



香港眼科醫學院

Visual sensations during phacoemulsification

Chong Fai Chung,¹ MRCSEd, Jimmy S. M. Lai,^{1,2} FRCS, FRCOphth, Ricky W. K. Law,² FHKAM (Ophth), Dennis S. C. Lam,² FRCS, FRCOphth

¹Department of Ophthalmology, United Christian Hospital, Kowloon, Hong Kong, China.

²Department of Ophthalmology & Visual Sciences, The Chinese University of Hong Kong, Kowloon, Hong Kong, China.

Correspondence and reprint requests:

Jimmy S. M. Lai, Department of Ophthalmology, United Christian Hospital, Kwun Tong, Kowloon, Hong Kong, China.

Cataract extraction is the most common ophthalmic operation in Hong Kong and phacoemulsification has become the surgery of choice for the majority of patients. While ophthalmologists are competent with the technical aspect of the operation, many of us may not be familiar with the intraoperative visual sensations experienced by the patients. It is well documented that patients undergoing cataract surgery under topical or regional anesthesia experience visual phenomena in the operated eye under the light microscope. Some patients are interested in knowing what they will see during cataract extraction and some patients even request general anesthesia for fear of perceiving mysterious intraoperative visual images. Although we provide detailed technical information about the surgery when obtaining an informed consent from patients, we seldom discuss the visual phenomena with them. The experience may be frightening if patients are not expecting to experience these visual sensations.

There have been numerous studies and reports of patients' visual sensations while undergoing extracapsular cataract extraction or phacoemulsification with different types of regional and topical anesthesia with or without sedation.¹⁻⁸ All the data show that there is a wide spectrum of visual sensations experienced during cataract extraction. These include perception of light, colors, moving objects, flashes, and patterns. Specific patterns of rainbows, radiating wave-like patterns, hands and fingers of the surgeons, and instruments have been described.^{1,2,7} Light and colors were the most frequently reported visual sensations (up to 80% of patients). Total loss of light perception has also been reported.

The rate varied from 15.7% to 20.0%. Au Eong et al have shown that the variety of visual sensations may be frightening for 5% of patients.²

The intraoperative visual sensations can be influenced by the method of anesthesia and the administration of sedation medications.⁹⁻¹⁵ Regional anesthesia via retrobulbar and peribulbar routes have been the conventional method for anesthesia for cataract surgery. However, retrobulbar injection can cause serious but rare complications including globe perforation, retrobulbar hemorrhage, central retinal artery occlusion, respiratory depression, and damage to the optic nerve.⁹⁻¹⁴ Peribulbar injection avoids potential complications of injection of an anesthetic agent into the subarachnoid space and damage to optic nerve. As topical anesthesia avoids all the above complications, it has become a popular method of anesthesia for phacoemulsification.^{16,17} Optic nerve function is impaired by regional anesthesia, as demonstrated by the development of relative afferent pupillary defect,¹⁸ increase in latency and decrease in amplitude of visual evoked potentials,¹⁹ and decrease in visual acuity after retrobulbar anesthesia.^{20,21} On the other hand, topical anesthesia has no effect on optic nerve function. Therefore patients operated under topical anesthesia may perceive more diverse patterns than under regional anesthesia.

Au Eong et al studied patients undergoing phacoemulsification under retrobulbar anesthesia.⁴ These researchers found that 15% of their patients reported loss of visual sensation during the surgery and more than 50% of them saw color,

movement of instruments and surgeons' fingers. Talks et al, in their study of phacoemulsification under peribulbar anesthesia, found that 100% of their patients reported reduced visual acuity, 25% reported loss of light perception and 20% perceived visual images during the surgery.¹⁸ Wickremasinghe et al studied the visual sensation in patients undergoing phacoemulsification under subtenons anesthesia.⁸ More than half of their subjects saw colored lights. These researchers reported an interesting finding that frightening experience was associated with the perception of color. They also found that injection of more than 4 ml of anesthetic significantly reduced patients' anxiety. In a separate study on phacoemulsification under topical anesthesia by Au Eong et al, it was found that more than 90% of patients perceived colored light and more than 60% experienced moving objects.⁵ Newman also found that 90% of patients saw colors and white illumination and 15% saw moving objects during phacoemulsification under topical anesthesia.³ In this issue of the *Hong Kong Journal of Ophthalmology*, Chung et al report their study on patients' visual sensations during phacoemulsification under topical anesthesia without the use of sedation. As sedation has been shown to cause amnesia,¹⁵ the description of the intraoperative visual sensations by this group of non-sedated patients may be more accurate. They reported that 6.2% of the patients with transient loss of light perception during the surgery, approximately 15% saw moving objects, shadow, and patterns. The majority saw only diffuse light.

The wide spectrum of visual sensations is the combined effects of entopic phenomena, light-induced sensation, and after-images. The dispersion of light secondary to corneal edema and corneal distortion, the balanced salt solution instilled on the corneal surface, the nuclear fragments, bubbles, and the intraocular lens in the anterior chamber, the moving instruments, and the surgeon's fingers can generate visual sensations ranging from diffuse color or colorless light to various images and wave-like patterns under the 2 bright lamps of the operating microscope. Verma has postulated that the radiating wave-like visual patterns perceived by patients undergoing phacoemulsification to be the result of stimulation of the photopreceptors by the ultrasonographic energy released from the phaco probe.²² The loss of visual perception of patients under retrobulbar anesthesia can be explained by the direct anesthetic effect and/or the

mechanical compression by the anesthetic volume on the optic nerve. The fact that many patients retained visual perception under retrobulbar anesthesia means that the optic nerve conduction was not completely blocked in most of the patients. The loss of visual sensation under topical anesthesia can be due to the strong illumination from the operating microscope that bleaches a large proportion of the visual pigments, and/or the transient elevation of intraocular pressure at some stage of the phacoemulsification.

To date, all the studies on visual sensations during cataract surgery have evaluated the overall visual experience by the patients. However, during phacoemulsification, visual stimuli are different at different stages of the surgery and sometimes the stimulus may be unique at a particular stage. During wound construction and capsulorrhexis, there is minimal intraocular fluid current. During phacoemulsification of lens nucleus, ultrasonographic energy is being generated. During irrigation and aspiration of the cortex, the effect of the cataract on the visual sensation is removed. When the intraocular lens has been implanted, the focusing effect of the intraocular lens is present. Analysis of the visual sensation in these different stages may provide more information on the source of the visual stimuli. Furthermore, patients can be informed preoperatively of the expected visual sensation at different stages of the operation. In view of this, Chung et al studied the visual sensation at different stages of phacoemulsification and posterior chamber intraocular lens implantation performed under topical and regional anesthesia.²³ These authors found that patients experienced a wide spectrum of visual sensations that were similar at all stages of the phacoemulsification and this study was unable to confirm that the ultrasonic energy from the phaco probe was related to the generation of the wave pattern.

Further studies to provide more information on the association of different visual sensations with age, sex, density of cataract, previous intraocular surgery, and concomitant ocular pathology will certainly be useful for preoperative counseling of patients. Knowledge of the wide spectrum of visual sensations during cataract extraction helps us to alleviate patients' fear during surgery. Psychological stress experienced by patients is expected to be lowered and patients are likely to be more cooperative, resulting in an easier operation.

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