

Fibres found in the eye during and after phacoemulsification cataract surgery

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Abstract

Purpose Fibres are regularly found within the delivery cartridge (DC) and in the anterior chamber (AC) during phacoemulsification cataract surgery (PCS) and postoperatively. The purpose of this study was to identify their frequency and possible significance.

Setting Dedicated ophthalmic day surgery.

Design Prospective, consecutive, single-surgeon, cohort study.

Methods In 639 eyes undergoing PCS, the presence of fibres was documented in or on both the DC and in the AC intraoperatively, and in the AC postoperatively. The intraoperative method of fibre removal was documented. Corrected distance visual acuity (CDVA) was recorded preoperatively, and at day 1, week 1, and week 4 postoperatively. The incidence of clinical cystoid macular oedema (CMO) and endophthalmitis in the retained fibre subcohort was compared with that of the non-fibre subcohort.

Results A total of 5.2% of the operated eyes had a fibre or fibres in or on the DC, which in all cases was removed with forceps intraoperatively. A total of 14.6% of operated eyes had a fibre or fibres in the AC intraoperatively; these were removed by irrigation/aspiration. Postoperatively, five eyes (0.78%) had a fibre in the AC. There was no significant difference in postoperative CDVA between the fibre and non-fibre subcohorts ($P = 0.26$), and no clinically significant CMO or endophthalmitis in either subcohort.

Conclusions Most fibres seen on the DC or in the eye are sterile and non-inflammatory. However, there have been reports of endophthalmitis attributed to retained fibres. In this study, there were no complications attributable to the fibres, but their removal may minimise any adverse potential.

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Introduction

Retained anterior chamber (AC) fibres post phacoemulsification cataract surgery (PCS) are well documented.^{1–11} There are numerous possible mechanisms recognised for the introduction of fibres into the AC. These are documented in Table 1. The significance of these fibres remains unclear.

The immunological potential of fibres appears varied, and a wide range of ocular responses to various intraocular fibres has been documented.^{5,6,10–12} Indeed, some fibres are benign and do not appear to cause any inflammatory response from the eye. Others, such as human cilia, may lead to devastating complications such as endophthalmitis.⁶

With the advances in modern cataract surgery, postoperative visual outcomes are generally very good. One important reason for poor vision postoperatively is cystoid macular oedema (CMO). We hypothesise that the retained intraocular fibres may not only result in intraocular inflammation that could ultimately result in CMO, but also in endophthalmitis.

This study identified and quantified the presence of fibres found both during PCS and on postoperative review. In our study, the significance of these fibres was evaluated by attempting to correlate their incidence with the incidence of postoperative CMO and other forms of postoperative intraocular inflammation. Our study appears to be the first documented attempt at studying the relationship between the incidence of retained fibres and of postoperative CMO and endophthalmitis.

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Table 1 The mechanisms proposed for introduction of fibres into the anterior chamber during phacoemulsification surgery

| <i>Mechanisms of fibre introduction into the anterior chamber</i> |
|---|
| Introduction on instruments (The phaco tip, the irrigation/aspiration (I/A) cannula, the second instrument, the hydrodissection cannulae, the ophthalmic viscoelastic device (OVD) cannulae, the delivery cartridge) |
| Aspiration into the wound (A result of the negative pressure created by removal of lens material during phacoemulsification and I/A) |
| Injection into the eye (Injection of OVD, hydrodissection or reformation of the anterior chamber with balanced salt solution towards the end of the procedure) |

Materials and methods

This study was a prospective, consecutive, single-surgeon cohort study of 639 eyes undergoing PCS. There were no exclusions. The procedures and documentation were performed according to the tenets of the Declaration of Helsinki.

During the operative procedure, fibres were identified in two sites: in or on the delivery cartridge (DC) and in the AC. Both the operating surgeon and the surgical assistant sought the presence of any fibres intraoperatively. Fibres found intraoperatively were removed by irrigation/aspiration.

Patients were followed up postoperatively at day 1, week 1, and week 4. At each postoperative visit, corrected distance visual acuity (CDVA) was measured. For any reduction in acuity, the presence of CMO was assessed on dilated fundus examination and optical coherence tomography.

All patients were fully assessed ophthalmologically, and particularly for evidence of retinal dysfunction and intraocular inflammation. Endophthalmitis was excluded.¹³

There were two subcohorts, namely, those with retained intraocular fibres and those without. These were compared for their CDVA, their incidence of postoperative CMO, and for endophthalmitis. Statistical analysis was performed using SPSS v21.0 (IBM Corporation, New York, NY, USA).

Results

Six hundred and thirty-nine consecutive eyes (401 female : 238 male = 62.8% : 37.2%) undergoing PCS were evaluated. The mean age was 71 years (SD ± 9.1).

A total of 143 fibres were detected intraoperatively in 122 cases (19.1%). Thirty-six fibres, in 33 cases (5.2%), were detected in or on the DC and were removed under the operating microscope before intraocular lens (IOL) implantation. One hundred and seven fibres in 93 eyes (14.6%) were identified within the AC intraoperatively and were removed once recognised.

There were five cases (0.78%) where a single residual fibre was found inside the eye during the postoperative follow-up examinations (Figure 1). There were no cases in which more than one residual intraocular fibre was found.

The majority of participants (92.8%) achieved postoperative CDVA of 6/4 at the week 4 visit. There was no significant difference in postoperative CDVA between the fibre and non-fibre subcohorts ($P = 0.26$).

There was no incidence of CMO or endophthalmitis in either subcohort.

Discussion

This study demonstrates that the introduction of fibres into the eye occurs much more frequently than previously recognised.

The literature indicates that the likely sources for fibres include the previously utilised cotton balls⁷ and various materials used in the operating room.⁸ There have also been concerning reports that standard sterilisation protocols may not be effective, in that fibres and other potentially pyogenic material may remain on instruments even after sterilisation.^{9,14} Eyelashes are also a potential source of fibres.^{6,10}

It has been suggested that retained fibres may be difficult to detect intraoperatively for several reasons. These include glare from the operating microscope lights on the irrigating solutions, the low contrast afforded to the surgeon by the illumination of certain operating microscopes, and occasionally by obstruction of view through a focally oedematous cornea.¹ However, a cataract surgical assistant may contribute to the detection of instrumental and intraocular fibres.

The introduction of fibres intraocularly must occur intraoperatively. The most serious postoperative wound complications relate principally to endophthalmitis.¹³ Even for the most capable cataract surgeon, the largest bacteria will always be smaller than the smallest incision.¹³ Thus, definitively suturing the corneal wound should further diminish the opportunity for a fibre to enter the eye postoperatively.

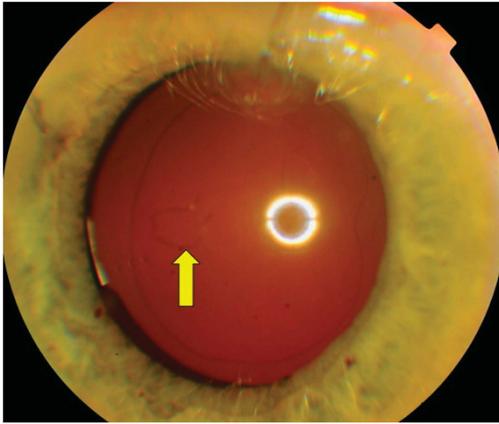


Figure 1 A retained intraocular fibre found behind the IOL and lying on the posterior capsule (yellow arrow). Note that the fibre is situated immediately axially to the toric IOL markings.

All fibres entering the eye are potentially infective or antigenically competent, and may have the capacity to cause intraocular infection or inflammation.^{11,12,15} Any amount of foreign material within the eye may result in intraocular inflammation, which may prejudice an otherwise excellent visual result.⁹ Thus the surgeon must remove any foreign body recognised intraoperatively, whether on instruments (Figure 2) or in the AC itself.

We believe that the patient should be informed of a fibre visible on the iris or elsewhere in the eye postoperatively, so that the patient's future healthcare professionals are aware. Just as a gossypiboma, a sponge retained in a surgical wound, for a General Surgeon,¹⁶ may be his or her legacy, a retained fibre in the anterior segment may become the unwanted signature of the cataract surgeon.

The issue of fibres in the eye can be tackled by adopting measures to minimise influx of fibres into the eye. The utilisation of disposable plastic drapes and lint-free instrument wipes, and ensuring that eyelashes are carefully excluded from the operating field¹⁷ diminish the potential for fibres to exist in the operative field. Routine mechanical cleaning at the end of surgery and ultrasonic cleaning before sterilisation will reduce the potential for instrumental debris^{9,14} to accumulate intraoperatively. Minimising the manipulation of IOLs extraocularly¹⁸ and close examination of each instrument, and the IOL, introduced into the eye before intraocular deployment will allow the surgeon to detect and eliminate fibres before they are introduced to the eye. Again this must be performed under the operating microscope. Definitive corneal wound suturing is likely to prevent fibres being implanted postoperatively.¹³

Indeed, in the practice of the authors, a number of these measures have been implemented. It is likely that the fibres demonstrated in this study were representative

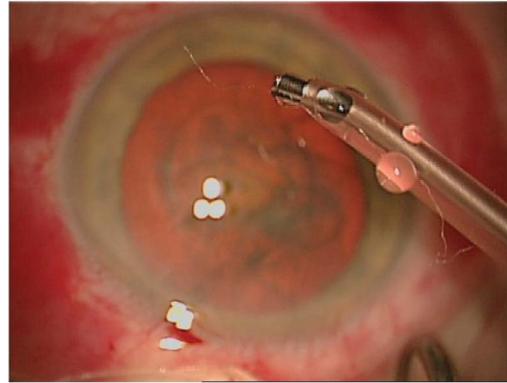


Figure 2 Fibre found on the phaco tip.

of the various textiles that enter the operating theatre in the form of scrubs, sterile operating gowns, draping materials, and sponges. Eyelashes, as a source of fibres, were probably not a cause for concern in this study, as the surgeon had previously implemented a strict exclusion technique involving the use of Steri-Strip's (3M, St Paul, MN, US).¹⁷ As demonstrated, when a capable surgical assistant is present, a large proportion of the fibres may be effectively removed from the surgical field. The elimination of fibres, as they are seen, must remain the principle form of retained fibre prevention. However, we have taken into consideration the nature of the various textiles and sterilisation techniques utilised in our practice, hoping to minimise their ingress into the operative field.

When a fibre is not discovered until postoperative follow-up, the question of whether the retained fibre should be removed remains largely unanswered. Due to heightened awareness of the surgeon and the assistant in this study, permitting active removal of fibres, the fibre-retaining subcohort was not large enough to show a link between adverse outcomes and retained intraocular fibres. Data are limited for the long-term follow-up of retained intraocular fibres, but no patient developed endophthalmitis, let alone mild-to-moderate uveitis. Current evidence suggests that the majority of retained intraocular fibres cause little or no inflammatory response.¹ In the absence of fibre-related adverse reactions/complications, such as endophthalmitis,^{6,9,11,12,15} surgical removal of fibres, found postoperatively, currently remains unjustified.

Conclusion

This study demonstrated a high incidence of fibres both on the instruments and inside the AC during routine PCS. The number of eyes with retained fibres was low due to active searching for and removal of fibres intraoperatively, and there were no complications

attributable to the fibres in this cohort. Removing intraocular fibres should minimise any related adverse potential.

Due to the low incidence of postoperative retained fibres in the eye, we were unable to demonstrate a significant relationship between these fibres and CMO or endophthalmitis. A larger cohort study is indicated to study the effects of fibres in the eye and their relationship to the incidence of postoperative complications.

Summary

What was known before

- The presence of fibres in the eye postoperatively has been documented previously.
- Cystoid macular oedema and endophthalmitis are rare complications of phacoemulsification surgery.

What this study adds

- The incidence of fibres found in the eye intraoperatively and postoperatively was found to be 19.1 and 0.78%, respectively.
- The potential link between the presence of these fibres, and postoperative cystoid macular oedema and endophthalmitis was proposed.
- The use of competent surgical assistant may lead to the reduction in postoperative retained intraocular foreign bodies.

Conflict of interest

The authors declare no conflict of interest.

References

- 1 Yuen HK, Lam RF, Kwong YY, Rao SK, Lam BN, Lam DS. Retained presumed intraocular cotton fiber after cataract operation: long-term follow-up with in vivo confocal microscopy. *J Cataract Refract Surg* 2005; **31**: 1582–1587.
- 2 Dunbar CM, Goble RR, Gregory DW, Church WC. Intraocular deposition of metallic fragments during phacoemulsification: possible causes and effects. *Eye (Lond)* 1995; **9**: 434–436.
- 3 Braunstein RE, Cotliar AM, Wirostko BM, Gorman BD. Intraocular metallic-appearing foreign bodies after phacoemulsification. *J Cataract Refract Surg* 1996; **22**: 1247–1250.
- 4 Martinez-Toldos JJ, Elvira JC, Hueso JR, Artola A, Mengual E, Barcelo A *et al*. Metallic fragment deposits during phacoemulsification. *J Cataract Refract Surg* 1998; **24**: 1256–1260.
- 5 Vail D. Lint in the anterior chamber following intraocular surgery. *Trans Am Ophthalmol Soc* 1950; **48**: 432–458.
- 6 Galloway GD, Ang GS, Shenoy R, Beigi B. Retained anterior chamber cilium causing endophthalmitis after phacoemulsification. *J Cataract Refract Surg* 2004; **30**: 521–522.
- 7 Shimada H, Arai S, Kawamata T, Nakashizuka H, Hattori T, Yuzawa M. Frequency, source, and prevention of cotton fibers in the anterior chamber during cataract surgery. *J Cataract Refract Surg* 2008; **34**: 1389–1392.
- 8 Pisani S. Fibres found during cataract surgery. *Br J Perioper Nurs* 2004; **14**: 508–514.
- 9 Leslie T, Aitken DA, Barrie T, Kirkness CM. Residual debris as a potential cause of postphacoemulsification endophthalmitis. *Eye (Lond)* 2003; **17**: 506–512.
- 10 Islam N, Dabbagh A. Inert intraocular eyelash foreign body following phacoemulsification cataract surgery. *Acta Ophthalmol Scand* 2006; **84**: 432–434.
- 11 Aggarwal P, Garg P, Sidhu HK, Mehta S. Post-traumatic endophthalmitis with retained intraocular foreign body - a case report with review of literature. *Nepal J Ophthalmol* 2012; **4**: 187–190.
- 12 Peiffer RL, Safrit HD, White E, Eifrig DE. Intraocular response to cotton, collagen and cellulose in the rabbit. *Ophthalmic Surg* 1983; **14**: 582–587.
- 13 Francis IC, Roufas A, Figueira EC, Pandya VB, Bhardwaj G, Chui J. Endophthalmitis following cataract surgery: the sucking corneal wound. *J Cataract Refract Surg* 2009; **35**: 1643–1645.
- 14 Dinakaran S, Kayarkar VV. Debris on processed ophthalmic instruments: a cause for concern. *Eye (Lond)* 2002; **16**: 281–284.
- 15 Yeniad B, Beginoglu M, Ozgun C. Missed intraocular foreign body masquerading as intraocular inflammation: two cases. *Int Ophthalmol* 2010; **30**: 713–716.
- 16 Rajagopal A, Martin J. Gossypiboma—"a surgeon's legacy": report of a case and review of the literature. *Dis Colon Rectum* 2002; **45**: 119–120.
- 17 Fox OJ, Sim BW, Win S, Singh R, Amjadi S, Agar A *et al*. Technique to exclude temporal lash incursion in phacoemulsification surgery. *J Cataract Refract Surg* 2012; **38**: 1885–1887.
- 18 Kirkness CM. Instrumental Debris. *Eye (Lond)* 2002; **16**: 687–688.