

Patients' expectation and experience of visual sensations during phacoemulsification under topical anaesthesia

C-L Ang¹, KG Au Eong^{1,2,3,4}, SSG Lee¹, SP Chan⁵ and CSH Tan¹

Abstract

Purpose To describe what patients expect to see and the visual sensations they actually experience during phacoemulsification under topical anaesthesia. We also sought to determine if patients find their intraoperative visual experience frightening and the factors associated with this.

Materials and methods Ninety-eight patients who underwent phacoemulsification and intraocular lens implantation under topical anaesthesia were interviewed preoperatively on what they expected to see with their operated eye during surgery and again postoperatively on what they actually saw. No patient received counselling about possible intraoperative visual sensations. A logistic (multivariate) regression model was used for statistical analysis.

Results Preoperatively, 36 patients (36.7%) expected at least light perception, 38 (38.8%) expected no light perception, and 24 (24.5%) were unsure what to expect. Some patients also expected a variety of different visual sensations. Postoperatively, all patients (100%) reported seeing light intraoperatively and many experienced various other visual sensations. Nineteen patients (19.4%) found their visual experience frightening. The following factors were statistically associated with a frightening visual experience: preoperative anxiety, previous cataract surgery in the fellow eye, experiencing an intraoperative increase in clarity, not seeing movement intraoperatively, and not knowing what to expect.

Conclusions The majority of patients in this study either expected that they would see

nothing at all during the surgery or were unsure of what to expect. All patients subsequently saw at least some light, and many perceived various other visual sensations that were frightening to nearly one in five patients. Preoperative counselling should inform about possible intraoperative visual experience.

Eye (2007) 21, 1162–1167; doi:10.1038/sj.eye.6702427; published online 26 May 2006

Keywords: phacoemulsification; topical anaesthesia; expectations; visual experience; fear; preoperative counselling

Introduction

Phacoemulsification and intraocular lens (IOL) implantation is increasingly being performed under topical anaesthesia. In a series of surveys of members of the American Society of Cataract and Refractive Surgery, Leaming¹ showed that the percentage of respondents who reported topical anaesthesia as their primary method of anaesthesia increased from 0.2% in 1993 to 37% in 1998,² and 61% in 2003.³ Topical anaesthesia has several advantages over regional anaesthesia: unlike injection anaesthetic techniques, there is rapid return of postoperative visual acuity,⁴ no postoperative ptosis or diplopia,⁴ and no risk of damage to the globe or orbital contents.^{5–7}

It is only in recent years that patients' intraoperative visual experience during cataract surgery using different forms of local (topical, peribulbar, retrobulbar, and sub-Tenon's) anaesthesia has been studied in detail.^{8–14}

¹The Eye Institute at Tan Tock Seng Hospital, National Healthcare Group, Singapore, Singapore

²Ophthalmology and Visual Sciences, The Eye Institute, Alexandra Hospital, Singapore, Singapore

³Department of Ophthalmology, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore

⁴Singapore Eye Research Institute, Singapore, Singapore

⁵Health Promotion Board, Singapore, Singapore

Correspondence: KG Au Eong, Ophthalmology and Visual Sciences, The Eye Institute, Alexandra Hospital, 378 Alexandra Road, Singapore 159964, Singapore
Tel: +65 6379 3741;
Fax: +65 6379 3540.
E-mail: Kah_Guan_Au_Eong@alexhosp.com.sg

Received: 7 October 2005
Accepted: 2 April 2006
Published online: 26 May 2006

Several studies have shown that only a minority (0–20%) of patients experience no light perception intraoperatively.^{8–10,12,13} Most patients perceive at least some light during the surgery. In addition, many patients see a variety of other visual sensations such as movement, flashes, colours, instruments, the surgeon's fingers or hands, the surgeon, or a change in brightness of light.^{8–13,15}

To the best of our knowledge, there has been no report on what patients expect to see during cataract surgery and how this compares to their actual intraoperative visual experience. We were also unable to find a reference to such a report in a computerised search utilising PubMed. We conducted a survey to investigate what patients about to undergo phacoemulsification using topical anaesthesia expected to see intraoperatively and what they subsequently saw during the surgery. In addition, we studied if patients' preoperative expectations had any influence on fear resulting from their intraoperative visual experience, and we sought to identify other factors that may be associated with a frightening visual experience.

Materials and methods

Consecutive cataract patients who were scheduled for routine phacoemulsification and IOL implantation under topical anaesthesia in our institution were interviewed face-to-face about 1 h preoperatively by one of two of the authors (CLA and SSGL), using a standardised questionnaire, about their expectations of possible intraoperative visual sensations during the surgery. They were not advised beforehand on the range of possible visual sensations that they might encounter. We asked patients to grade their anxiety levels at the time of the interview based on a visual analogue scale of 0–10, where 0 represents no anxiety and 10 represents maximal anxiety. The same author interviewed the patients again within 1 h postoperatively about the visual sensations they actually experienced in the operated eye during surgery. They were also asked whether they found their visual experience frightening. The study was approved by our Institutional Review Board and informed consent was obtained from the patients before their participating in the study.

Two–three drops of preservative-free amethocaine 1% (Minims[®], Chauvin Pharmaceuticals, Essex, England) was administered onto the operated eye about 5 min before the surgery. No patient was given preoperative sedation or direct intracameral anaesthetic injection. Thirty-five patients were given intraoperative sedation, using intravenous propofol (Diprivan[®], AstraZeneca, Wilmington, DE, USA) (10–30 mg, 23 patients), midazolam (Dormicum[®], Roche, Basel, Switzerland)

(0.5–2 mg, 16 patients), fentanyl (Fentanyl Citrate DBL[®], David Bull, Melbourne, Australia) (12.5–25 µg, 10 patients), or a combination of these sedatives.

Fisher's exact tests were conducted for univariate analyses. A logistic (multivariate) regression model was built to ascertain the effects of identified factors that may result in a frightening visual experience, with the Hosmer–Lemeshow test applied to check for its goodness of fit. The graph of change in Pearson's χ^2 was used to identify influential observations. All statistical tests were conducted at 5% level of significance and the data were entered into STATA 7.0 (Stata Corporation, 4905 Lakeway Drive, College Station, TX, USA) for analysis.

Results

One hundred consecutive patients were interviewed preoperatively. Two patients were excluded from analysis after they declined to be interviewed postoperatively owing to fatigue, leaving a total of 98 patients who completed the study. No patient experienced any intraoperative complication such as posterior capsule rupture. The patient demographics are as shown in Table 1.

Intraoperative sedation was given in 35 patients (35.7%) and omitted in the remaining 63 patients (64.3%) based on the anaesthetist's assessment of the patients' level of anxiety and sympathetic response (heart rate, respiratory rate, blood pressure) during the operation. The mean (\pm SD) duration of operation was 15.9 (\pm 6.7) min (range, 5–45). Forty-two patients (42.9%) indicated that they were anxious about their operations preoperatively with a mean score (\pm SD) of 3.7 (\pm 2.2) (range, 2–8) on a visual analogue scale of 0–10.

Thirty-six patients (36.7%) expected to see at least some light intraoperatively, 38 patients (38.8%) expected that they would not perceive any light at all, and the remaining 24 (24.5%) did not know what to expect. Some of the patients who expected to see light also expected that they would see a variety of other visual sensations as summarised in Table 2. Seven patients (7.1%) expected to lose light perception transiently during the surgery.

Of the 55 patients having their first cataract operation, 10 patients (18.2%) expected to see at least some light during the operation, whereas the remaining 45 patients (81.8%) either did not expect to retain light perception (26 patients, 47.3%) or did not know what to expect (19 patients, 34.5%). In contrast, among the 43 patients undergoing their second cataract operation, 26 patients (60.5%) expected to retain light perception, and only 17 patients (39.5%) either did not expect to do so (12 patients, 27.9%) or did not know what to expect (five patients, 11.6%). This difference was statistically significant (Fisher's exact test, two-tailed, $P < 0.001$).

Postoperatively, all patients (100%) reported that they could see at least some light during the surgery. In addition, they reported a variety of other visual sensations (Table 2). Twenty-six patients (26.5%) reported that they lost light perception for short intervals during

the surgery. There was no statistically significant association between the use of intraoperative sedation and periods of losing light perception (Fisher's exact test, two-tailed, $P = 0.999$).

Nineteen patients (19.4%) found their visual experience frightening. Those who were anxious ($P = 0.004$), who had a history of cataract surgery in the fellow eye ($P = 0.018$), who experienced an intraoperative increase in clarity ($P = 0.020$), who did not see movement intraoperatively ($P = 0.022$), or who did not know what to expect ($P = 0.049$) were more likely to report that they were frightened, after taking into account a series of other factors using the logistic regression model (Table 3). The model was found to be satisfactory in terms of the Hosmer–Lemeshow test ($\chi^2_8: 7.34; P\text{-value: } 0.50$). There were several severe influential observations identified but these warranted no further investigation. There were no statistically significant associations between a frightening visual experience and gender, age, coexisting ocular pathology, preoperative best-corrected visual acuity, duration of surgery, and a difference between patients' preoperative expectations and their actual visual experience (Table 3). Use of intraoperative sedation was not associated with fear from visual experience.

Fifty-seven (58.2%) patients reported postoperatively that they felt that appropriate preoperative counselling about possible intraoperative visual sensations would have been useful, whereas 41 (41.8%) did not think so. Among the 19 patients who experienced fear, 73.7% (14 patients) indicated that they would have found preoperative counselling useful compared to 54.4% (43 patients) among the 79 patients who were not frightened. This difference was, however, not statistically significant (Fisher's exact test, two-tailed, $P = 0.195$).

Nine patients (9.2%) indicated that their visual experience affected their satisfaction with the operation. Of these, two (22.2%) reported that their visual

Table 1 Patient demographics

Patient characteristics	Number (percentage) of patients (n = 98)
Gender	
Male	47 (48.0%)
Female	51 (52.0%)
Mean age (\pmSD) (years)	
All patients	65.4 (\pm 10.0) (range, 33–82)
Male	66.0 (\pm 10.3) (range, 33–82)
Female	64.9 (\pm 9.8) (range, 42–80)
Preoperative BCVA	
6/9–6/36	76 (77.6%)
6/60–light perception	22 (22.4%)
Operated eye	
Right	39 (39.8%)
Left	59 (60.2%)
Coexisting ocular pathology in the operated eye	
Yes	13 (13.3%) ^a
No	85 (86.7%)
History of cataract surgery in the fellow eye	
Yes	43 (43.9%) ^b
No	55 (56.1%)

^aFive patients (5.1%) had nonproliferative diabetic retinopathy, four (4.1%) had dry age-related macular degeneration, two (2.0%) had glaucoma, one (1.0%) had proliferative diabetic retinopathy, and one (1.0%) had retinal vein occlusion.

^bOf the 43 patients, 19 (44.2%) received topical anaesthesia in their previous operations, 11 (25.6%) received regional anaesthesia, one (2.3%) received general anaesthesia, and 12 (27.9%) could not remember what anaesthesia they received.

Table 2 Proportion of patients who expected to see various specific visual sensations and those who experienced these sensations

Types of specific visual sensation	Number (%) of patients who expected to see visual sensation (n = 98)	Number (%) of patients who experienced visual sensation (n = 98)
Light	36 (36.7%)	98 (100%)
Colour(s)	18 (18.4%)	80 (81.6%)
Movement	20 (20.4%)	54 (55.1%)
Flashes	20 (20.4%)	59 (60.2%)
Instruments	8 (8.2%)	21 (21.4%)
Surgeon's fingers/hands	17 (17.3%)	29 (29.6%)
Surgeon/medical staff	10 (10.2%)	7 (7.1%)
Intraoperative increase in clarity	9 (9.2%)	29 (29.6%)
No light perception at times	7 (7.1%)	26 (26.5%)
No light perception at all during surgery	38 (38.8%)	0 (0%)

Table 3 Potential risk factors associated with a frightening intraoperative visual experience

Potential risk factor	Odds ratio	95% Confidence interval	P-value ^a
Age	0.956	0.881, 1.037	0.28
Gender	0.833	0.143, 4.864	0.839
History of cataract surgery	11.085	1.507, 81.537	0.018
Coexisting ocular pathology	1.051	0.049, 22.721	0.975
Preoperative BCVA	1.595	0.224, 11.359	0.641
Preoperative anxiety	25.717	2.908, 227.431	0.004
<i>Preoperative expectation</i>			
Expected to see some light			
Expected to see no light	2.465	0.169, 35.900	0.509
Did not know what to expect	15.179	1.014, 227.180	0.049
Intraoperative sedation	1.893	0.362, 9.891	0.449
Duration of operation	0.999	0.866, 1.151	0.985
Difference between expectations and visual experience	0.35	0.019, 6.380	0.478
<i>Intraoperative visual sensations experienced</i>			
Colour(s)	0.911	0.110, 7.550	0.931
Movement	0.076	0.008, 0.694	0.022
Flashes	1.513	0.238, 9.609	0.66
Instruments	2.723	0.247, 30.031	0.413
Surgeon's hands/fingers	1.898	0.232, 15.506	0.55
Surgeon/medical staff	0.496	0.022, 11.018	0.658
Intraoperative increase in clarity	14.297	1.507, 135.65	0.02
No light perception at times	1.544	0.221, 10.794	0.662

^aLogistic (multivariate) regression model.

experience was unpleasant and had overall decreased satisfaction, whereas seven (77.8%) indicated their overall satisfaction was increased owing to the intraoperative visual pleasantries. A frightening visual experience was statistically more likely to result in decreased satisfaction than increased satisfaction (Fisher's exact test, one-tailed, $P=0.028$). One of the patients who had found his visual experience pleasant described the 'fantastic colours' that he saw.

Discussion

A significant number of patients in our study (63.3%) either believed that they would not see any light at all (38.8%) or did not know what visual sensations to expect (24.5%) during phacoemulsification under topical anaesthesia. Only 36.7% expected to see at least some light. The expectation of seeing during the operation was higher in patients undergoing their second cataract operation ($P<0.001$). It is possible that intraoperative visual sensations experienced in the first operation may have influenced their beliefs as a previous cataract surgery may be regarded as a practical form of 'counselling' on the visual sensations during cataract surgery. Regardless of the patients' expectations, all of them retained light perception during surgery, similar to the studies by Au Eong *et al* and Newman,^{9,13} and many of them also perceived a variety of other visual

sensations, which were in excess of their preoperative expectations (Table 2).

In this study, 19.4% of our patients were frightened by their visual sensations, a proportion that is slightly higher than the 15.4% previously reported by Au Eong *et al*.⁹ Fear experienced during cataract surgery is of clinical significance as it may cause a sympathetic stress response, which can result in tachycardia, hypertension, hyperventilation, ischaemic strain on the heart, and acute panic attacks.¹⁶⁻¹⁸ In addition, it may cause patients to become less cooperative during the surgery and may increase intraoperative morbidity as most cataract patients are in the geriatric age group and have significant concurrent chronic diseases like hypertension and ischaemic heart disease.

There were several interesting risk factors that correlated with patients' likelihood of being frightened by their intraoperative visual experience. The risk factor with the most significant correlation was preoperative anxiety ($P=0.004$). Preoperative preparation of patients should thus include a specific aim to allay anxiety and adequate knowledge of what they can expect to see during the surgery may be useful. Another risk factor for fear was patients' preoperative expectations: patients who did not know what to expect were significantly more likely to be frightened compared to those who expected to see some light ($P=0.049$). In addition, a higher proportion of patients who were frightened

indicated that preoperative counselling would have been useful compared to those who were not frightened.

It thus appears from the above results that preoperative counselling may allay anxiety and reduce fear resulting from intraoperative visual experience. In fact, this finding is also suggested by a paper by Tan *et al.*¹⁸ Currently, preoperative counselling about possible visual experience during surgery may still not be widely practised. In our study, no patient received any preoperative counselling about possible intraoperative visual experience. The lack of routine preoperative counselling may be because some ophthalmologists are still unaware of the varied and often vivid visual sensations patients may experience intraoperatively or are unconvinced by the usefulness of preoperative counselling (Leo SW, Lee LKM, Au Eong KG. Visual experience during phacoemulsification and intraocular lens implantation under topical anaesthesia: a nationwide survey on the knowledge and practices of ophthalmologists in Singapore. Presented at the XXIXth International Congress of Ophthalmology, Sydney, April 21–25, 2002).

Of interest is the finding that patients with a history of previous cataract surgery were statistically more likely to be frightened than those without ($P = 0.018$). As noted in Table 1 (demographics), out of the 43 patients who had a history of cataract surgery, 19 patients (44.2%) received topical anaesthesia in their previous operations, 11 (25.6%) received regional anaesthesia, one (2.3%) received general anaesthesia, and 12 (27.9%) could not remember what anaesthesia they received. Also previously noted was that the majority of those undergoing their second cataract operation expected to be able to see during the surgery. At first glance, this may seem to indicate that preoperatively expecting to retain light perception predisposes to a frightening visual experience, contrary to our other finding that patients who did not know what to expect were more likely to be frightened. A possible explanation for this is that the patients who had a more invasive form of anaesthesia (at least 12 in our study) during the first cataract surgery compared to the topical anaesthesia used for the second operation might have experienced a more vivid visual experience the second time and this could have alarmed them. It has been shown in a recent prospective randomised clinical trial that more patients operated on using topical anaesthesia experienced perception of light, colours, and a change in light brightness compared to those operated on using retrobulbar anaesthesia.¹⁹ The results therefore suggest that preoperative counselling should target all patients regardless of their preoperative expectations or whether or not they have had a previous cataract surgery.

Another interesting finding from our study is that nine patients (9.2%) reported a change in their satisfaction with the surgery owing to their visual experience, and seven (7.1%) among these nine patients reported their visual experiences to be pleasant, whereas two (2.0%) had unpleasant experiences. This finding is similar to a recent randomised controlled trial conducted in India, which found that visual experiences can be both pleasant and unpleasant.¹⁹ Our anecdotal experience has also shown that some patients do find their visual experiences pleasant owing to the unexpected multitude of colours and shapes, an observation that has been pointed out in recent articles by Zia *et al.*²⁰ and Au Eong *et al.*²¹

Newman documented that six out of 102 patients (5.9%) lost light perception at times during phacoemulsification and IOL implantation under topical anaesthesia.¹³ Transiently raised intraocular pressure could be responsible for this phenomenon. In this study, a higher proportion of patients (26.5%) reported transient loss of light perception during the operation, and this was not associated with the use of intraoperative sedation ($P = 0.999$). Loss of light perception intraoperatively can conceivably be frightening to some patients who may misconstrue this as a complication occurring during the surgery. Preoperative counselling should therefore include a warning about this phenomenon.

In summary, our study shows that a significant proportion of patients undergoing phacoemulsification under topical anaesthesia were either unsure about the possible visual sensations they might experience during the operation or did not expect to see anything. Contrary to their beliefs, all of them experienced at least some light perception, with many perceiving a variety of other visual sensations that were frightening to nearly one in five patients. A majority of patients felt that preoperative counselling about possible intraoperative visual sensations would have been useful and the proportion of patients who felt so was higher among those who were frightened than those who were not. This suggests the importance of preoperative counselling in helping to alleviate the fear experienced by patients.

Acknowledgements

Previously presented at:

- Poster presentation at NHG Scientific Congress 2003, 4–5 October 2003, Singapore
- Poster presentation at 22nd Singapore–Malaysia Joint Meeting in Ophthalmology (in conjunction with the 5th Singapore National Eye Research Meeting), 28–30 May 2004, Singapore
- Oral presentation at NHG Annual Scientific Congress 2004 Ophthalmology Symposium, 9–10 October 2004,

Singapore. There are no vested proprietary or financial interests in the products or results mentioned in the manuscript.

References

- 1 Leaming DV. Practice styles and preferences of ASCRS members—1993 survey. *J Cataract Refract Surg* 1994; **20**: 459–467.
- 2 Leaming DV. Practice styles and preferences of ASCRS members—1998 survey. *J Cataract Refract Surg* 1999; **25**: 851–859.
- 3 Leaming DV. Practice styles and preferences of ASCRS members—2003 survey. *J Cataract Refract Surg* 2004; **30**: 892–900.
- 4 Nielsen PJ. Immediate visual capability after cataract surgery: topical *versus* retrobulbar anaesthesia. *J Cataract Refract Surg* 1995; **21**: 302–304.
- 5 Edge KR, Nicoll JM. Retrobulbar haemorrhage after 12,500 retrobulbar blocks. *Anesth Analg* 1993; **76**: 1019–1022.
- 6 Duker JS, Belmont JB, Benson WE, Brooks Jr HL, Brown GC, Federman JL *et al*. Inadvertent globe perforation during retrobulbar and peribulbar anaesthesia. Patient characteristics, surgical management, and visual outcome. *Ophthalmology* 1991; **98**: 519–526.
- 7 Hay A, Flynn Jr HW, Hoffman JI, Rivera AH. Needle penetration of the globe during retrobulbar and peribulbar injections. *Ophthalmology* 1991; **98**: 1017–1024.
- 8 Au Eong KG, Lim TH, Lee HM, Yong VS. Subjective visual experience during phacoemulsification and intraocular lens implantation using retrobulbar anaesthesia. *J Cataract Refract Surg* 2000; **26**: 842–846.
- 9 Au Eong KG, Low CH, Heng WJ, Aung T, Lim TH, Ho SH *et al*. Subjective visual experience during phacoemulsification and intraocular lens implantation under topical anaesthesia. *Ophthalmology* 2000; **107**: 248–250.
- 10 Au Eong KG, Lee HM, Lim AT, Voon LW, Yong VS. Subjective visual experience during extracapsular cataract extraction and intraocular lens implantation under retrobulbar anaesthesia. *Eye* 1999; **13**: 325–328.
- 11 Levin ML, O'Connor PS. Visual acuity after retrobulbar anaesthesia. *Ann Ophthalmol* 1989; **21**: 337–339.
- 12 Murdoch IE, Sze P. Visual experience during cataract surgery. *Eye* 1994; **8**: 666–667.
- 13 Newman DK. Visual experience during phacoemulsification cataract surgery under topical anaesthesia. *Br J Ophthalmol* 2000; **84**: 13–15.
- 14 Verma D. Subjective visual experience during phacoemulsification and intraocular lens implantation under topical anaesthesia [letter]. *Ophthalmology* 2001; **108**: 1004–1005.
- 15 Au Eong KG. The Royal College of Ophthalmologists cataract surgery guidelines: what can patients see with their operated eye during cataract surgery [letter]? *Eye* 2002; **16**: 109–110.
- 16 Tan CS, Rengaraj V, Au Eong KG. Visual experiences of cataract surgery. *J Cataract Refract Surg* 2003; **29**: 1453–1454.
- 17 Tan CS, Au Eong KG, Kumar CM, Rengaraj V, Radhakrishnan M. Fear caused by intraoperative visual sensations during cataract surgery. *Acta Ophthalmol Scand* 2005; **83**: 631–632.
- 18 Tan CS, Au Eong KG, Kumar CM, Rengaraj V, Radhakrishnan M. Fear from visual experiences during cataract surgery. *Ophthalmologica* 2005; **219**: 416.
- 19 Rengaraj V, Radhakrishnan M, Au Eong KG, Saw SM, Srinivasan A, Matthew J *et al*. Visual experience during phacoemulsification under topical *versus* retrobulbar anaesthesia: results of a prospective, randomised, controlled trial. *Am J Ophthalmol* 2004; **138**: 782–787.
- 20 Zia R, Schlichtenbrede FC, Greaves B, Saeed MU. 'Only rarely seen in dreams'—visual experiences during cataract surgery. *Br J Ophthalmol* 2005; **89**: 247–248.
- 21 Au Eong KG, Tan CS, Ang CL, Lee SS, Venkatesh R, Muralikrishnan R *et al*. Intraoperative visual experiences of cataract patients can be both pleasant and unpleasant. *Br J Ophthalmol* 2005; **89**: 1386.