

# THE CLINICAL IMPACT OF FLOATERS AND SUCCESS OF LASER VITREOLYSIS

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Whether patients with symptomatic floaters should be offered treatment or told to “carry on regardless” continues to be debated. Moreover, whether physicians should offer laser vitreolysis or vitrectomy has also been discussed. One thing is for certain; more patients are complaining of floaters and the impact they have on their quality of life.

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## AT A GLANCE

- Literature suggests that the visual symptoms associated with floaters are a growing concern
  - Laser vitreolysis allows for appropriate vaporisation of floaters and thus reduction of bothersome symptoms
  - High rates of patient satisfaction, regardless of the type of floaters, are possible with laser vitreolysis
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## THE VITREOUS

It is well known that the vitreous forms 80% of the ocular body and consists of water (98%) and a network of collagen fibrils and hyaluronic acid (2%). Thus, the vitreous is typically characterised as a transparent gel firmly attached to the retina. Vitreal transparency is key as it allows transmission of light through unobstructed media to the retina for visual stimulation. With age, the vitreous begins to liquefy due to molecular rearrangement between hyaluronic acid and collagen

macromolecules. This involves cross-linking and aggregation of collagen causing light scattering and consequently “floaters” and entoptic-like symptoms. Simultaneously, there is a weakening of the vitreous and retinal interface causing separation of the posterior vitreous cortex, a phenomenon known as posterior vitreous detachment (PVD). During this process, the acute onset of multiple floaters and those of longstanding appearance causes functional visual problems for patients and bothersome symptoms<sup>1</sup>.

## IMPACT OF FLOATERS

Many physicians will typically rule out events of retinal detachment or vitreous haemorrhage before discharging a patient with symptomatic floaters. However, the implication of floaters is misunderstood and under appreciated.

Interestingly, Webb et al.,<sup>2</sup> reported that of 603 smartphone users, an overwhelming 76% (n=458) noticed floaters; of these patients, 199 had noticeable vision impairment. Furthermore, myopes and hyperopes were 3.5 and 4.4 times (respectively) more likely to report moderate-to-

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severe floaters. This study highlights quite clearly that floaters are very common in the general population, irrespective of age, race, gender and eye color.

Furthermore, Wagle<sup>3</sup> presented very compelling information regarding the functional quality of life impairment associated with floaters in a study of 311 outpatients. Using time-trade off (TTO) and standard gamble (SG) to determine clinical utility, Wagle found that symptomatic floaters had a negative impact on health-related quality of life. The utility values of floaters were equal to age-related macular degeneration, yet lower than glaucoma, mild angina, stroke and asymptomatic HIV. This demonstrates that floaters have a significant impact on quality of life - similar to ocular and systemic diseases. These utility values have also been confirmed in a study by Zou et al, who investigated TTO and the effect of floaters on quality of life. Findings showed that the presence of floaters considerably diminished patients' life perception<sup>4</sup>.

## LASER VITREOLYSIS

As previously stated, patients with floaters are commonly told that there is no treatment available. More severe cases, however, have been treated with pars plana vitrectomy. Whilst considered to be highly effective in reducing floaters, vitrectomy is

associated with a high incidence of side effects<sup>5,6</sup>.

With recent modifications in YAG laser technology, physicians are now able to offer laser vitreolysis for a range of floaters. Although laser vitreolysis has been shown to have an excellent safety profile, there is limited published evidence regarding its efficacy.

Laser vitreolysis, utilizing the Ultra Q Reflex™ system (Ellex Medical Lasers Ltd, Adelaide, Australia), vaporizes floaters (using a plasma spark to produce a shockwave) at low energy levels and with fewer shots than standard YAG laser systems<sup>7</sup>. Unlike standard YAG lasers, the Ultra Q Reflex™ has been designed to focus onto the front surface of the floater. The laser emits a short (3 nanoseconds) and small (8 microns) burst of energy that provides a potent power density (109 J/cm<sup>2</sup>). The energy allows the collagen and hyaluronic molecules found in a floater to be converted into a gas, which is then resorbed into the eye.

Once the threshold amount of energy is reached, additional energy translates into the propagation of the plasma zone towards the laser source in an inverse exponential fashion.

Additional energy does not translate into a 'longer' plasma zone linearly,

but the plasma also propagates laterally, thus forming a plasma cone. The cascade reaction breaks down when the electromagnetic field is no longer strong enough. The cascade reaction is very short, since all the energy is delivered to the target zone in a 3 nanosecond pulse, therefore there is a nonlinear increase in plasma cone extension as the energy is increased. For instance, the plasma cone extension is 180 microns at 5mJ but at 20mJ the extension is only 280 microns (not a 4 fold increase in extension despite a 4 fold increase in energy per shot). This energy profile allows the surgeon to increase the energy per shot without the risk of a linear increase in energy dissipated in the eye. I can therefore achieve higher power density and tightly controlled plasma, with fewer shots and less energy being delivered to the patient.

The laser platform allows the operator's vision, the target illumination, and the treatment beam to sit along the same optical path and the same optical plane. This allows one to focus on-axis with more depth and spatial reference when treating posterior floaters. Furthermore, one can use the illumination tower coaxially to enhance the view of the target opacity by using the fundus red-reflex as a contrast comparison to more effectively vaporize it. In

contrast, traditional YAG lasers deliver the illumination and laser from a low, non-coaxial position with larger convergent zones, making it extremely difficult to target and treat vitreous opacities in various locations.

Historically, using standard YAG laser systems, the clinician could not see the middle and posterior vitreous: when using the Ultra Q Reflex™ system, I have started taking advantage of the on- and off-axis capabilities of the system. This visualization capability is a key differentiator of the laser system and is truly the reason for the increased efficacy and safety of the procedure. I think it is vitally important for the surgeon to appreciate spatial context. It is crucial to understand how far behind the lens you can treat. I utilize the on-axis feature first to visualize a floater against the red-glow background (to help visualize floaters in the middle and posterior vitreous), then I go off-axis to determine how far behind the lens it is. If the floater is hard to see in off-axis mode then I know that it is safe to treat since off-axis setting only allows for visualization 1-2 mm behind the lens. When floaters are located in the anterior vitreous, on-axis is very hard to visualize (as they look transparent against the red fundus glow), and off-axis allows a negative contrast (floaters look white against the black

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background) to help visualize them better. Therefore, the off-axis feature not only helps me to see floaters but also gauge and assess whether to treat when they are close to the lens. This combination of on- and off-axis allows for a safer and more efficacious treatment.

Despite limited published findings, compelling evidence shows very low complication rates with laser vitreolysis. For instance, in a study of 1500 patients, Karickhoff<sup>9</sup> reported that the adverse event profile was 0.1%. The study also showed that treatment was effective in 75-95% of patients. Furthermore, Geller showed a similar success rate (85%)<sup>9</sup>, which is corroborated by my own findings with no report of post-treatment complications (i.e., retinal detachments, hemorrhages, holes or vitritis).

In my experience, the success of laser vitreolysis depends on the type, size and location of the floater, as this will determine the energy and number of shots required. Typically, floaters in the mid-to-posterior face of the vitreous will require higher energy and more shots to vaporize than smaller anterior floaters. This also reduces any associated risks of lens pitting or damage that can be associated with the procedure. As confidence with the procedure grows and treatment plans are tailored according to the type of floater, physicians will be able to provide a solution for smaller diffuse floaters rather than limiting treatment to classic Weiss rings and large solitary floaters.

## LASER VITREOLYSIS AND PATIENT SATISFACTION

A study in my own outpatient clinic<sup>10</sup> using laser vitreolysis for the treatment of symptomatic floaters shows promising patient satisfaction ratings.

The retrospective, observational study, designed to assess the impact of laser vitreolysis on patient satisfaction and to determine the rate of complications with the procedure, included 296 eyes of 198 patients (mean age, 66 years [range, 38 to 89 years]) who underwent laser vitreolysis with the Ultra Q Reflex™ system. Patient satisfaction was assessed using a simple 1-10 self-rated scale, with higher values indicating greater patient satisfaction, and a “Yes” or “No” indicating whether they were satisfied with improvements in daily functioning and activities that they previously found difficult.

Despite one case of intraocular pressure (IOP) spike requiring medication, and two phakic lenses being hit (only one of which required cataract surgery), there were no retinal complications or anterior chamber and vitreous reactions.

When asked if they were satisfied with their improvement in daily visual functioning, 93% of patients (i.e. 184 patients) answered “Yes”. This was confirmed with an average degree of improvement rating of 8.2 out of 10 (range, 2-10).

In patients with a Weiss ring floater, on average 1.14 sessions were required (average treatment time, 6 minutes) to vaporise the floater, compared with 3.2 sessions (average treatment time, 11 minutes) in patients with amorphous clouds. The number of laser shots to sufficiently vaporise floaters averaged around 315, with notably

more required for amorphous clouds (540 shots vs. 158 with Weiss rings). Power settings also varied depending on the floaters (Weiss rings: 9 mJ vs. amorphous clouds: 4.6 mJ) and ranged from 2.8mJ - 9 mJ.

The findings of this preliminary study demonstrate that laser vitreolysis is associated with a high degree of patient satisfaction. Clearly, the study presents data from a limited sample and longitudinal multicentre data is necessary to confirm these findings. Additional functional outcomes such as contrast sensitivity and quality of life (VF-14) also merit investigation. Nonetheless these results confirm that laser vitreolysis has an excellent risk/benefit ratio, such that it should be considered a first-line treatment for symptomatic floaters.

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