Lecture

6th Yahya Cohen Lecture: Visual Experience During Cataract Surgery†

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Abstract

***Introduction**: The visual sensations many patients experience during cataract surgery under local anaesthesia have received little attention until recently. This paper reviews the recent studies on this phenomenon, discusses its clinical significance and suggests novel approaches to reduce its negative impact on the surgery. **Methods**: Literature review. **Results**: Many patients who have cataract surgery under retrobulbar, peribulbar or topical anaesthesia experience a variety of visual sensations in their operated eye during surgery. These visual sensations include perception of light, movements, flashes, one or more colours, surgical instruments, the surgeon's hand/fingers, the surgeon and changes in light brightness. Some patients experience transient no light perception, even if the operation is performed under topical anaesthesia. The clinical significance of this phenomenon lies in the fact that approximately 7.1% to 15.4% of patients find their visual experience frightening. This fear and anxiety may cause some patients to become uncooperative during surgery and trigger a sympathetic surge, causing such undesirable effects as hypertension, tachycardia, ischaemic strain on the heart, hyperventilation and acute panic attack. Several approaches to reduce the negative impact of patients' visual experience are suggested, including appropriate preoperative counselling and reducing the ability of patients to see during surgery. **Conclusions**: The findings that some patients find their intraoperative visual experience distressing have a major impact on the way ophthalmologists manage their cataract patients. To reduce its negative impact, surgeons should consider incorporating appropriate preoperative counselling on potential intraoperative visual experience when obtaining informed consent for surgery.*

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Introduction

What a patient can see during his or her surgery can be a cause of anxiety for the patient. It may cause additional stress to what for most patients is already a traumatic event. Furthermore, it may be a cause of anxiety for some surgeons. In the majority of non-ophthalmic surgery, the procedure is performed under general anaesthesia or out of the patient's view. However, when surgery is performed on the eye itself, it is difficult, if not impossible, to keep it out of the patient's view.

With the majority of cataract surgery performed under local anaesthesia, it is important for surgeons to recognise if patients indeed are aware of their visual environment, and to understand their experience. While most surgeons provide their patients with adequate technical information about the surgery, its potential complications and perioperative management, the intraoperative visual experience has received little or no attention. Yet many patients are concerned if they can see during surgery, and for some, it is the most vivid and feared event of the entire procedure.

Cataract and its Surgery in Singapore

A recent community-based study of 574 subjects aged 60 years and above in Singapore disclosed that the prevalence of cataract – defined as lens opacities observed by an ophthalmologist and a visual acuity of 6/9 or worse in the same eye – was 78.6%.[1] The percentage of persons with cataract increased from 63.6% in those between 60 and 64 years to 94.6% in those 75 years and older. The prevalence of blindness – defined as best-corrected visual acuity of 6/60 or worse in the better eye – and visual impairment – defined as best-corrected visual acuity of worse than 6/12 but better than 6/60 in the better eye – were 3.0% and

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15.2%, respectively, in the same study. Cataract was the sole or contributory cause of blindness in 16 out of 17 cases and the sole or contributory cause of impaired vision in 86 out of 87 cases. It was the most common ocular pathology found in these elderly individuals and the most frequent cause of visual loss.

Cataract surgery is the most commonly performed elective surgery in many countries including Singapore. In Western countries, the rate of cataract surgery has risen 3- to 6-fold in the past 3 decades, from about 100 operations per 100,000 persons/year in the 1970s and 1980s to about 300 to 500 operations per 100,000 persons/year in the 1990s.[2] In Singapore, data from Medisave claims disclosed a significant increase in the number of cataract surgeries performed, from 5679 operations in 1986 to 12,177 in 1995.[3] There was a steady increase in the rate of cataract surgery from 277.4 operations per 100,000 persons/year in 1991 to 465.0 per 100,000 persons/year in 1996.[2] This works out to be an average increase of 40 operations per 100,000 persons/year (95% confidence interval, 28.6-52.8).[2]

Anaesthetic Options and Trend for Cataract Surgery

General anaesthesia is currently rarely used for routine cataract surgery, but is indicated in uncooperative patients and children. The vast majority of cataract surgeries are performed under local anaesthesia, which includes several techniques.[4]

In many countries, the most commonly used local anaesthetic technique is regional anaesthesia. This may involve an injection of anaesthetic solution aiming for the intraconal space behind the globe (retrobulbar anaesthesia) or around the globe (peribulbar anaesthesia) (Fig. 1).

A relatively new local anaesthetic technique for small incision cataract surgery is topical anaesthesia. It was started by Fichman in Manchester, Connecticut in 1991.[5] The technique is simple, and essentially involves the instillation of anaesthetic eyedrops or ointment into the conjunctival sac. The analgesia induced, with or without supplemental intracameral lignocaine (lidocaine), is sufficient to allow cataract surgery to be carried out painlessly in most cases. One significant advantage of topical anaesthesia is that it avoids many of the potential ocular and systemic complications such as retrobulbar haemorrhage, optic nerve injury, globe perforation and inadvertent intracranial anaesthetic injection associated with injection anaesthesia such as retrobulbar and peribulbar anaesthesia. For this reason, it is rapidly gaining popularity with ophthalmic surgeons worldwide.

In the 2000 survey of members of the American Society of Cataract and Refractive Surgery, 49% of respondents reported that their primary method of anaesthesia was topical anaesthesia (from 0% in 1990, 8% in 1995 and 45% in 1999), 26% retrobulbar anaesthesia (from 69% in 1990, 50% in 1995 and 29% in 1999), 24% peribulbar anaesthesia (from 30% in 1990, 38% in 1995 and 24% in 1999) and 2% topical anaesthesia with subconjunctival blocks.[6-9] Topical anaesthesia was used with intracameral lignocaine by 40% of respondents and without intracameral lignocaine by 9%.[6] Retrobulbar anaesthesia was used with a facial block by 12% of respondents and without a facial block by 14%.[6]

Effects of Local Anaesthesia on the Visual Function

Traditionally, ophthalmologists and anaesthetists who use injection regional anaesthesia are concerned mainly with blocking two functions of the eye: the abilities of the eye to feel pain and to move. When these desired dual goals of analgesia and akinesia are achieved, the injection regional anaesthesia is considered successful (Table I). Analgesia allows the cataract surgery to proceed without causing pain to the patient, and akinesia makes the operation easier to perform for the surgeon and safer for the patient, especially for extracapsular cataract extraction. There is, however, a third function of the eye, the visual function, which has received little or no attention. This is rather surprising considering the fact that the surgery is to be performed on the organ of vision itself.

So what effect, if any, do the various modalities of local anaesthesia have on patients' ability to see during cataract surgery? It has been shown that retrobulbar anaesthesia causes a temporary reduction in visual acuity.[10-12] This is consistent with findings of a transient afferent pupillary defect and marked reduction of the visual evoked potential with this form of local anaesthesia.[11-13] Retrobulbar anaesthesia, however, frequently does not completely block the optic nerve, allowing some of its function to be retained. This is evidenced by the not infrequent remarks from patients that they could experience vivid visual sensations during cataract surgery using retrobulbar anaesthesia. In fact, only about 15.7%[14] to 20%[15] of patients had no light perception in the eye following a retrobulbar anaesthetic injection in two clinical series.

Likewise, peribulbar anaesthesia also does not block the optic nerve completely. Studies by Talks et al[16] and Scott

TABLE I: EFFECTS OF REGIONAL (RETROBULBAR OR PERIBULBAR) AND TOPICAL ANAESTHESIA ON THE FUNCTIONS OF THE EYE

Function of eye	Effect of anaesthetic agent on function of eye		
		Regional anaesthesia	Topical anaesthesia
Feel	Analgesia	+	+
Move	Akinesia	+	-
See	Anopia	±	-

TABLE II: VISUAL EXPERIENCE DURING CATARACT SURGERY

Authors (year)	Levin and O'Connor[11] (1989)	Murdoch and Sze[19] (1994)	Au Eong et al[15] (1999)	Au Eong et al[14] (2000)	Newman[20] (2000)	Au Eong et al[18] (2000)
No. of patients	26	56	100	70	102	52
Age (y)	–	71.5 (median), (range, 33-89)	68.4 (mean), (range, 40-87)	65.1 (mean), (range, 37-87)	79 (median), (range, 55-98)	67.5 ± 10.8 (mean ± S.D.)
Type of cataract surgery	Extracapsular cataract extraction	Extracapsular cataract extraction	Extracapsular cataract extraction	Phaco-emulsification	Phaco-emulsification	Phaco-emulsification
Anaesthetic technique used	Retrobulbar anaesthesia	Majority peribulbar anaesthesia; some retrobulbar anaesthesia	Retrobulbar anaesthesia	Retrobulbar anaesthesia	Topical and subconjunctival anaesthesia	Topical anaesthesia
Sedation	None	None	Preoperative oral diazepam	Preoperative oral diazepam	None	Preoperative oral diazepam
Proportion of patients who perceived:						
No light	–	4%	20%	15.7%	5.9%	0%
Light*	–	96%	80%	84.3%	97.1%	100%
Movements*	–	68%	39%	48.6%	18.6%	61.5%
Flashes*	–	66%	36%	50.0%	6.9%	46.2%
Colour(s)*	–	80%	56%	55.7%	71.6%	96.2%
Instruments*	73.1%	–	16%	17.1%	11.8%	23.1%
Surgeon's hand/fingers*	–	11%	10%	15.7%	–	25.0%
Surgeon*	–		–	–	–	7.7%
Change in light brightness*	–	64%	44%	44.3%	48.0%	46.2%

* The percentages do not add up to 100% because each patient may experience more than one visual sensation.

Reprinted with permission from: Au Eong K G. The Royal College of Ophthalmologists cataract surgery guidelines: what can patients see with their operated eye during cataract surgery? Eye 2002; 16:109-10.

et al[17] showed that 25% and 22% of their series of patients respectively had no light perception following a peribulbar injection.

Clearly, if only a minority of patients with retrobulbar or peribulbar anaesthesia have no light perception shortly after administration of the anaesthesia, the majority will have retained sufficient visual function to perceive light or to see more details of their visual environment during cataract surgery.

Topical anaesthesia alone is not known to have any effect on the function of the retina or optic nerve. It is therefore conceivable that patients operated on using topical anaesthesia will retain even more vision during surgery than those given retrobulbar or peribulbar anaesthesia.

It is likely that how much vision is retained during surgery depends on such factors as variations in the anaesthetic technique employed, type and volume of anaesthetic agent used, anatomical location where the agent is injected or instilled, and concomitant use of other drugs such as adrenaline and hyaluronidase. Techniques that have a greater propensity to block conduction through the optic nerve will conceivably cause a more marked reduction in the ability of the patient to perceive his visual environment during surgery. In addition, systemic medications such as preoperative or intraoperative sedation, either orally or intravenously, may affect the patient's alertness to his environment, including his visual environment. It may also affect the recall of any visual sensations that may have been experienced.

Can Patients See with Their Operated Eye During Cataract Surgery Under Local Anaesthesia?

Whether or not patients can see with their operated eye during cataract surgery is not discussed in any major ophthalmic textbooks and has not been well studied until recently.[14,15,18-20] There is a common misconception among some ophthalmologists that retrobulbar or peribulbar anaesthesia blocks the optic nerve completely and results in no light perception. These surgeons, therefore, do not expect patients having these forms of anaesthesia to be able to see with the operated eye during surgery. Even the

patient information leaflet in the *Cataract Surgery Guidelines* published in 2001 by the Royal College of Ophthalmologists, London, states that patients given local anaesthesia during cataract surgery "will not be able to see what is happening, but will be aware of a bright light".[21] This advice, however, contradicts recent findings published in the literature.[22]

Visual Experience During Cataract Surgery

Many patients experience a variety of visual sensations in the operated eye during surgery using retrobulbar,[11,14,15] peribulbar[19] or topical anaesthesia.[18,20] These visual sensations include perception of light, movements, flashes, one or more colours, surgical instruments, the surgeon's hand/fingers, the surgeon and changes in light brightness. The proportion of patients who perceived these sensations in several clinical studies are summarised in Table II.

Interestingly, Newman[20] documented that even under topical anaesthesia, some patients experience no light perception for brief intervals during their surgery.

Drawings by Patients

Several artists have recorded their visual experience during cataract surgery.[19,23,24] The paintings of one artist reported by Murdoch and Sze[19] and that of another reported by Sumich et al[23] are shown in Figures 2 and 3. Verma[24] reported a beautiful colour painting titled "A brilliant sky" by a 73-year-old artist based on her visual experience during phacoemulsification under topical anaesthesia (Fig. 4). He interpreted his patient's painting as movements of the phacoemulsification probe in the eye with possible stimulation of colour photoreceptors by the ultrasonographic energy because "the picture mimics the waves coming out of the phacoemulsification probe".[24,25] It is doubtful, however, if ultrasonographic energy plays a key role in the genesis of these images because some patients operated on by extracapsular cataract extraction could also experience images similar to those who had phacoemulsification.[26] Khan[27] believes that these movements of the phaco-emulsification probe can actually be "seen" by the patient. He explained the optics of the phenomenon as follows: "To understand how this could be, one needs to consider the posterior surface of the cornea as a concave mirror with its reflecting power (D) equal to two divided by its radius of curvature (r), i.e., D = 2/r. Assuming a typical value of r = 6.7 mm, this reflecting power is +298.5 dioptres (D). Let us now follow the image of the probe, assuming the probe to be 4 mm in front of the mirror and illuminated by the operating microscope. It comes to the mirror with a –250 (–1/0.004) D and leaves the mirror with +48.5 D. With the cataract partially removed and light able to pass around it, there is an image of the probe 1/48.5 m or 20.6 mm in front of the mirror — this is almost imaged on the retina in an eye of average length. If we assume the probe to be 3.9 mm behind the posterior cornea, the image is approximately 24 mm posterior to the posterior cornea, placing it on focus on the retina in an eye with an average axial length and therefore able to be seen in a typical patient undergoing minimally invasive cataract surgery."[27]

Au Eong and associates[14,15,18,26] invited all their patients in several studies to draw their visual images with colour pencils after the operation. None of their patients was an artist. Approximately half of the patients were able to produce a rough sketch of their visual experience (Fig. 5), but many had difficulty drawing a still picture from the kaleidoscope of moving colours and changing shapes they experienced. Some patients drew only a sketch of the visual images they experienced during a specific stage of the surgery, while others drew a montage of images from different stages of the procedure. The drawings varied greatly and no two sketches were identical. The patients' interpretation of their sketches also varied enormously and some reported seeing "balls of yellow", "shimmering blue stars", "a pair of cat's eyes" (probably from the two light sources in the microscope), surgical instruments, and shapes of circles, ovals, waves and stars.

The visual images seen by each patient are probably unique because they are likely to be a combination of images of objects close to but outside the eye (e.g., fingers, hands, instruments) and entoptic phenomena produced by objects on the corneal surface and in the eye. Dynamic factors such as moving fluids and bubbles on the corneal surface and in the eye, moving instruments in the eye, and the ever-changing shape and opacity of the lens as it is being emulsified (or expressed) and aspirated probably produce the changing kaleidoscope of colours and shapes reported by many of the patients. In addition, the refractive state of the eye also changes during the surgery, because the refractive elements of the eye such as the cornea and lens are deformed, and the eye is rendered from the phakic to aphakic, and finally pseudophakic state.

Clinical Significance of Visual Experience During Cataract Surgery

Ophthalmologists strive to provide the safest and most effective ophthalmic care to their cataract patients. In addition, they want the cataract surgery experience to be pleasant for their patients. So what is the clinical significance of patients being able to see with their operated eye during cataract surgery? Its significance lies in the fact that it can negatively impact on the safety of the surgery as well as the patient's satisfaction with the operation.

Au Eong and associates[14,18] were the first to document that some patients found their visual experience during cataract surgery frightening. Approximately 15.4% of pa-

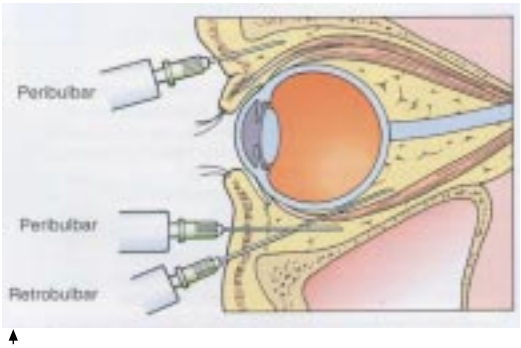

Fig. 1. Retrobulbar and peribulbar anaesthesia. (Reprinted with permission from: Batterbury M, Bowling B. Ophthalmology: an illustrated colour text. London: Churchill Livingstone, 1999:86.)

Fig. 2. The subjective visual experience of cataract surgery under local anaesthesia as illustrated by an artist. (Reprinted with permission from: Murdoch I E, Sze P. Visual experience during cataract surgery. Eye 1994; 8:666-7.)

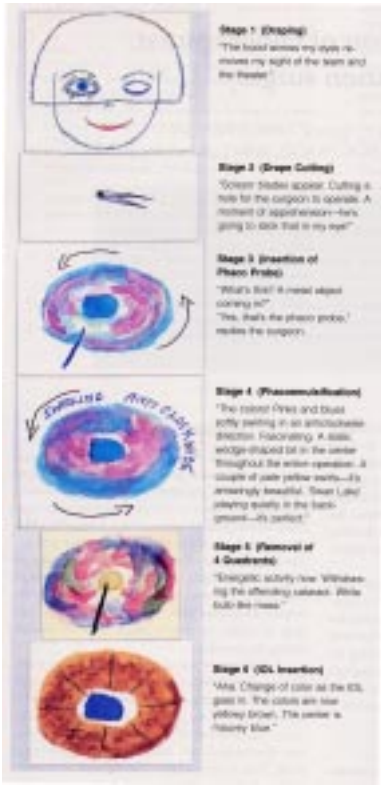

Fig. 3. An artist's drawings and descriptions of various stages of phacoemulsification surgery using retrobulbar anaesthesia. (Reprinted with permission from: Sumich P M, Francis I C, Kappagoda M B, Alexander S L. Artist's impression of endocapsular phacoemulsification surgery. J Cataract Refract Surg 1998; 24:1525-8.)

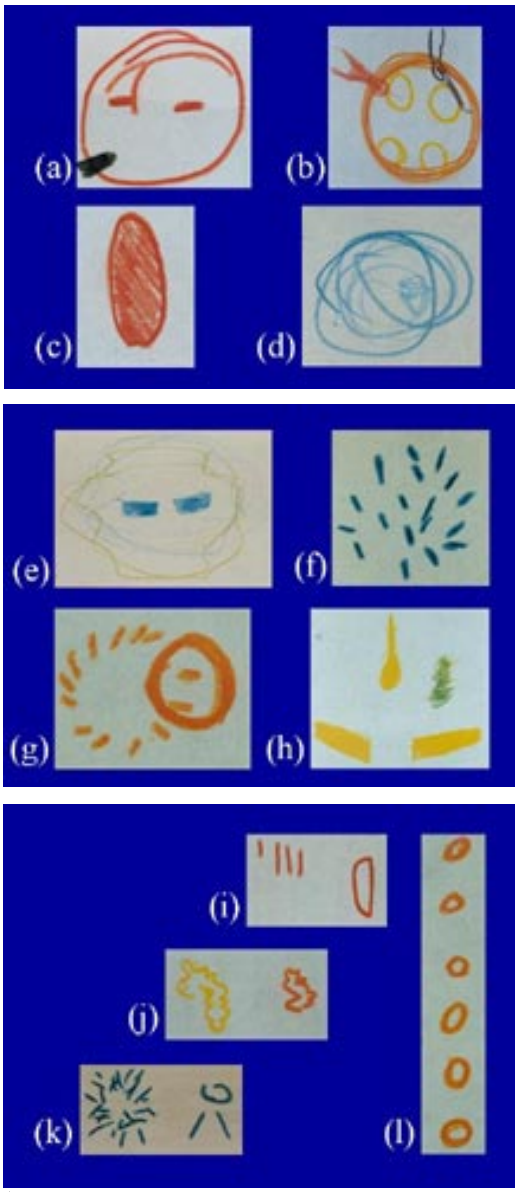

Fig. 5 (top, middle, bottom). (a) to (l) are sketches made by different patients on their visual experience during cataract surgery under local anaesthesia.

Fig. 4. "A brilliant sky": an artist's rendition of the visual images during phacoemulsification and intraocular lens implantation under topical anaesthesia. (Reprinted with permission from: Verma D. Retained visual sensation during cataract surgery [letter]. Ophthalmology 2001; 108:1004.)

tients who had phacoemulsification under topical anaesthesia[18] and 7.1% operated on under retrobulbar anaesthesia[14] were frightened by their visual experience. This fear and anxiety may cause patients to become uncooperative during the surgery, making continuation of the operation difficult or impossible without sedation or conversion to general anaesthesia, and increasing the risk of intraoperative complications. Furthermore, the stress response may trigger a sympathetic surge, causing such undesirable effects as hypertension, tachycardia, ischaemic strain on the heart, hyperventilation and acute panic attack. These responses are especially unfavourable for the majority of patients undergoing cataract surgery who are of the geriatric age group, often presenting with concurrent medical problems such as hypertension, diabetes mellitus and ischaemic heart disease. Blunting of this stress response with sedatives may, therefore, become necessary. Recent evidence, however, showed that the use of intravenous sedation is associated with a significant increase in adverse medical events for topical (1.20%) and injection anaesthesia (1.18%), relative to topical anaesthesia without intravenous sedation.[28]

When patients who had phacoemulsification under topical anaesthesia were asked whether they would have preferred a retrobulbar or peribulbar anaesthetic injection specifically to reduce their ability to see during surgery, 28.8% answered "yes", 52.8% answered "no" and 17.3% said "don't know".[18] Even when they were counselled in detail on the small risk of retrobulbar haemorrhage and globe perforation from retrobulbar or peribulbar anaesthesia, 7.7% of patients were prepared to accept the additional risks and would still have preferred injection anaesthesia to topical anaesthesia. These findings suggest that the intraoperative visual experience can affect patient satisfaction, and some patients are prepared to take additional risks just to reduce their ability to see during surgery.

What Can be Done to Reduce Fear and Anxiety from Intraoperative Visual Experience?

Since the visual experience during cataract surgery can cause fear and anxiety and adversely affect patient satisfaction, any intervention that can reduce its negative impact would contribute to making the operation safer and more pleasant for patients. There are several approaches to reduce the impact of this phenomenon on the safety and comfort of patients. These include appropriate preoperative counselling to prepare patients for any potential intraoperative visual sensations or images and reducing the ability of patients to see during surgery. The former may be performed verbally or aided by the use of drawings from artists or other patients while the latter may be effected by either systemic sedation or by the local effect of anaesthetic agents on the visual function.

A) Preoperative Counselling

Many patients about to undergo surgery fear the unknown. When patients who have not been forewarned experience visual sensations during cataract surgery, they are unable to interpret these images in the proper context without prior knowledge. Specifically, they are unsure if their experience is "normal". For example, patients who see vivid images may interpret that they have not been given sufficient anaesthesia. On the other hand, patients who experience no light perception may spuriously believe that some complications have occurred during the surgery. It is, therefore, conceivable that preoperative counselling about the variety of visual sensations patients can expect to experience during surgery and reassuring them that these experiences are "normal" may help to allay their anxiety during their operation. How should this preoperative counselling be carried out? There are at least two main approaches, both of which have not been well studied.

(i) Showing an artist's impression: Sumich and co-workers[23] had a 77-year-old artist recorded her visual perceptions during phacoemulsification and intraocular lens implantation using retrobulbar anaesthesia. The artist arbitrarily selected 6 stages for her illustrations (Fig. 3). The authors subsequently showed 30 consecutive patients who were about to undergo phacoemulsification in their first eye to assess the value of being shown the sketches preoperatively. Twenty per cent of the patients graded the value of having seen the drawings as "very useful", while another 30% found it "quite useful". The authors now provide the drawings to all their patients preoperatively as an adjunct to their informed consent.[29]

The artist's impression in Sumich and co-workers' article (Fig. 3) differs significantly from that of other artists who had also documented their experience[19,24] (Figs. 2 and 4). In addition, it is also different from sketches by other patients in 3 studies by Au Eong and co-workers[14,15,18] (Fig. 5). These differences demonstrate that these visual experiences are varied and that the patients' impressions are subjective.[26] This is supported by the experiences of patients reported by Sumich and co-workers,[23] as well as by patients in other studies.[14,15,18-20] In fact, only 1 out of 30 patients in Sumich and co-workers' series reported a "similar experience" to that of the artist.[23] For this reason, it is doubtful if showing patients one particular artist's impression preoperatively would be as helpful as sharing with the patients the collective experience of a series of patients operated on using similar surgical (extracapsular cataract extraction versus phacoemulsification) and anaesthetic (topical versus regional) techniques.[26] In addition, it is possible that patients shown only one particular artist's impression may misconstrue that as the "normal" phenomenon and may therefore become unduly anxious when they either have no

light perception during the surgery or when their experience differs from that of the artist.[26]

It is possible that showing cataract surgery candidates more drawings from a group of artists or patients could potentially be more helpful than just showing them a single artist's impression. Patients noting the great variations in the drawings by different artists may then get the correct impression that each person's visual experience is unique, and hence be less likely to be frightened if their personal experience is not similar to any one person's drawing.

(ii) Verbally advising patients specifically what to expect: The Royal College of Ophthalmologists' *Cataract Surgery Guidelines* include a brief advice on patient's intraoperative visual experience in its patient information leaflet.[21] It tells patients specifically that because of the local anaesthesia, they "will not be able to see what is happening, but will be aware of a bright light". This advice, unfortunately, is neither complete nor accurate based on current evidence in the literature.[22] First, some 15.7%[14] to 20%[15] of patients given retrobulbar anaesthesia and 22%[17] to 25%[16] given peribulbar anaesthesia have no light perception after administration of the regional anaesthesia. Even with topical anaesthesia, 5.9% of patients in one series lost light perception for a short interval during the surgery.[20] Second, in addition to light perception, many patients experience a variety of visual sensations in the operated eye during surgery using retrobulbar,[11,14,15,19] peribulbar[19] or topical anaesthesia (Table II).[18,20] Because the preoperative advice published by the Royal College of Ophthalmologists is neither complete or accurate, it is possible that patients who take the advice literally may become unduly anxious and frightened when they see only a dim light, have no light perception or experience additional visual sensations besides a bright light.[22]

Preoperative counselling about potential intraoperative visual sensations is conceivably more effective when the information given is complete and accurate. The collective experience of groups of patients using specific cataract surgery and anaesthesia techniques such as those in several clinical series shown in Table II, can be helpful to prepare patients on what to expect during their surgery. In fact, preliminary findings from a multicentre randomised clinical trial showed that patients who were given additional detailed counselling about potential intraoperative visual sensations were less likely to find their visual experience frightening compared to those who were not counselled.[30]

B) Reducing the Ability of Patients to See During Surgery

If the ability of patients to see during cataract surgery is reduced, the potential undesirable effects of these visual experiences on patients can be minimised. General anaesthesia completely eliminates any intraoperative visual experience, but its routine use specifically for this purpose during cataract surgery is unwarranted because of its associated risks. Other potential interventions include the judicious use of systemic sedation and administration of local anaesthetics for their effects on the visual function.

(i) Sedation: Oral or intravenous sedation reduces the alertness of a patient to his environment, including his visual environment. This reduced visual awareness, coupled with the anxiolytic properties of the drug itself, are likely to reduce anxiety from the visual experience. However, because the use of intravenous sedation is associated with a small but significant increase in adverse medical events, surgeons and anaesthetists should weigh the potential risks and benefits of using sedation for their individual patients for this purpose.[28]

(ii) Local effect of anaesthetic solution on the visual function: Although the effect of regional anaesthesia on the function of the optic nerve is often incomplete, the visual function is reduced as evidenced by objective findings such as transient afferent pupillary defect and marked reduction of the visual evoked potential.[10-13] Interestingly, Au Eong and associates[14,18] found that 15.4% of patients who underwent phacoemulsification under topical anaesthesia compared to 7.1% who were operated on using retrobulbar anaesthesia found their visual experience frightening. Although these 2 series are not directly comparable because the patients were operated in different institutions by different surgeons, it is possible that fewer patients who were given retrobulbar anaesthesia were frightened by their visual experience because the images they saw were less vivid as a result of the effect of the local anaesthetic on the function of the optic nerve.

Some surgeons have advocated the use of intracameral unpreserved lignocaine to augment analgesia during cataract surgery under topical anaesthesia.[31,32] This technique has become very popular in the United States, and among members of the American Society of Cataract and Refractive Surgery whose primary method of anaesthesia for cataract surgery was topical anaesthesia, 81.6% of them supplement the anaesthesia with intracameral lignocaine.[6] Interestingly, a few anecdotal reports of transient visual loss following the use of intracameral lignocaine have brought attention to the possible effects of this medication on the retina and optic nerve, especially in the presence of compromise to the posterior lens capsule or zonules.[33]

Hoffman and Fine[33] described a case of transient complete visual loss in a patient who received 0.5 mL of intracameral unpreserved 1% lignocaine for repair of a traumatic corneal graft dehiscence under topical anaesthesia. The authors postulated that the patient's complete visual loss was caused by total anaesthesia of the retinal nerve fibre layer

at or near the optic nerve head. They believe that because all ganglion cell axons converge at the optic nerve head, even a small amount of anaesthetic at this location could result in complete visual loss. Their patient had previously undergone pars plana lensectomy and vitrectomy, and essentially had no barrier for diffusion of the lignocaine into the posterior segment. The visual recovery of the patient coincided with the duration of action of lignocaine, suggesting that this medication was the cause of the profound temporary visual loss.

Hoffman and Fine[33] have also observed several patients who developed mild visual loss immediately after cataract surgery that recovered to normal by the first postoperative day. These patients had injection of additional intracameral anaesthetic after posterior capsular rupture had developed during the surgery. They believe that the intracameral anaesthesia was the cause of the temporary visual loss in these cases. Can intracameral lignocaine therefore reduce patients' intraoperative visual experience by its effect on the retina, bearing in mind that ordinarily, intracameral lignocaine given during routine cataract surgery may not have as much effect on the retina because of the barrier effect of the lens capsule, zonules and vitreous humour?

There is no study to date that has specifically evaluated if intracameral lignocaine can reduce patients' visual experience during cataract surgery under topical anaesthesia. Several investigators, however, have studied its effect on patients' discomfort from the microscope light or photophobia.[34-36]

Gillow and associates[34] conducted a large prospective, randomised, double-masked, clinical trial to determine whether the routine use of supplementary intracameral lignocaine had any benefit over topical anaesthesia alone when performing cataract surgery. Their patients were randomised to receive either topical anaesthesia plus 0.5 mL intracameral unpreserved 1% lignocaine or topical anaesthesia plus 0.5 mL intracameral balanced salt solution. Although they did not find any significant relationship between the use of intracameral lignocaine and either intraoperative ($P = 0.34$) or postoperative ($P = 0.45$) pain scores, there was a statistically significant reduction in the discomfort caused by the operating microscope light when intracameral lignocaine was used ($P = 0.04$). The mean microscope light pain scores were 1.35 (of a maximum of 10) when intracameral balanced salt solution was used and 0.98 when intracameral lignocaine was used. In another prospective, randomised, double-masked, placebo-controlled clinical trial reported by Crandall and co-workers,[35] 6% of patients in the intracameral lignocaine group compared to 10% in the control group reported that the microscope light bothered them "a lot" while 19% in the lignocaine group compared to 18% in the control group were bothered "a little" by the microscope light. The differences in this study, however, were not statistically significant ($P = 0.35$).

In a small prospective paired-eye study involving 15 patients, Pang and co-workers[36] studied the effect of intracameral lignocaine on photophobia, and retinal and optic nerve function after phacoemulsification. The first eye of each patient was randomly assigned to either 0.5 mL intracameral preservative-free 2% lignocaine or 0.5 mL of intracameral sterile saline. The second eye automatically received intracameral saline if the first eye received intracameral lignocaine and vice versa. The authors found that none of the patients reported any significant difference in photophobia between their eyes. When comparing test eyes with control eyes, they also did not observe any significant differences in electroretinographic and visual evoked response tests in the immediate postoperative period.

Conclusion

The findings that many patients can see a variety of visual sensations during cataract surgery under local anaesthesia and that some of them find their visual experience distressing have a major impact on the way ophthalmologists manage their cataract patients. All ophthalmologists ultimately want their patients to have a safe surgery and a pleasant experience. Reducing the potential negative impact of intraoperative visual experience will help surgeons achieve these objectives although the optimal approach to accomplish this is currently unknown. Since appropriate preoperative counselling appears to be effective and is not associated with any known side effects, surgeons should consider routinely incorporating sufficient preoperative counselling on potential visual experience when obtaining informed consent for surgery. More studies to evaluate the effectiveness of other approaches are also warranted.

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