Case Report

Nd:YAG Laser Application for the Treatment of Retained Lens Fragment in the Anterior Chamber Following Cataract Surgery

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Abstract

Cataract surgery is the most frequently performed surgery worldwide. Although it is an effective surgical treatment option for improving patients' visual acuity, various complications can occur postoperatively. One such complication is the presence of retained lens material in the anterior chamber, which can lead to intraocular inflammation, increased intraocular pressure, corneal edema, and endothelial cell loss. Treatment options include observation and surgical removal of the retained lens material. Another notable treatment option is the use of neodymium-doped yttrium aluminum garnet (Nd:YAG) laser to fragment the retained lens material. In this paper, we aim to present two cases from our clinic where Nd:YAG laser treatment was applied to patients with retained small lens fragments in the anterior chamber following cataract surgery. It was observed that in both patients, the retained lens fragments were resorbed by the first day after Nd:YAG laser treatment, and no complications developed.

Keywords: Cataract surgery, retained lens fragment, Nd:YAG laser, anterior chamber

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Introduction

Cataract surgery is a common and generally safe procedure aimed at restoring vision by removing the clouded lens of the eye and replacing it with an artificial lens.[1] Nevertheless, complications such as retained lens fragments may arise, potentially hindering recovery and requiring further medical intervention.[2,3] These fragments may lead to various ocular complications, including intraocular inflammation, increased intraocular pressure (IOP), corneal edema, and endothelial cell loss, potentially necessitating additional medical or surgical interventions.[4,5]

Various treatment strategies exist for managing retained lens fragments, ranging from observation to more invasive surgical removal. The application of neodymium-doped yttrium aluminum garnet (Nd:YAG) laser to fragment and facilitate the resorption of retained lens material represents an additional treatment option. This technique offers a minimally invasive approach that may help mitigate the complications associated with retained lens fragments. In this report, we present two patients from our clinic who developed retained lens fragments in the anterior chamber following cataract surgery and were treated with Nd:YAG laser.

Case Reports

Case 1

An 80-year-old male patient presented for a routine evaluation. The best corrected visual acuity (BCVA) was 0.3 Snellen decimal in the right eye and 0.6 in the left eye, with IOP measurements of 18 mmHg bilaterally. Anterior segment examination revealed bilateral pseudoexfoliation syndrome and posterior subcapsular cataracts, along with insufficient pupillary dilation. Fundus examination was normal. The anterior chamber depth (ACD), axial length (AL), and lens thickness (LT) were 2.85 mm, 22.48 mm, and 4.87 mm, respectively. Cataract surgery was recommended for the right eye, and following

informed consent, phacoemulsification with iris hooks was performed without complications.

On the first postoperative day, BCVA improved to 0.9. IOP measured 20 mmHg in the right eye. The cornea was clear, with a +1 anterior chamber reaction (ACR). However, a retained nuclear fragment measuring 1.0x1.0 mm was detected in the inferior anterior chamber (Figure 1A). Given the minimal size of the lens material and the absence of complications, a management strategy involving observation and topical therapy was selected. The patient was prescribed hourly topical steroids (0.1% dexamethasone; Maxidex, Alcon, Puurs, Belgium) and a topical non-steroidal anti-inflammatory drug (0.1% diclofenac sodium; Inflased, Bilim Pharmaceuticals, Istanbul, Türkiye). Despite two weeks of treatment, the retained lens fragment neither resolved nor decreased in size, and no complications were observed during this period.

After a thorough discussion of all available treatment options, the patient consented to Nd:YAG laser therapy (total energy: 13.0 mJ, number of shots: 5) to address the retained lens material. On the first day post-treatment, no residual lens material was observed in the anterior chamber, the cornea remained clear, and the BCVA was 0.9 in the right eye (Figure 1B). IOP measurement was 18 mmHg, and gonioscopic examination revealed no lens material (Figure 2A). At the six-month follow-up, the patient exhibited no complications, and optical coherence tomography (OCT) confirmed the absence of macular edema (Figure 2B).

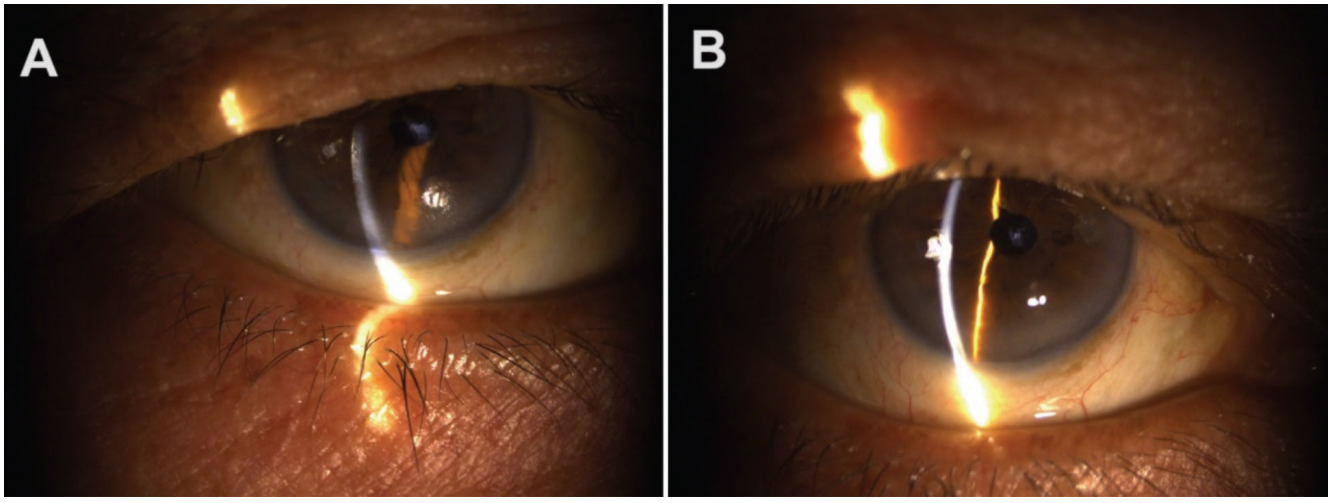

Figure 1. Anterior segment photography of an 80-year-old male patient reveals retained nuclear material in the inferior anterior chamber following cataract surgery (A). Anterior segment imaging of the same patient one day after Nd:YAG laser application shows the absence of lens material (B)

Nd:YAG: Neodymium-doped yttrium aluminum garnet

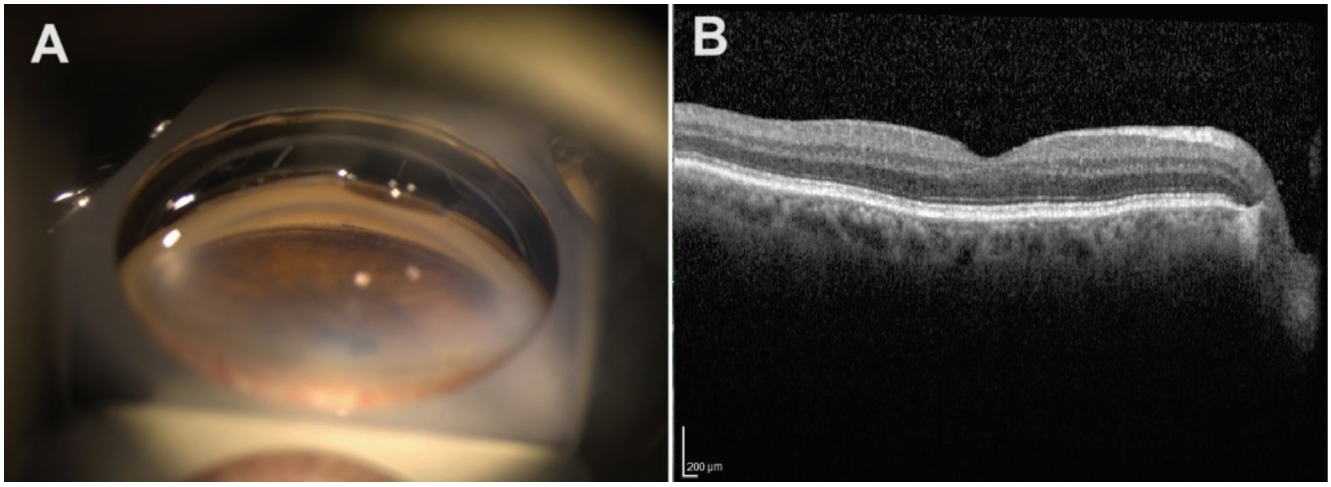

Figure 2. Gonioscopic evaluation of case 1 demonstrates the absence of retained material in the inferior angle following laser treatment (A). Optical coherence tomography reveals a normal macula appearance, with no evidence of cystoid macular edema after laser therapy (B)

Case 2

A 71-year-old female patient was admitted for a routine evaluation. The BCVA was 0.05 Snellen decimal in the right eye and 0.3 in the left eye. IOP measurements were 14 mmHg in both eyes. Anterior segment examination revealed bilateral corticonuclear cataracts. Fundus examination was normal. The ACD, AL, and LT were 2.68 mm, 23.19 mm, and 4.5 mm, respectively. Cataract surgery was recommended for the right eye, and following informed consent, phacoemulsification was performed without complications by an inexperienced surgeon.

On postoperative day one, a large retained cortical lens fragment measuring 3.0x4.0 mm was detected in the anterior chamber, accompanied by grade 1 inferior corneal edema and Descemet's membrane folds extending through the visual axis. The BCVA in the right eye was 0.5, and IOP measured 21 mmHg. Additionally, a +3 ACR with limbal injection was noted. Despite the large size of the retained lens material, a management approach involving observation with topical medications was initially preferred due to the cortical nature of the lens material. The retained material decreased in size to 2.0 x 2.0 mm, but intraocular inflammation remained uncontrolled, and persistent mild corneal edema was observed despite the intensification of topical steroid therapy (Maxidex, Alcon, Puurs, Belgium) and the absence of lens material touch to the cornea after one-week treatment (Figure 3A).

Treatment options were thoroughly discussed with the patient. The patient expressed reluctance to undergo a second surgical intervention. With her consent, Nd:YAG laser therapy (total energy: 20.1 mJ, number of shots: 9) was administered to fragment the retained lens material into smaller pieces, thereby increasing its surface area and promoting faster dissolution. On post-treatment day one, no residual lens material was observed in the anterior chamber, with a +1 ACR noted (Figure 3B). Improvement in corneal edema was also documented, and no lens material was detected during gonioscopic examination (Figure 4A). At the six-month follow-up, no complications were noted (Figure 4B). The final BCVA in the right eye was 1.0.

Nd:YAG Laser Procedure

The VISULAS YAG III laser (Carl Zeiss Meditec, Jena, Germany) was employed under topical anesthesia. An Abraham iridotomy lens was applied and the defocus was set to zero. Initial laser power was set at 2.5 mJ and adjusted as needed based on the fragmentation (0.2± mJ). Careful attention was given to prevent tissue damage such as corneal burns. Laser treatment continued until the prominent lens pieces were fully fragmented. Topical anti-inflammatory (Maxidex, Alcon, Puurs, Belgium) and IOP-lowering medications (0.15% brimonidine tartrate; Brimogut, Bilim Pharmaceuticals, Istanbul, Türkiye) were administered after laser treatment.

Discussion

Retention of lens fragments following cataract surgery is an uncommon but significant complication of phacoemulsification that often requires additional treatment.[6,7] These fragments can lead to severe complications, such as corneal edema, which may progress to corneal decompensation.[7]

The presentation of retained lens fragments in the anterior chamber can vary significantly, with detection occurring from the acute postoperative period to several years later.[8,9] Tien et al.[9] reported a case in which retained lens fragments were identified 32 years after cataract surgery. Additionally, retained lens fragments have been identified after Nd:YAG laser capsulotomy, even when the initial cataract surgery occurred a year prior.[6] In contrast, we identified retained lens fragments acutely

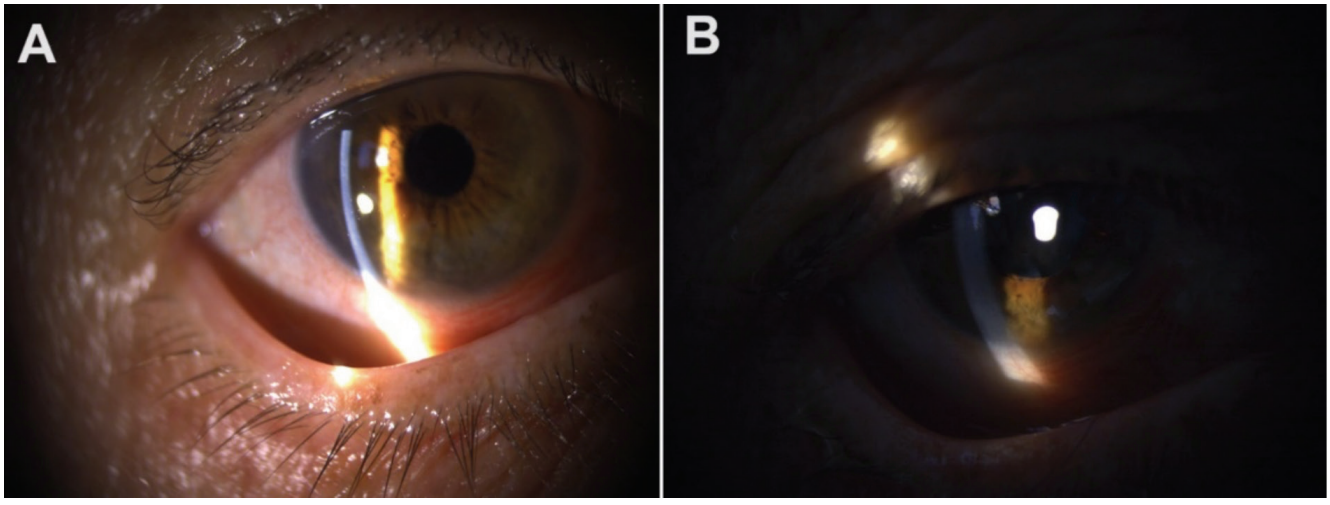

Figure 3. Anterior segment photography of a 71-year-old female patient demonstrates limbal injection, mild inferior corneal edema, and residual cortical material in the inferior anterior chamber following phacoemulsification (A). One day after Nd:YAG laser treatment, anterior segment imaging of the same patient reveals a clear anterior chamber, free of any lens material (B)

Nd:YAG: Neodymium-doped yttrium aluminum garnet

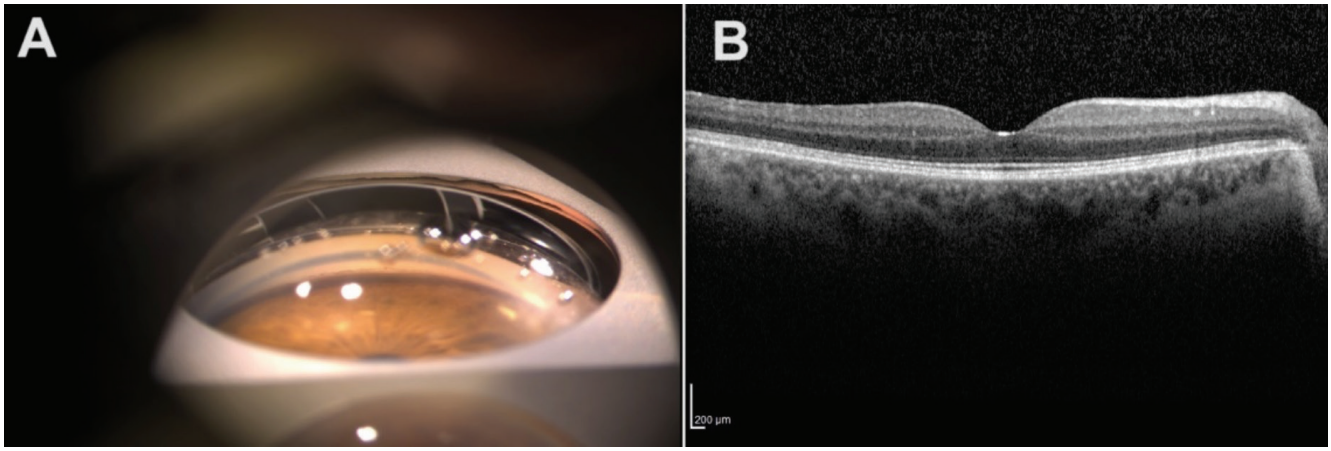

Figure 4. Gonioscopic assessment in case 2 shows no residual material in the inferior angle post-laser treatment (A). Optical coherence tomography depicts a normal macular profile, with no signs of cystoid macular edema after laser therapy (B)

after phacoemulsification, allowing for immediate treatment management.

Several risk factors can increase the likelihood of retained lens fragments following cataract surgery. These include advanced age, dense or mature cataracts, pseudoexfoliation syndrome, thick lenses, and posterior capsular rupture.[3] Although studies show conflicting results, variations in ADC may be an additional risk factor for lens fragment retention.[3,10] In our patients, the presence of pseudoexfoliation syndrome and mid-dilated pupils were significant risk factors for retained lens fragments. Additionally, a lower level of surgical experience may constitute an additional risk factor.

Based on a review of the literature, the primary treatment options for retained lens fragments in the anterior chamber include observation and surgical removal.[11] However, there is a notable lack of detailed descriptions regarding the use of Nd:YAG laser therapy in the management of retained lens fragments. Initially, we opted for observation with adjunctive topical medications, subsequently offering Nd:YAG laser treatment as a less invasive alternative to surgical removal. This approach was motivated by concerns that irrigation/aspiration of the residual material could potentially result in further corneal endothelial loss, endothelial decompensation, or endophthalmitis. Moreover, surgical removal may not always be definitive, particularly when lens material is inadequately visualized during irrigation/aspiration, leading to incomplete removal and possibly necessitating repeated surgeries. Therefore, the application of Nd:YAG laser can be recommended as a preliminary approach before considering surgical removal, given its less invasive nature and lower risk of severe complications compared to the surgery. In line with this view, Meduri et al.[12] stated in their multicenter retrospective case series that the Nd:YAG laser procedure may be a good option for treating retained lenticular fragments in the anterior chamber. The authors also indicated that the procedure offers advantages over repeat surgery, such as reducing endothelial damage, minimizing patient discomfort, and lowering healthcare expenses.[12]

However, Nd:YAG laser treatment may not be suitable for all patients. The procedure can induce intraocular inflammation and increase IOP, rendering patients with glaucoma, uveitis, or maculopathy ineligible for laser therapy. In one instance from our practice, a patient presented with uncontrolled intraocular inflammation. However, Nd:YAG laser treatment was performed nevertheless due to the patient's reluctance to undergo surgery and the cortical nature of the retained lens material, which is typically more amenable to resolution than nuclear fragments. Furthermore, surgical removal may be a more appropriate approach for patients presenting with large nuclear fragments in the anterior chamber.

Significant corneal edema can also be a limiting factor for Nd:YAG laser application, as it may obstruct laser focus and elevate the risk of corneal damage. Nd:YAG laser may induce endothelial loss due to the proximity of material to the cornea, but likely to a lesser degree than surgery. Descement's membrane detachment has been reported following Nd:YAG laser iridotomy.[13] Additionally, because the retained lens material is located inferiorly in the anterior chamber, possible iris damage during laser treatment may lead to dysphotopsia or pigment dispersion.[14] It is essential to discuss the risks and benefits of various treatment options with patients, allowing for a collaborative decision-making process to determine the most suitable treatment modality.

In conclusion, Nd:YAG laser treatment represents a viable option in the management of retained lens materials in the anterior chamber, potentially mitigating the need for surgical removal and thereby reducing the associated risks of surgical complications.

Ethics

Informed Consent: Written informed consent was obtained from all patients.

Declarations

Authorship Contributions

Surgical and Medical Practices: A.M.K., Concept: A.M.K., Design: A.M.K., Data Collection or Processing: A.M.K., B.E.A., Ö.U., Analysis or Interpretation: A.M.K., Literature Search: A.M.K., Writing: A.M.K.

Conflict of Interest: No conflict of interest was declared by the authors.

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