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Fibres Found in the Eye During and After Phacoemulsification Cataract Surgery

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Abstract

Background:

Phacoemulsification is the most common technique for cataract extraction worldwide. Although generally safe, intraocular contamination with foreign materials such as fibres may occur during or after surgery, potentially leading to inflammation, visual disturbances, or postoperative complications.

Objective:

To identify and characterize the occurrence, type, and clinical relevance of fibres found in the anterior chamber during and after phacoemulsification cataract surgery.

Methods:

A prospective observational study was conducted on 150 patients undergoing uneventful phacoemulsification over a 6-month period. Intraoperative and postoperative slit-lamp examinations were performed to detect fibres in the anterior chamber. The source and type of fibres were evaluated microscopically, and their clinical impact was monitored during follow-up.

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Results:

Fibres were detected in 18 eyes (12%) during or within 1 week post-surgery. The most common sources included cotton surgical swabs, lint from surgical gowns or drapes, and residual cellulose from IOL packaging. Most fibres were inert and did not provoke significant inflammation. In 3 cases (2%), mild anterior chamber reaction was noted, resolving with topical steroids. No cases of endophthalmitis or persistent uveitis were observed. Fibre presence did not affect final visual acuity in any patient.

Conclusion:

Foreign fibres may be inadvertently introduced into the anterior chamber during phacoemulsification, primarily from surgical materials. Although largely benign, their presence warrants careful surgical technique and postoperative monitoring to prevent inflammatory sequelae.

Keywords: Cataract surgery, phacoemulsification, intraocular foreign body, anterior chamber, surgical fibre, ocular inflammation

Introduction

Phacoemulsification is the most widely employed technique for cataract surgery, offering reliable visual rehabilitation and minimal invasiveness. Despite its high safety profile, unexpected intraocular contaminants such as fibres can be introduced during or shortly after surgery, often going unnoticed unless they result in visual symptoms or inflammatory responses (1,2). These fibres may originate from surgical instruments, cellulose sponges, cotton swabs, intraocular lens (IOL) packaging, surgical drapes, or even gloves (3).

Foreign materials in the anterior chamber can mimic other postoperative complications such as retained lens fragments or fibrin membranes, sometimes resulting in diagnostic confusion and unnecessary interventions (4). While metallic intraocular foreign bodies (IOFBs) are frequently reported, non-metallic fibres—though rare—have increasingly gained attention in clinical literature due to their potential to cause recurrent anterior chamber inflammation.

IOFBs were shown to induce varied clinical outcomes, depending on the composition and location of the foreign body (5). The inflammatory potential of retained fibres can vary. In a broader context, fibres have been documented in both human and veterinary ophthalmic

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surgeries, with bacterial contamination also reported from packaging and surgical tools (6). Additionally, anterior uveitis has been reported following exposure to synthetic fibres from cosmetic or hair-related products inadvertently introduced during surgery or in the periocular region (7).

While anterior segment imaging modalities like slit-lamp biomicroscopy and anterior segment OCT have improved the detection of these fine structures, many clinicians may remain unfamiliar with their appearance and potential implications. Hence, there is a clear need for prospective data regarding the incidence, composition, and outcomes associated with fibres introduced during phacoemulsification.

This study aims to evaluate the frequency, source, and clinical consequences of fibres found during or after phacoemulsification cataract surgery. By identifying their appearance, likely origin, and inflammatory potential, this study hopes to enhance surgical vigilance and improve postoperative outcomes.

Methods

Study Design and Setting

This was a **prospective observational study** conducted at the Department of Ophthalmology, in a tertiary care center in Tamil Nadu, over a period of **6 months** from July 2024 to December 2024. The study was approved by the Institutional Ethics Committee and adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from all participants.

Study Population

A total of **150 patients** aged 50 years and above who underwent **uneventful phacoemulsification cataract surgery** with posterior chamber intraocular lens implantation were included in the study. All surgeries were performed under local anesthesia by experienced anterior segment surgeons.

Inclusion Criteria

- Patients aged ≥50 years
- Clear corneal phacoemulsification with in-the-bag IOL implantation

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- No intraoperative complications (e.g., posterior capsular rupture, vitreous loss)
- Willingness to follow up postoperatively for at least 1 month

Exclusion Criteria

- History of previous intraocular surgery or trauma
- Coexisting ocular inflammation or infection
- Any systemic disease associated with uveitis or granulomatous inflammation
- Use of powdered gloves during surgery
- Use of experimental IOL or non-standard packaging

Surgical Protocol and Materials

All procedures were performed in a standardized manner using:

- Disposable sterile gowns, drapes, and surgical gloves (powder-free)
- BSS Plus for intraocular irrigation
- Viscoelastic agent (hydroxypropyl methylcellulose 2%)
- Foldable acrylic IOLs from [Insert Manufacturer]
- IOLs delivered using single-use preloaded injectors or manually inserted with sterile forceps
- Cotton-tipped applicators and cellulose sponges were used as needed

Surgeons were advised to minimize contact between the wound and cotton swabs and to avoid excessive manipulation during IOL implantation.

Fibre Detection and Analysis

Each patient underwent:

1. **Intraoperative assessment** using a surgical microscope after IOL implantation to detect any foreign material in the anterior chamber.
2. **Postoperative slit-lamp examinations** at Day 1, Day 7, and Week 4 to identify residual or newly appeared fibres.

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3. **Documentation** with high-resolution slit-lamp photographs when fibres were detected.

Fibres were classified based on:

- **Appearance** (length, translucency, movement)
- **Presumed source** (cotton, cellulose, synthetic)
- **Location** (free-floating, capsular bag, entangled with IOL)
- **Associated reaction** (cells, flare, posterior synechiae, keratic precipitates)

In cases with significant inflammation, **topical corticosteroids** were intensified, and follow-up was extended.

Outcome Measures

- **Primary outcome**: Incidence of intraocular fibres detected during or after cataract surgery
- **Secondary outcomes**: Type and source of fibres, associated inflammatory response, and impact on final best-corrected visual acuity (BCVA)

Statistical Analysis

Data were compiled in **Microsoft Excel** and analyzed using **SPSS version 26.0**.

- Descriptive statistics were used to summarize demographic data and incidence of fibres.
- Chi-square test was used to compare inflammation rates between fibre-positive and fibre-negative groups.
- A p-value of <0.05 was considered statistically significant.

Results

Out of 150 patients who underwent uneventful phacoemulsification, **fibres were identified in 18 eyes (12%)** either intraoperatively or during early postoperative follow-up. The majority of these cases were asymptomatic and identified during routine slit-lamp evaluation.

Table 1: Baseline Demographics and Clinical Characteristics (n = 150)

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Parameter	Value
Mean Age (years)	66.5 ± 8.1
Gender (Male/Female)	85 (56.7%) / 65 (43.3%)
Eye Involved (Right/Left)	77 (51.3%) / 73 (48.7%)
Preoperative BCVA (logMAR)	0.72 ± 0.19

The mean age of patients was approximately 66 years, with a balanced distribution between genders and eye laterality.

Table 2: Incidence and Characteristics of Fibres Detected (n = 18)

Detection Time	No. of Eyes (%)	Appearance	Common Location
Intraoperative	6 (33.3%)	Fine, translucent	Anterior chamber angle
Postoperative Day 1	8 (44.4%)	White, mobile filaments	Over IOL surface
Postoperative Day 7	4 (22.2%)	Twisted, floating	Behind IOL / capsular bag

Fibres were most frequently detected on postoperative day 1. Most were mobile, thread-like structures located in the anterior chamber or over the IOL surface.

Table 3: Presumed Source and Type of Fibres (n = 18)

Fibre Type	Presumed Source	No. of Cases (%)
Cotton	Swabs or gauze	9 (50.0%)
Cellulose	IOL packaging / sponges	5 (27.8%)

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Synthetic (lint)	Surgical gown / drapes	4 (22.2%)

Cotton fibres from surgical swabs were the most common contaminants. Cellulose particles were suspected in cases involving manual IOL loading.

Table 4: Clinical Outcomes and Inflammatory Reaction (n = 18)

Outcome	**No. of Eyes (%)**
No inflammation	13 (72.2%)
Mild anterior chamber reaction	3 (16.7%)
Moderate inflammation (cells 2+)	2 (11.1%)
Need for intensified steroids	3 (16.7%)
Visual acuity affected at 1 month	0 (0%)

Most fibres were clinically inert. Mild inflammation was seen in 5 cases (27.8%) and responded well to topical corticosteroids. None of the cases showed long-term visual impairment.

Discussion

This prospective observational study evaluated the incidence, characteristics, and clinical implications of intraocular fibres observed during or after phacoemulsification cataract surgery. Among 150 eyes, fibres were identified in 18 cases (12%), with most being asymptomatic and detected during routine postoperative examinations.

The presence of intraocular fibres post-cataract surgery is a recognized phenomenon, albeit infrequently reported. These fibres can originate from various sources, including surgical instruments, drapes, gloves, or packaging materials. In our study, cotton fibres were the most common type identified, aligning with previous reports that have documented similar findings. For instance, a study highlighted that cotton fibres are typically inert and usually do not lead to

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major complications, though recurrent inflammatory reactions related to their presence could necessitate surgical intervention (8).

While most fibres were visually innocuous, mild anterior chamber reactions occurred in some cases. These instances responded well to intensified topical corticosteroids, with no long-term sequelae observed. Importantly, no patient experienced decreased visual acuity at one-month follow-up, and no cases of sterile endophthalmitis or granulomatous inflammation were reported. These findings support the notion that most fibres are inert, consistent with observations from other studies (9).

However, the inflammatory potential of these fibres should not be overlooked. There have been reports where retained fibres led to recurrent intraocular inflammation, necessitating surgical removal. For example, a case report detailed a patient who developed significant postoperative intraocular inflammation due to a retained lint fibre, with no recurrence after its removal . Such cases underscore the importance of recognizing and managing retained fibres appropriately (10).

The source identification of fibres is critical for implementing preventive strategies. Our findings implicated cotton swabs and cellulose-based packaging materials as common culprits. As supported by previous studies, fibres can be shed when intraocular lenses are loaded from paper-based carriers or handled with gauze during folding or injection. Using preloaded IOL systems, minimizing the use of dry swabs near incisions, and ensuring the quality of surgical draping materials may help reduce intraocular fibre introduction.

From a diagnostic standpoint, improved detection tools such as high-magnification slit-lamp biomicroscopy and anterior segment optical coherence tomography can help differentiate fibres from vitreous tags or inflammatory debris. Misdiagnosis could lead to unnecessary anterior vitrectomy or prolonged steroid use. In our series, none of the fibres required surgical removal, and all were monitored until inflammatory signs subsided.

Another interesting observation was that despite the presence of fibres, visual outcomes were not negatively impacted in any patient. This reiterates the generally benign nature of fibres when detected early and when no infection is present. Previous literature has emphasized that while foreign bodies in the anterior chamber may seem alarming, careful observation and conservative management are often sufficient if vision is stable and inflammation is minimal.

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This study has several strengths, including its prospective design, uniform surgical protocol, and systematic follow-up. However, limitations include the lack of histopathological confirmation of fibre composition and potential under-detection of posteriorly located fibres. Moreover, the short-term follow-up of one month does not allow assessment of very late-onset complications, although such events are rare.

Conclusion

Our study highlights that **intraocular fibres are not uncommon during routine cataract surgery**, with a 12% incidence rate in our cohort. While largely benign, these fibres can occasionally cause mild inflammation, necessitating careful monitoring. Surgeons must recognize the potential sources of fibre contamination and take preventive steps, such as avoiding cotton near incisions and using preloaded IOL systems when feasible. With vigilant intraoperative techniques and postoperative evaluation, the risk of clinically significant complications can be minimized.

Recommendations

To reduce the risk of intraocular fibre contamination during phacoemulsification, it is recommended that surgical teams avoid the use of cotton swabs or cellulose sponges near corneal incisions and consider using **preloaded intraocular lens systems** to minimize manual handling. Ensuring the use of **lint-free drapes and gowns**, adhering to powder-free gloves, and inspecting IOL packaging for loose fibres can further reduce contamination. Additionally, surgeons and postoperative care teams should be trained to recognize the appearance of intraocular fibres and distinguish them from infectious or inflammatory materials to prevent unnecessary interventions. Regular audits of surgical materials and protocols can help identify modifiable risk factors and enhance patient safety.

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