available at http://www.tzuchimedjnl.com/

Tzu Chi Medical Journal

ELSEVIER

Case Report

Thermal Burns Caused by Ophthalmic Viscosurgical Device Occlusion in Torsional Phacoemulsification

Yuan-Chieh Lee[1,2,3]*

[1]*Department of Ophthalmology, Buddhist Tzu Chi General Hospital, Hualien, Taiwan*
[2]*Department of Medicine, Tzu Chi University, Hualien, Taiwan*
[3]*Department of Ophthalmology, National Taiwan University Hospital, Taipei, Taiwan*

Article info

Article history:
Received: March 22, 2010
Revised: April 7, 2010
Accepted: May 7, 2010

Keywords:
Ophthalmic viscosurgical device
Phacoburns
Thermal burns
Torsional phacoemulsification

Abstract

Heat is a byproduct of phacoemulsification, which can lead to phacoburns. Torsional phacoemulsification has been reported to generate less heat and hence fewer phacoburns. We describe three cases of phacoburns during torsional phacoemulsification, which were caused by ophthalmic viscosurgical device (OVD) occlusion. Prominent phacoburns occurred at the beginning of sculpting using torsional phacoemulsification. The tips and tubing were patent on examination. Occlusion sounds disappeared after aspiration of OVD. The corneal wounds were closed with sutures, leaving the adhesion of the iris to the corneal wounds. Separation of the iris from the cornea was done later, and a central round pupil was achieved in Cases 2 and 3. Astigmatism improved with time in all three patients. OVD still needs to be cleared around the tip before torsional phacoemulsification is activated. Once a thermal burn has occurred, sutures with acceptable adhesion of the iris to the wound and delayed separation may be considered. (*Tzu Chi Med J* 2010;22(4):229–231)

*Corresponding author. Department of Ophthalmology, Buddhist Tzu Chi General Hospital, 707, Section 3, Chung-Yang Road, Hualien, Taiwan.
E-mail address: yuanchieh.lee@gmail.com

1. Introduction

Phacoemulsification is now the primary method of cataract extraction because of its efficiency, small incisions, and rare sight-threatening complications. Some complications, however, may have increased as the unintended effects of technological advances. During phacoemulsification, the handpiece changes electrical energy to mechanical energy to emulsify the lens nucleus. Heat is a byproduct of this process, and the tip is cooled by irrigation and aspiration. Any disruption to fluid flow can lead to phacoburns within seconds (1,2). Possible causes include overly tight wounds that compress the handpiece, kinks or bends in the tubing, unrecognized tears in the phacoemulsification sleeve, and viscoelastic plugging or occlusion that prevents fluid flow around the tip (2–4). We report three cases of phacoburns due to ophthalmic viscosurgical device (OVD) occlusion and their clinical courses.

2. Case reports

2.1. Case 1

A 60-year-old man underwent phacoemulsification of a grade two nuclear sclerosis in the right eye in February 2008. Preoperative keratometry showed

© 2010 Buddhist Compassion Relief Tzu Chi Foundation

a corneal astigmatism of –0.75 D × 90°. Under topical anesthesia, sodium chondroitin sulfate–sodium hyaluronate (Viscoat; Alcon Laboratories, Inc., Fort Worth, TX, USA) was injected through a 2.75-mm temporal cornea incision, and a capsulorhexis and hydrodissection were done. At the start of nuclear sculpting (phaco power 0%, torsional power 75%, 15 pulses per second with 50% duty cycle, vacuum 100 mmHg, aspiration rate 24 mL/min, irrigation pressure 95 cmH_2O), a white plume was visible at the ultra 30° Kelman mini-flared ABS tip (with a Microsleeve) of the OZiL torsional handpiece (Alcon Laboratories Inc.). The tip and the tubing were changed and reprimed, but a larger plume and whitening of the wound were still noted on sculpting. With higher vacuum and aspiration rate (vacuum 360 mmHg, aspiration rate 35 mL/min, irrigation pressure 135 cmH_2O) to aspirate the Viscoat around the tip, the "occlusion" sound disappeared, and sculpting went on smoothly. The wound was closed with three tight interrupted 10-0 nylon sutures and adhesion of the iris to the internal side of the wound.

Corneal astigmatism was –6.75 D × 100° 2 weeks postoperatively, and decreased to –3 D × 100° 1 month postoperatively. The stitches were then removed. Six months later, the corneal astigmatism had decreased to –2.0 D × 95°. The corrected visual acuity was 20/15. A pseudo-pterygium had formed, and iridocorneal adhesion causing a pear-shaped pupil persisted. But all the corneal folds were gone.

2.2. *Case 2*

A 55-year-old woman had a renal transplant 4 years previously, and had been using steroids for 4 years. Posterior subcapsular cataract developed in both eyes. She underwent phacoemulsification in her right eye in September 2007 uneventfully, and had a severe corneal burn during phacoemulsification of the left eye in September 2008. Preoperative keratometry showed a corneal astigmatism of –0.50 D × 98°. Under topical anesthesia, Viscoat (Alcon Laboratories Inc.) was injected through a 2.75 mm temporal clear cornea incision, and a continuous curvilinear capsulorhexis and hydrodissection were done. Although smoothly primed, a small white plume was visible at the Kelman tip of the torsional handpiece at the beginning of sculpting, and the corneal wound instantly whitened. The tip and tubing were changed and reprimed. However, after the tip entered the anterior chamber, the INFINITI Vision System (Alcon Laboratories Inc.) signaled occlusion as the surgeon pedaled lightly without actually sculpting the nucleus. After aspiration of Viscoat with a higher vacuum and aspiration rate, the surgeon sculpted the nucleus without the occlusion sound. The wound was closed with two tight sutures, leaving adhesion of the iris to the corneal wound.

Corneal astigmatism was –5.0 D × 80° 3 weeks postoperatively. A pear-shaped pupil was noted, and iridocorneal adhesion was released through the side pore. The stitches were removed 4 weeks postoperatively. The astigmatism had decreased to –1.25 D × 68°, and visual acuity improved to 20/25 4 months postoperatively.

2.3. *Case 3*

A 64-year-old woman had phacoemulsification of a grade four nuclear sclerosis in the right eye in September 2008. Preoperative keratometry showed a corneal astigmatism of –0.75 D × 179°. Under topical anesthesia, Viscoat (Alcon Laboratories Inc.) was injected through a 2.75 mm temporal clear cornea incision, and a continuous curvilinear capsulorhexis and hydrodissection were done. At the start of nuclear sculpting, a white plume was visible at the ultra 30° Kelman mini-flared ABS tip of the OZiL torsional handpiece, and the corneal wound instantly whitened. After shifting from "sculpting" mode into "quadrant removal" and aspirating most of the Viscoat, the surgeon easily sculpted the nucleus in the "sculpting" mode without any occlusion sound from the machine. The procedure was completed with posterior chamber intraocular lens implantation, and the wound was closed with two tight interrupted 10-0 nylon sutures, but there was also adhesion of the iris to the corneal wound.

The astigmatism was –6.0 D × 90°, best corrected visual acuity was 20/30, and iridocorneal adhesion still existed 5 days postoperatively. The adhesion was separated from the side pore 2 weeks postoperatively, when the astigmatism was –5.0 D × 94°. The astigmatism decreased to –2.5 D × 96°, and best corrected visual acuity was 20/30 2 months postoperatively. The corneal sutures were removed. The astigmatism had decreased to –0.75 D × 30°, and best corrected visual acuity was 20/20 4 months postoperatively.

3. Discussion

Ernest et al evaluated factors resulting in phacoburns, and lack of irrigation and aspiration resulted in the greatest thermal rise. Both the cohesive and dispersive OVDs were associated with a delay in the start of irrigation/aspiration and similar maximum temperatures (5). OVDs even blocked the opening defined by the internal wound edges and the outside of the infusion sleeve, thus stopping all fluid exchange (6), and added up to six times the heat in comparison with balanced salt solution (7).

In our series, a new INFINITI Vision System Pack, which included a new tip, new tubing and a new cassette, was used for each patient, and was primed

smoothly. The occlusion was still noted after changing to a new set in Cases 1 and 2, and the tips and tubes showed no obstruction on examination. Instead, after aspiration of the OVD around the tip, there was no more occlusion sound on sculpting. We believe that OVD occlusion led to phacoburns in our patients.

Although torsional phacoemulsification generated less heat (8), OVD occlusion still led to phacoburns within seconds using torsional phacoemulsification in our patients. OVD needed to be cleared around the tip before phacoemulsification power was activated. Compartmentalizing the anterior chamber with OVD and injecting balanced salt solution underneath, as described by Arshinoff in the ultimate soft-shell technique (9), or removing some OVD with a high vacuum setting before phacoemulsification, are both good ways.

Once a thermal burn occurred, sutures of the fish-mouthed wound were associated with a large amount of astigmatism. In our patients, sutures were used with allowance of the iris adhering to the burned wound. Tying too hard only led to cut-through of sutures and further damage of the necrotic wound. Iris tissue helped to seal the wound and could be separated later. Separation of the iris from the cornea was done 3 weeks later in Case 2 and 2 weeks later in Case 3. A central round pupil was achieved in both patients. Astigmatism secondary to shrinkage of tissue and tight sutures improved a lot with time in these three patients.

The key to avoiding phacoburns is prevention and awareness. If the machine signals complete occlusion of the tip, usually an audible sound, phacoemulsification power should not be activated, especially in the "sculpting" mode, when aspiration is low. Viscoat needs to be cleared around the tip by irrigation/aspiration before phacoemulsification power is activated. Once a thermal burn has occurred, sutures with acceptable adhesion of the iris to the wound and delayed separation of the adhesion may be considered.

References

1. No authors listed. Scleral and corneal burns during phacoemulsification with viscoelastic materials. *Health Devices* 1988;17:377–9.
2. Gionni RJ, Osher RH. Intraoperative complications of phacoemulsification surgery. In: Steinert RF, ed. *Cataract Surgery: Techniques, Complications and Management.* Philadelphia: WB Saunders, 1995:327–40.
3. Majid MA, Sharma MK, Harding SP. Corneoscleral burn during phacoemulsification surgery. *J Cataract Refract Surg* 1998;24:1413–5.
4. Sugar A, Schertzer RM. Clinical course of phacoemulsification wound burns. *J Cataract Refract Surg* 1999;25: 688–92.
5. Ernest P, Rhem M, McDermott M, Lavery K, Sensoli A. Phacoemulsification conditions resulting in thermal wound injury. *J Cataract Refract Surg* 2001;27:1829–39.
6. Sippel KC, Pineda R Jr. Phacoemulsification and thermal wound injury. *Semin Ophthalmol* 2002;17:102–9.
7. Floyd M, Valentine J, Coombs J, Olson RJ. Effect of incisional friction and ophthalmic viscosurgical devices on the heat generation of ultrasound during cataract surgery. *J Cataract Refract Surg* 2006;32:1222–6.
8. Han YK, Miller KM. Heat production: longitudinal versus torsional phacoemulsification. *J Cataract Refract Surg* 2009; 35:1799–805.
9. Arshinoff SA. Using BSS with viscoadaptives in the ultimate soft-shell technique. *J Cataract Refract Surg* 2002; 28:1509–14.