and 3) surgical vitrectomy. The conventional pars plana vitrectomy (PPV) is an invasive method with risks of complications. Recent technological advancements in Nd: YAG lasers have optimized and improved its efficacy and safety profile. It is important to bear in mind that laser vitreolysis is not proposed to substitute or contest with vitrectomy surgery, but it offers a modern, non-invasive, quick vitreolysis solution for selective candidates with specific floaters.[10,11]

Nd: YAG (neodymium-doped yttrium aluminum garnet) is a crystal that is used as a laser medium for solid-state lasers. The mechanism of Nd: YAG laser Weiss ring vitreolysis is photo-disruption of the Weiss ring and eventual displacement outside the visual axis. Short intense pulses are used to produce energy bursts that vaporize the Weiss ring into plasma by rising the temperature over 1000 Kelvin at a limited spot. Studies have shown that Nd: YAG laser vitreolysis alleviates symptomatic vitreous floaters.[12]

Our present study aims to treat symptomatic vitreous floaters by Nd: YAG laser vitreolysis of the Weiss ring in patients with posterior vitreous detachment in the outpatient department of a tertiary care hospital.

METHODS

This quasi-experimental trial was conducted in the out-patient department (OPD) of The Layton Rahmatullah Benevolent Trust (LRBT) Tertiary Teaching Eye Hospital, Korangi, Karachi from February 2023 to July 2023. After obtaining approval from the Hospital Ethical Review Committee, we used non-probability purposive sampling technique and included a total of75 eyes of 75 patients after taking informed consent and explaining nature of procedure and possibility of the adverse consequences of the procedure. Following patients were included; symptomatic vitreous floaters for 6 months or more, posterior vitreous detachment and Weiss ring evident on clinical examination, age 40 years or above, willing to undergo vitreolysis and compliance of the related risks and ability for regular follow up. The study excluded patients with acute posterior vitreous detachment (<6 months), PVD without an evident Weiss ring on clinical examination, <40 years age, only-eyed patients and history of uveitis, diabetic retinopathy, macular edema, glaucoma, retinal breaks/detachment, retinal vein occlusion, vitreous hemorrhage and other vitreous pathologies.

Before the laser floater treatment (LFT), patient's age, sex, lens status, Best Corrected Visual Acuity (BCVA) and Intra Ocular Pressure (IOP) were recorded. Dilated fundus examination was performed and the presence and size of the Weiss ring was observed. The quality of vision was documented using the Visual Function Questionnaire (VFQ-25).[13] The pupil was dilated using Tropicamide 1% and Proparacaine drops were used as topical anesthesia. The Ocular Peyman 12.5mm, 18mm and 25mm Wide Field Lens set and/or the Ocular Mainster PRP 165 Lens was used to visualize the Weiss ring on the Nidek YC-1800 Ophthalmic YAG Laser System. The retina and lens were kept out of focus. Anterior offset of 125um was maintained. Single pulsed shot was selected and power was set at a minimum of 4mJ which was increased until the disruption of the Weiss ring was noticed (range 4-10mJ). The Weiss ring was vitriolized/displaced after which the patients were called for regular follow ups at 2 weeks, 1 month, 3 month and 6 months after the procedure to assess the efficacy and the safety profile of the laser vitreolysis. After 6 months dilated fundoscopy was performed to examine the vitriolized/displaced Weiss ring. The quality of vision was documented again using the VFQ-25.

Data was analyzed using IBM-SPSS version 23.0. Paired sample t-test was used to compare the LFT VFQ scores, stratification with gender and age group was also done to measure the effect of both factors on LFT VFQ scores. P-values less than 0.05 were considered statistically significant.

RESULTS

In the present study sixty-five patients out of 75 were included with mean age of 54.63±4.10. Majority

(69.2%) were between 48 and 56 years of age and 56.9% were female. Mean number of shots were 160±15.53. Table-1 reports the baseline characteristics of the studied sample.

Table 1: *Baseline Characteristics of Studied Samples.*

Variables		N	%
Age Group	48 – 56 years	45	69.2
	57 – 62 years	20	30.8
	Mean ±SD	54.63	±4.10
Gender	Female	37	56.9
	Male	28	43.1
Number of Shots	Mean ±SD	160.0	±15.53

Table-2 reports the comparison of pre and post LFT VFQ scores. Results showed that mean pre-LFT VFQ score was 56±5.89and mean post-LFT VFQ score was 74±13.2. The mean difference pre versus post treatment was -18 units (p<0.001).

For age group 48–56 years, mean difference pre-versus post-treatment was -18.13 units (p<0.001) and for age group 57–62 years sample mean difference pre-versus post-treatment was -17.70 units (statistically significant with p<0.001). For females, mean difference pre- versus post-treatment was -16.10 units (statistically significant with p<0.001), whereas for male sample mean difference pre- versus post-treatment was -20.50 units (statistically significant with p<0.001).

Bar diagram 2 showing a significant increase in LFT VFQ at post level in overall samples, also with respect to age group and gender.

DISCUSSION

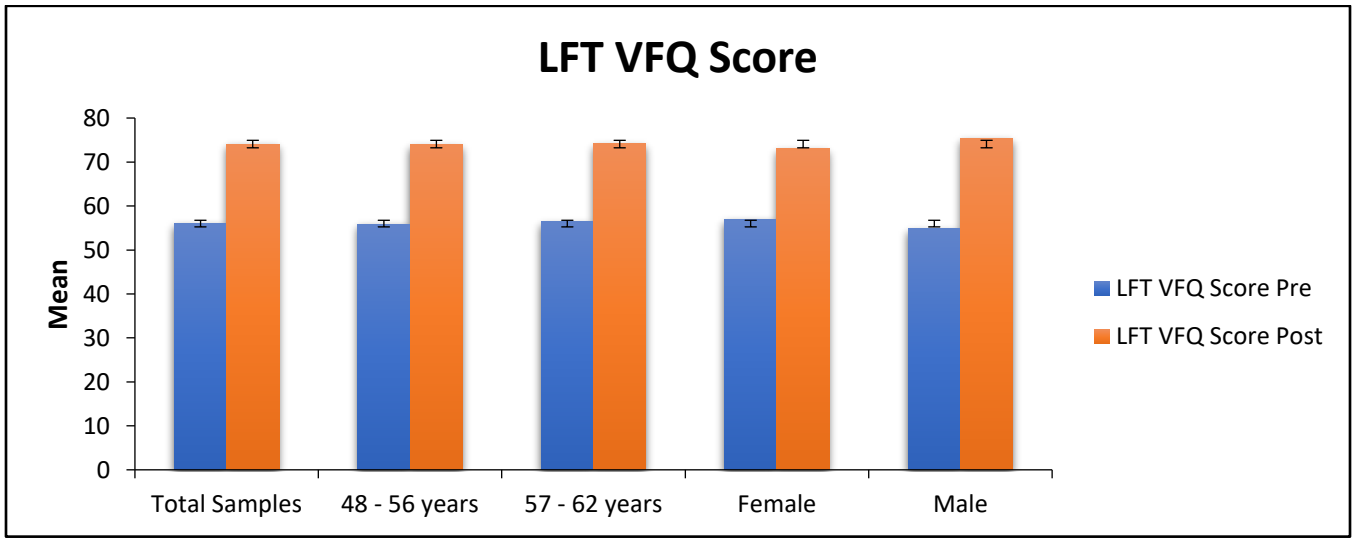
Nd: YAG laser has been widely used for the treatment of many conditions such as posterior capsular opacification, pupillary membrane, retro-hyaloid hemorrhage, sickle cell retinopathy and vitreous cysts.[14-17]

In 1993 Tsai et al, first used YAG laser for vitreolysis to treat 15 patients and reported patient relief without any adverse effects.[18] Similarly Delaney et al, conducted a retrospective study with 42 eyes in 31 patients that were subjected to either laser vitreolysis or vitrectomy surgery and determined that

Table 2: *Comparison of LFT VFQ scores.*

Variables		Pre-LFT VFQ Score		Post-LFT VFQ Score		p-value
		Mean	SD	Mean	SD	
Total Samples	N=65	56.0	5.89	74.0	13.2	<0.001*
Age Group	48 – 56 years	55.80	5.53	73.93	15.51	<0.001*
	57 – 62 years	56.45	6.77	74.15	6.02	<0.001*
Gender	Female	56.86	5.53	72.97	5.06	<0.001*
	Male	54.86	6.25	75.36	19.49	<0.001*

*p<0.05 was considered statistically significant using paired sample t-test



Graph 2: LFT VFQ score bar diagram.

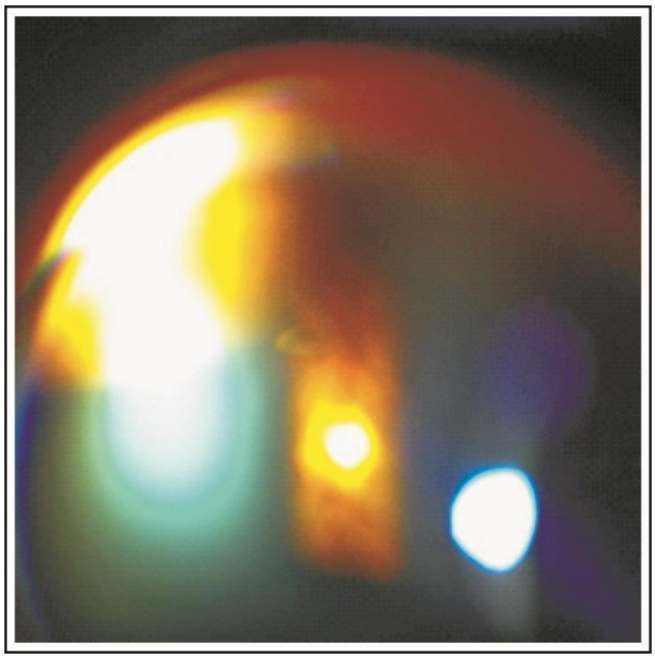


Figure 1: Right Eye with Weiss ring present before Nd YAG laser vitreolysis.

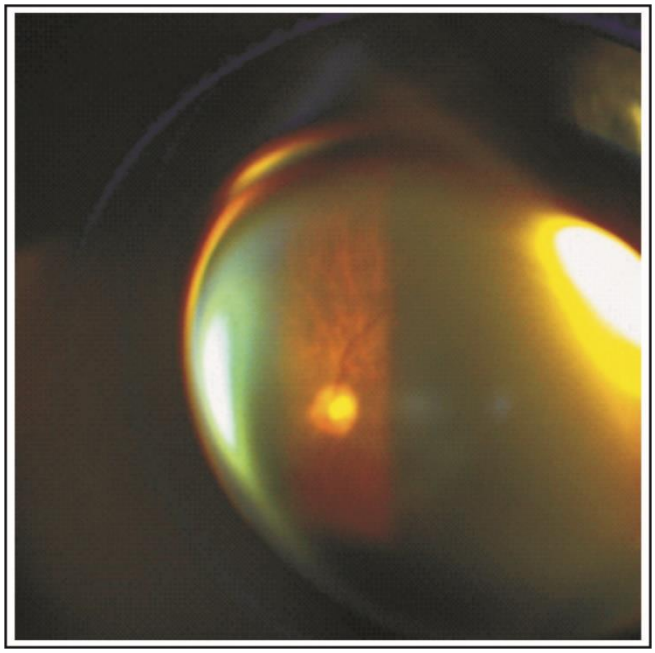


Figure 2: Right Eye with Weiss ring absent after Nd YAG laser vitreolysis.

vitreolysis was safer but not as successful as vitrectomy.[19] It is vital to note that the Nd: YAG laser vitreolysis is not proposed to substitute or contest with the vitrectomy surgery but de Nie et al,[20] reported macular hole/edema, retinal detachment, epiretinal membrane and resistant glaucoma after vitrectomy surgery for floaters.[20] However, Navarro et al, described excellent patient satisfaction without any complication after performing pars plana vitrectomy in 16 eyes.[21]Shah et al, performed a randomized, masked, sham-controlled trial in 36 patients and 16 control who were subjected to either YAG vitreolysis or sham laser, he reported greater symptomatic relief and visual improvement in the vitreolysis group compared to sham laser.[10] Ludwig et al, reported improvement in floater symptoms of 77% patients in the intervention group after a single laser YAG session compared with only 25% in the control group.[1] Singh IP et al, concluded that the improved visualization, energy delivery and cooling mechanisms offered by recent technological advanced YAG lasers have revolutionized the modern vitreolysis experience.[11]In another study by Bessa, 66.23% patients reported satisfaction one year after vitreolysis.

In the present study, a significant subjective improvement in the quality of vision 56±5.89versus 74±13.2 was noted with the NEI VFQ-25 at 6 months. There were no adverse effects like cataract, macular edema, retinal detachment, retinal breaks or IOP spikes, which supports the safety profile of this procedure. However, a patient suffered from mild retinal hemorrhage which resolved spontaneously within few weeks. Twenty patients complained of blurring of vision after LFT which resolved the next day.

In a study by I-Ting Sun et al, rapid cataract development was noted in a patient who underwent laser vitreolysis.[23] Similarly, Roderick O'day et al, reported bilateral posterior capsular injury resulting in cataract formation and the patient had to undergo cataract surgery.[24] Retinal tears have also been reported 1.4 to 2.8 years after undergoing laser vitreolysis.[25]

One limitation of our study was the absence of a control group, along with a small sample size and a relatively short follow-up period of six months. The laser floater treatment was only administered to patients with a specific type of floater, namely the Weiss ring. Further research involving larger sample sizes and longer follow-up periods is necessary to thoroughly assess the safety and efficacy of laser floater treatment.

CONCLUSION

Nd: YAG laser vitreolysis is a non-invasive and rapid treatment option for select patients with specific

floaters. However, additional controlled trials, randomized studies, and clinical research with extended follow-up periods are crucial to accurately assess the safety and efficacy of laser vitreolysis.

Funding: This study was not funded by any organization.

Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(LRBT/TTEH/ERC/4405/02)**.

REFERENCES

1. **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. Doi: 10.1177/1120672120968762
2. **Nunes GM, Ludwig GD, Gemelli H, Zanotele M, Serracarbassa PD.** Long-term evaluation of the efficacy and safety of Nd: YAG laser vitreolysis for symptomatic vitreous foaters. Arq Bras Oftalmol. 2022;**87(2):**0395. Doi: 10.5935/0004-2749.2021-0395.
3. **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. 2022;**32(2):**1143-1148. Doi: 10.1177/11206721211008036
4. **Shah CP, Fine HF.** Management of floaters. Ophthalmic Surgery, Lasers and Imaging Retina. 2018;**49(6):**388-391. DOI:10.3928/23258160-20180601-01
5. **Son G, Sohn J, Kong M.** Acute symptomatic vitreous floaters assessed with ultra-wide field scanning laser ophthalmoscopy and spectral domain optical coherence tomography. Scientific Reports. 2021;**11(1):**8930. Doi:10.1038/s41598-021-88371-9
6. **Su D, Shah CP, Hsu J.** Laser vitreolysis for symptomatic floaters is not yet ready for widespread adoption. Surv Ophthalmol. 2020;**65(5):**589-591. Doi: 10.1016/j.survophthal.2020.02.007
7. **Milston R, Madigan MC, Sebag J.** Vitreous floaters: Etiology, diagnostics, and management. Sur Ophthalmol. 2016;**61(2):**211-227. Doi:10.1016/j.survophthal.2015.11.008
8. **Souza CE, Lima LH, Nascimento H, Zett C, Belfort R Jr**. Objective assessment of YAG laser vitreolysis in patients with symptomatic vitreous floaters. Int J Retina Vitreous. 2020;**6:**1. Doi: 10.1186/s40942-019-0205-8.
9. **Kalavar M, Hubschman S, Hudson J, Kuriyan AE, Sridhar J,** editors. Evaluation of available online information regarding treatment for vitreous floaters. Seminars in ophthalmology; 2021: Taylor & Francis. Doi:10.1080/08820538.2021.1887898
10. **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. Doi: 10.1001/jamaophthalmol.2017.2388
11. **Singh IP.** Modern vitreolysis—YAG laser treatment now a real solution for the treatment of symptomatic floaters. Surv Ophthalmol. 2020;**65(5):**581-588. Doi:10.1016/j.survophthal.2020.02.006
12. **Sun X, Tian J, Wang J, Zhang J, Wang Y, Yuan G.** Nd: YAG laser vitreolysis for symptomatic vitreous floaters: application of infrared fundus photography in assessing the treatment efficacy. J Ophthalmol. 2019;2019. Doi: 10.1155/2019/8956952
13. **Mangione CM, Lee PP, Gutierrez PR, Spritzer K, Berry S, Hays RD, et al.** Development of the 25-item National Eye Institute Visual Function Questionnaire. Arch Ophthalmol. 2001;**119(7):**1050-1058. Doi:10.1001/archopht.119.7.1050
14. **Ling R, Borkenstein EM, Borkenstein AF.** Evaluation of Nd: YAG Laser Capsulotomy Rates in a Real-Life Population. Clin Ophthalmol. 2020;**14:**3249-3257. Doi: 10.2147/OPTH.S276329.
15. **SÜMer F.** Fibrin Membrane Induced Pupillary Block Glaucoma Treated with Nd: YAG Laser After Uncomplicated Cataract Surgery. Arch Curr Med Res. 2023;**4(1):**58-61. Doi: 10.47482/acmr.1148751
16. **Tripathi A, Agarwal R, Chaurasia S.** Role of Neodymium Double Frequency Laser Posterior Hyaloidotomy in Delayed Presentation of Sub-hyaloid Hemorrhage. Cureus. 2022;**14(1)**. Doi: 10.7759/cureus.21534
17. **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. Doi: 10.1007/s12325-020-01261-w.
18. **Tsai WF, Chen YC, Su CY.** Treatment of vitreous floaters with neodymium YAG laser. Br J Ophthalmol. 1993;**77(8):**485-488.Doi:10.1136/bjo.77.8.485
19. **Delaney YM, Oyinloye A, Benjamin L.** Nd:YAG vitreolysis and pars plana vitrectomy: surgical treatment for vitreous floaters. Eye (Lond). 2002;**16(1):**21-26. Doi:10.1038/sj.eye.6700026

20. **de Nie KF, Crama N, Tilanus MA, Klevering BJ, Boon CJ.** Pars plana vitrectomy for disturbing primary vitreous floaters: clinical outcome and patient satisfaction. Graefes Arch Clin Exp Ophthalmol. 2013;**251(5):**1373-1382. Doi:10.1007/s00417-012-2205-3
21. **Navarro RM, Machado LM, Maia O Jr, Wu L, Farah ME, Magalhaes O Jr, et al.** Small-Gauge Pars Plana Vitrectomy for the Management of Symptomatic Posterior Vitreous Detachment after Phacoemulsification and Multifocal Intraocular Lens Implantation: A Pilot Study from the Pan-American Collaborative Retina Study Group. J Ophthalmol. 2015;**2015:**156910. Doi: 10.1155/2015/156910.
22. **Bessa AS.** One-year follow-up of patients after yttrium aluminum garnet laser vitreolysis for vitreous floaters. Egypt Retina J.2019 Jan 1;**6(1):**1-4.
23. **Sun IT, Lee TH, Chen CH.** Rapid Cataract Progression after Nd: YAG Vitreolysis for Vitreous Floaters: A Case Report and Literature Review. Case Rep Ophthalmol. 2017;**8(2):**321-325. Doi: 10.1159/000477159.
24. **O'Day R, Cugley D, Chen C, Fabinyi D.** Bilateral posterior capsule injury after Nd: YAG laser vitreolysis: unintended consequence of floaters treatment. Clin Exp Ophthalmol. 2018;**46(8):**956-958. Doi: 10.1111/ceo.13190.
25. **Shah CP, Heier JS.** Long-Term Follow-Up of Efficacy and Safety of YAG Vitreolysis for Symptomatic Weiss Ring Floaters. Ophthalmic Surg Lasers Imaging Retina. 2020;**51(2):**85-88. Doi: 10.3928/23258160-20200129-04.

Authors Designation and Contribution

Muhammad Kaunain Ghoghari; Resident: *Concepts, Design, Literature search, Data acquisition, Manuscript preparation, Manuscript editing.*

Hunain Razzak; Consultant Ophthalmologist: *Concepts, Design, Literature search, Data acquisition, Manuscript preparation, Manuscript editing.*

Zeeshan Kamil; Chief Medical Officer: *Concepts, Design, Manuscript review.*

Syed Fawad Rizvi; Chief Consultant Officer: *Concepts, Design, Manuscript review.*

Ali Afsar; Resident: *Literature search, Data acquisition, Data analysis, Statistical analysis.*