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“Phacoemulsification tip fracture and how to manage it.”

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ABSTRACT

Purpose: To describe a rare complication of phacoemulsification (Phaco) cataract extraction.

Observations: A phaco tip fracture occurred during the sculpting of the nucleus in a cataract extraction surgery of a 60-year-old woman. The surgeon introduced the second instrument through the side port to retrieve the broken portion of the tip while maintaining it inside the sleeve.

Conclusions and importance: Phaco tip fracture is a rare but serious complication that all cataract surgeons should be able to manage safely. Main risk factors for phaco tip fractures are: Aspiration Bypass System (ABS) phaco tip design and sterilization and reuse of instruments. A step by step plan of action was described in detail for a surgeon to manage a phaco tip fracture which mainly consists of removing the fractured phaco tip while it is still inside the sleeve to prevent any touch between the sharp broken edge of the tip and any intraocular component.

1. Introduction

The standard of care for surgical cataract extraction is phacoemulsification. In the following, we describe a rare complication of phacoemulsification surgery and propose a way to manage it.

2. Case presentation

A 60-year-old woman was admitted for phacoemulsification surgery of the left eye. Preoperative ophthalmological examination was insignificant: her best distance-corrected visual acuity was 20/40 in the right eye and 20/60 in the left eye; slit lamp examination revealed a bilateral corticonuclear cataract. Intraocular pressure and fundus examination were normal bilaterally. Her past medical, surgical and ophthalmological histories were insignificant.

Surgery was performed on the left eye under topical anesthesia with 2% Xylocaine gel. Paracentesis, temporal corneal incision, continuous curvilinear capsulorrhexis, hydrodissection and hydrodelineation were then performed uneventfully. Phacoemulsification was then carried out using a round tip 20-gauge Aspiration Bypass System (ABS) phaco tip (Infiniti, Alcon laboratories, Inc., Fort Worth, TX, USA) on the standard handpiece of the Alcon Infiniti phacoemulsification machine. During sculpting, the followability of the nucleus was poor and there was no vacuum build up in system. A break of the phaco tip, while it was still inside the sleeve, was detected by the surgeon. The break was transverse and located at the distal quarter of the phaco tip (Fig. 1). The surgeon

then inserted a Lebuissou manipulator (Moria/Microtek Inc., Doylestown, PA, USA) through the side port and used it to stabilize the broken distal end of the phaco tip inside the sleeve (Fig. 2). He then slowly retrieved the phaco tip through the main incision while maintaining the broken end inside the sleeve using the Lebuissou manipulator. The phaco tip was replaced with a new one and nuclear sculpting was attempted again. On the second attempt of sculpting, followability was still poor and the machine signaled an error. The surgeon then manually flushed the handpiece, using a 5 ml syringe containing balanced salt solution, through the aspiration port. While flushing, resistance was initially felt and then dissipated concomitantly with small metallic foreign bodies going out of the phaco tip. To eliminate the risk of metal foreign bodies being entrapped inside the tubes, tubing was changed and the system tested successfully. The surgery was carried out with no further complications. Ophthalmological examination of the patient was normal 48-h postoperatively with uncorrected visual acuity of 20/30. Ophthalmological examination remained stable through 1 month postoperatively except for an ameliorated uncorrected visual acuity of 20/20.

3. Discussion

Instrument related problems are rare phacoemulsification surgery complications. Previously, mushroom manipulator,¹ phacoemulsification sleeve² and second instrument³ breaks were described. These breaks are likely due to a combination of manufacturing defects and

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Fig. 1. Picture showing the two parts of the broken phaco tip with multiple pits on its lateral side.

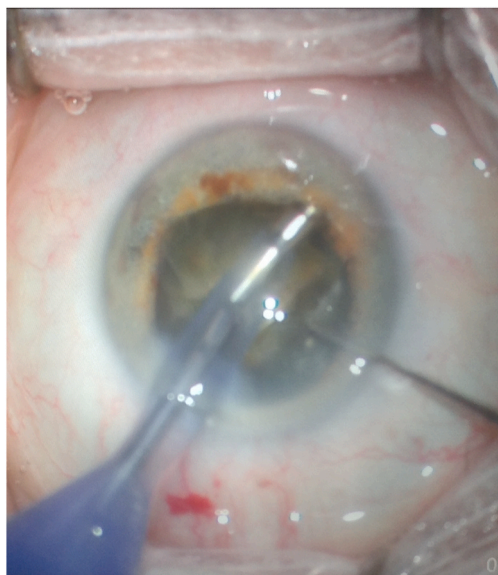


Fig. 2. Picture showing the broken phaco tip inside the sleeve and the second instrument of the operator inserted through the side port.

progressive weakening from inadvertent instrument touch.³ Handpiece-related problems have also been described. After phacoemulsification surgery, metallic foreign bodies originating from the phaco tip or the handpiece can be found on the iris and usually have no detrimental effects.⁴⁻⁶ Their origin is speculated to be metal fatigue due to reesterilization, instrument touch during surgery, metallic fragments adherent to new phaco tips that were shaken loose with vibration, or fragments originating from the wrench that was used to tighten the phaco tip.⁵⁻⁷

We present a rare handpiece-related phacoemulsification complication: intraoperative phaco tip fracture. This complication was previously described twice in the literature. Angmo et al. described in 2014 a case of phaco tip fracture during sculpting of the nucleus; they concluded that the phaco tip fracture was due to a manufacturer error related to the ABS microhole.⁸ Similarly, Khokhar et al. described in 2020 a case of a phaco tip fracture that occurred during nucleus chopping.⁹

In our case, the phaco tip fracture was probably due to the ABS design and to the reuse of the phaco tip. ABS microholes are two small full thickness openings present in the walls of the distal end of the phaco

tip. Their role is to reduce post-occlusion surge by reducing vacuum build-up inside the tubing system when the phaco tip is occluded. Their presence renders the phaco tip at risk of breakage following a minor trauma. On the other hand, reuse of phaco tips has been previously described to cause many side effects such as dissemination of metallic foreign bodies, loss of occlusion during chopping and excessive use of ineffective U/S energy.¹⁰ In our institution, phaco tips are used ten times and are reesterilized using a steam-sterilizing autoclave at 134° Celsius. We believe that the sterilization and reuse of phaco tips causes the metal to wear making it more susceptible to break and could lead to undetected trauma during the sterilization procedure. In fact, as shown in Fig. 1, the broken phaco tip presented multiple small pits on its lateral side indicating metal wear and microtrauma due to the reesterilization.

Because ABS microholes are inherent to the phaco tip design, because reuse of instruments cannot be prevented in many institutions due to economical considerations, and because phaco tip fracture could lead to endothelial, iris, ciliary body or posterior capsular touch we recommend that cataract surgeons be familiar with this complication.

The best way to extract the fractured phaco tip is by retrieving it from the eye while maintaining it inside the phaco sleeve. In that way, the sleeve will play a protective role preventing any contact between the sharp edge of the broken phaco tip and any intraocular component. To do so, when the fracture is detected, the surgeon should immediately stop aspiration and ultrasound delivery. Ophthalmic viscosurgical device should then be inserted through the side port to protect the corneal endothelium during the extraction of the broken tip. The second instrument (Lebuisson manipulator, cyclodialysis spatula or other instruments) should then be used to help the main hand slowly remove the fractured phaco tip from the eye by maintaining the fractured end inside the sleeve. Before proceeding with the surgery, the handpiece should be flushed with balanced salt solution, the irrigation and aspiration tubes should be replaced by new ones and the machine should be tested to make sure that all metallic bodies originating from the break were washed out of the system.

4. Conclusion

Phaco tip fracture is a rare but dangerous complication of phacoemulsification surgery. Its main risk factors are the ABS design which renders the architecture of the tip fragile and sterilization procedures that cause the metal to wear. All cataract surgeons should be aware of this complication and of how to manage it successfully.

Patient consent

Written consent not obtained. This report does not contain any personal identifying information.

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All listed authors meet the ICMJE criteria. We attest that all authors contributed significantly to the creation of this manuscript, each having fulfilled criteria as established by the ICMJE.

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Declaration of competing interest

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