ARTYKUŁ ORYGINALNY ORIGINAL RESEARCH STUDY
DOI: 10.24292/01.OT.200622

The impact of various factors on the occurrence and type of visual experiences during the cataract surgery

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ABSTRACT

Aims: The aim was to check whether there is a relationship between ophthalmic and non-ophthalmic concomitant diseases and visual experiences during surgery. In addition, we wanted to verify whether visual experiences are influenced by such factors as age, gender, education, stress, etc.

Methods: The patients phoned a few days after the surgery in order to be interviewed post-operatively by a 30-question questionnaire. Questions were asked on demographic data, concomitant diseases, both ophthalmic and non-ophthalmic, emotional and visual experiences during the cataract surgery p-value was calculated from the Chi-Square Test.

Results: The study comprised 121 women and 87 men. 63.9% of patients underwent cataract surgery for the first time. Among 208 respondents 73 (35.1%) had light impressions and 77 (37%) reported visual impressions. Patients under 60 were more likely to experience both light and visual impressions ($p < 0.05$). Particular visual defects and concomitant diseases, both ophthalmic and non-ophthalmic, can influence the type of visual experiences. Stress was positively correlated with the occurrence of both light and visual impressions ($p < 0.05$) but it did not influence the exact type of visual experiences. For half of the respondents (51.0%), the impressions seen during the surgery were neutral. Only 14.4% of patients assessed these sensations as pleasant.

Conclusion: Patients experienced a variety of visual sensations, which are not usually unpleasant, however they occurred more often among stressed patients and could also raise the stress level. Proper preoperative counseling is needed to help patients cope with the stress before surgery.

Key words: cataract surgery, visual experiences, intraoperative stress, light impressions, visual impressions

HIGHLIGHTS

Age and stress influence the occurrence of visual impressions, whereas concomitant diseases influence the type of visual experiences.

INTRODUCTION

Cataract is a medical condition resulting in clouding of the lens of the eye and leading to decrease of visual acuity. It is the most common cause of blindness and visual impairment, usually associated with ageing [1]. This explains the fact that one of the most commonly performed ophthalmic procedures is cataract surgery. Studies indicated that over 20 million surgeries were carried out worldwide in 2015, including 4.2 million in the European Union and 3.6 million in the United States of America [2].

The technology progress made cataract surgery the safest and most predictable eye surgery, performed under either local or topical anesthesia. The majority of patients are awake during the procedure which allows them to experience a multitude of visual sensations intraoperatively. Some of them include changes in light brightness and colours, flashes, movements, surgical instruments, the surgeon's hands or fingers [3–6].

At present, it is not known how to explain the light and visual phenomena experienced by patients during cataract surgery.

The aim of our research was to check whether there is a relationship between ophthalmic and non-ophthalmic concomitant diseases and visual sensations during surgery. In addition, we wanted to verify whether these sensations are influenced by such factors as gender, education, stress, etc.

PATIENTS AND METHODS

A study was conducted from October 2020 to January 2021. The inclusion criteria embraced adults over forty years old who underwent at least one cataract surgery. In case of patients having undergone more than one cataract surgery, only the latest one was taken into consideration. Informed consent was obtained from all participants. All cataract extractions were performed under topical anesthesia, proxymetacaine hydrochloride 0.5% eye drops preoperatively.

The patients phoned a few days after the surgery in order to be interviewed post-operatively by a 30-question questionnaire. Questions were asked on demographic data (age, sex, education, profession, place of residence), concomitant diseases – both ophthalmic and non-ophthalmic such as hypertension, diabetes, obesity, myopia, hyperopia, retinopathy. The survey also comprised emotional and visual experiences during the cataract surgery. Among the intraoperative visual experiences, light and visual impressions were set apart. Light impressions were represented by: homogenous dark images, homogeneous fair images, scotomas (dark spots on fair background), flashes (fair spots on dark background) and changes in light intensity. As far as visual impressions are concerned, patients were asked about undermentioned phenomena: image movements, changes of colours, intensification of a colour, weakening of a colour, monochrome images, images consisting of more than one colour, spotted images, lined images, geometric images, images of the surgeon's hands/fingers and images of colorful clouds. Both light and visual impressions' intensity was assessed. The psychological part of the survey included questions on pre-, intra- and postoperative emotions and stress. An overall subjective assessment of the visual experiences was also recorded along with the appointment with an ophthalmologist, during which the course of the cataract surgery was explained.

P-value was calculated from the Chi-Square Test. This study involves human participants but an Ethics Committees exempted this study. According to the Ethics Committee, ethical approval is not required for questionnaire studies. The study was conducted in accordance with Helsinki Declaration.

RESULTS

The patients who participated in the study were operated in the Ophthalmology Ward of Kornel Gibiński University Clinical Centre, Medical University of Silesia in Katowice and in the Ophthalmology Ward of County Hospital in Limanowa. In our study there were 121 women and 87 men among 208 respondents. Their age and education are presented in table 1.

TABLE 1

Demographic data.

Age (years)	Number of respondents
45–50	19
51–55	12
56–60	17
61–65	27
66–70	30
71–75	43
76–80	23
81–85	16
86–90	11
90	10
Education	
Primary school	19
Lower secondary education	11
Secondary education	68
Higher education	61
Vocational education	49
Place of residence	
Village	34

City < 50,000 inhabitants	40
City 50,000–100,000 inhabitants	34
City 100,000–300,000 inhabitants	52
City > 30,000 inhabitants	48

As far as the occupation is concerned, pensioners were the largest group – 120 respondents. White collar workers and blue collar workers were respectively 37 and 33. 11 patients were unemployed and 7 were annuitant. Table 1 presents also the place of residence of the surveyed patients. Among the non-ophthalmic diseases the most common were hypertension and obesity (fig. 1).

In terms of ophthalmic diseases and vision defects, myopia and dry eye syndrome were reported the most often (fig. 2). Out of the group of 208 patients, 63.9% underwent cataract

FIGURE 1

Non-ophthalmic diseases frequency.

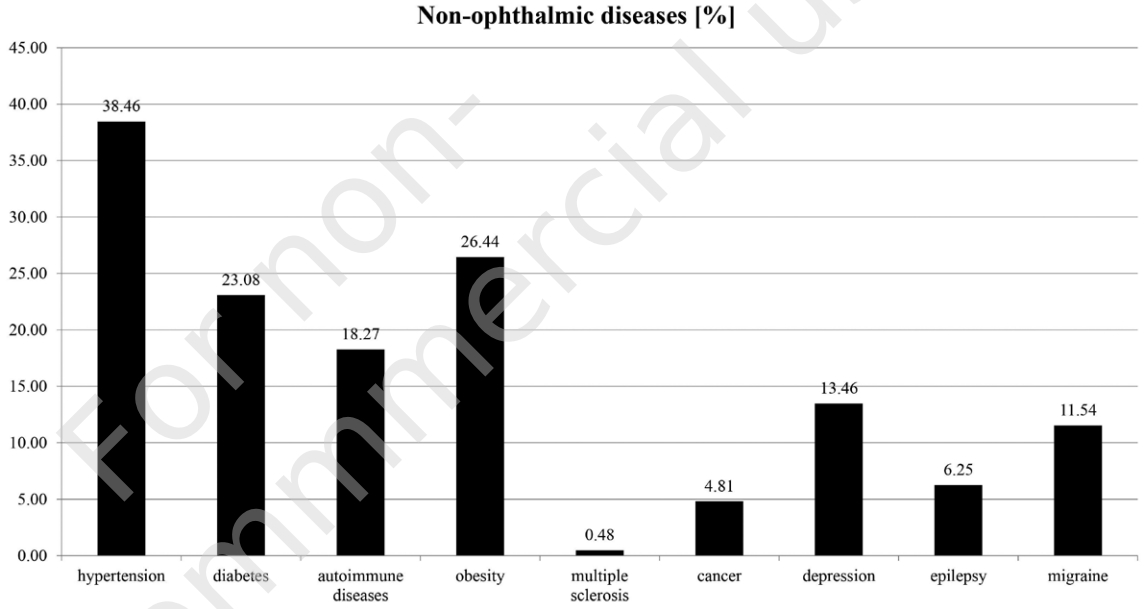
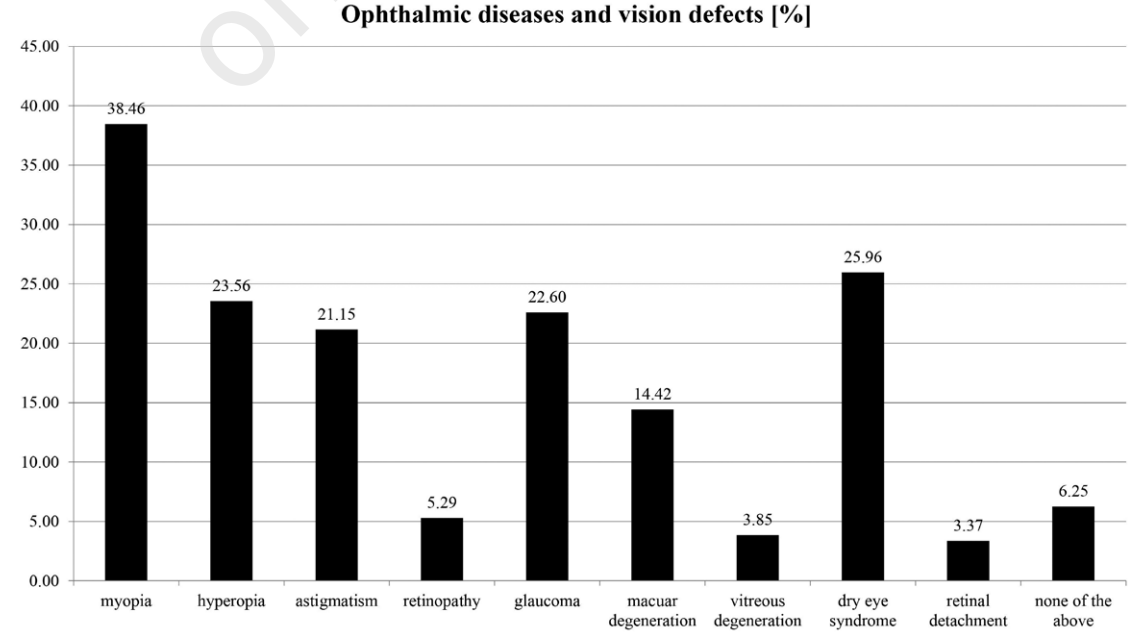


FIGURE 2

Ophthalmic diseases and vision defects frequency.



surgery for the first time, while the rest (36.1%) underwent it for the second time. Before the surgery patients were asked to evaluate their visual acuity. Patients were asked how they rated their visual acuity on a scale from 1 to 5. Only 9.6% of the surveyed patients rated their visual acuity as "very good" (5). Rest of the patients rated it as: 4 (23.6%), 3 (24.0%), 2 (30.3%) and 1 (12.0%).

Before the surgery, more than half of the patients reported a gradual deterioration of visual acuity (53.4%) and blurry vision (56.7%). The other, most common symptoms listed by patients included: difficulties with walking and distance assessment (28.4%), faster than usual eyes fatigue (26.4%); bright, disturbing light (19.7%). Moreover, patients reported: increasing myopia (14.9%), double vision of objects and disturbed perception of objects' shapes (14.9%). Only 11 (5.3%) out of 208 examined patients reported colour vision impairment before surgery. Over 30% of patients encountered difficulties in choosing correct glasses. Among 208 respondents 73 (35.1%) had light impressions during the surgery. Most of them (39.7%) reported changes in light intensity. The least common impressions were homogenous dark images (8.2%) respondents (fig. 3).

29 patients experienced the intensification of light impressions during the procedure. 19 of them had them mostly at the beginning of the surgery, and 14 respondents at the end of the procedure. Among 11 patients the light impressions did not change. Among 208 respondents 77 (37%) reported visual impressions. Most of them (22.1%) experienced images of the surgeon's hands/fingers. Changes of colours and intensification of a colour were both reported by 20.8% respondents (fig. 4).

As far as colours are concerned, the warm ones (orange, red, yellow) predominated in 40 patients and cold ones (green, blue, purple) in 30 respondents. Single colour dominated among 30 of them (10 patients – yellow, 7 – red, 5 – purple and blue, 2 – orange).

28 patients experienced the intensification of the light impressions during the procedure. 20 of them at the end of the surgery, and 13 respondents at the beginning of the procedure. Among 16 patients no changes of the visual impressions were reported.

Patients under 60 were more likely to experience both light and visual impressions ($p < 0.05$). No association between the occurrence of light and visual impressions and such factors as sex, education, profession, place of residence, concomitant ophthalmic diseases and subjective quality of vision has been found.

Particular concomitant diseases – both ophthalmic and non-ophthalmic – influence the type of visual experiences. Patients with myopia, compared to the whole group, were less likely to see homogenous dark images ($p < 0.05$) and more likely to see changes in light intensity ($p < 0.05$). Patients with hyperopia experienced changes of colours more often compared to other patients ($p < 0.05$). Other eye disorders and ophthalmic diseases did not influence the type of visual experiences ($p > 0.05$).

As far as non-ophthalmic concomitant diseases are concerned, patients with autoimmune diseases experienced changes in light intensity, intensification of a colour, weakening of a colour and images of the surgeon's hands/fingers more often compared to the whole group ($p < 0.05$).

FIGURE 3

Light impressions frequency.

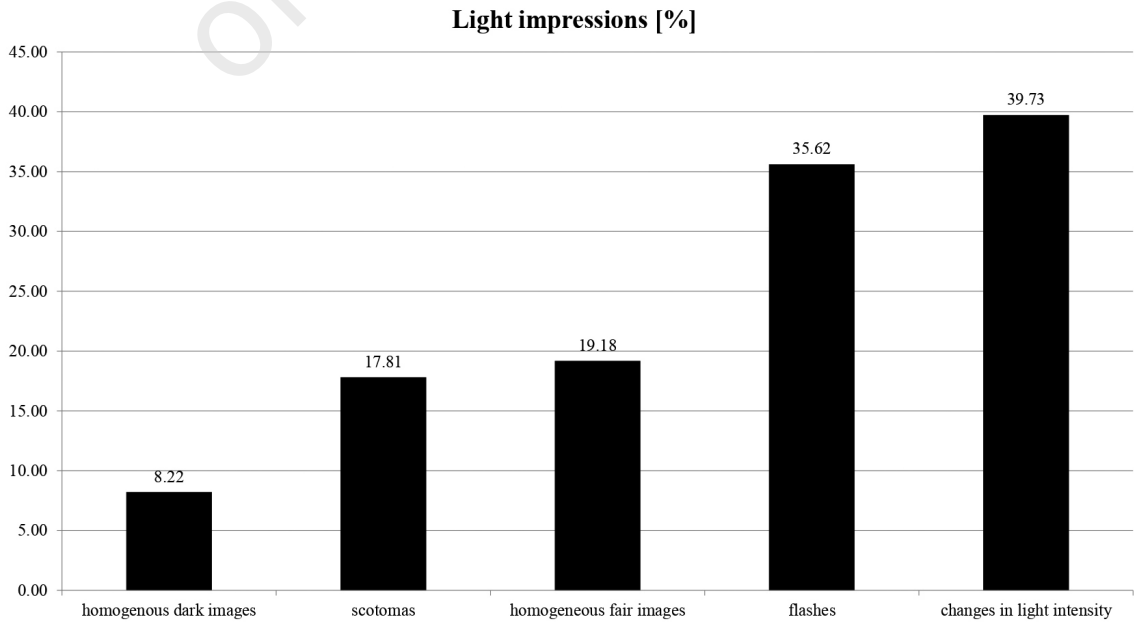
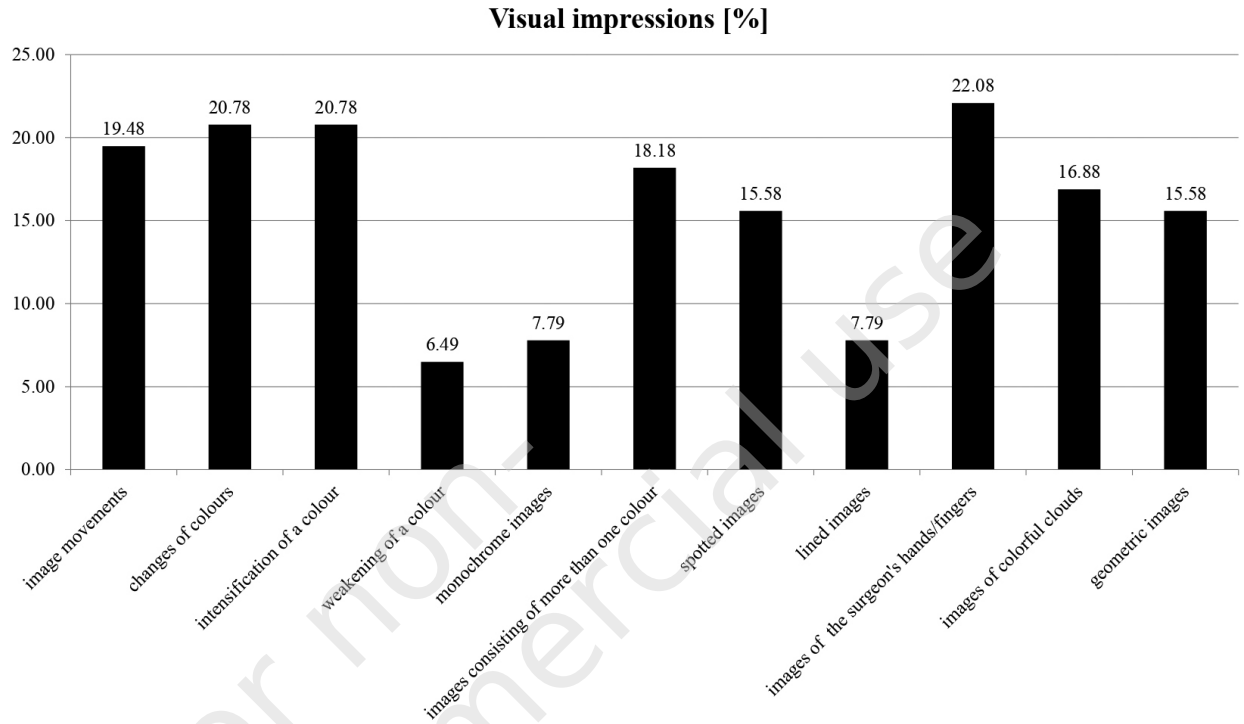


FIGURE 4

Visual impressions frequency.



Patients suffering from hypertension experienced more frequently images of colorful clouds ($p < 0.05$) and patients with diabetes experienced less frequently colorful clouds and images consisting of more than one colour ($p < 0.05$). No other relationship between the non-ophthalmic concomitant diseases and the type of visual experiences has been found.

In connection with the cataract surgery, stress was experienced by the majority, i.e. 63.0% of patients, especially patients under 60 reported the surgery as stressful more often than people over 60 ($p < 0.05$). For the majority of patients (54.2%) the most stressful period was the time before surgery. Stress during surgery was reported by 32.1% of patients and after surgery it was only 13.7% of respondents. No association between stress and such factors as sex, education, profession, place of residence and concomitant diseases has been found. Stressed patients experienced more often the occurrence of both light and visual impressions ($p < 0.05$) but stress did not influence the exact type of visual experiences. Among stressed patients, visual impressions were the most vivid at the beginning and at the end of surgery more often than in the not stressed persons ($p < 0.05$). No similar relationship between light impressions and stress has been found. Patients who experienced neither light nor visual impressions were more likely to rate the surgery as pleasant or neutral ($p < 0.05$).

Of the 208 people surveyed, 140 patients (67.3%) spoke with an ophthalmologist directly before the procedure, and the remaining 32.7% did not consult an ophthalmologist directly before surgery. The data show that the appointment did not change the stress level in 52.9% of patients, while in 39.3% the stress was visibly lower. Only in 7.9% of patients the stress increased after consultation.

For half of the respondents (51.0%), the impressions seen during the surgery were neutral; only 14.4% of patients assessed these sensations as pleasant, while the rest of the respondents reported negative feelings related to intraoperative sensations: 18.3% assessed them as rather unpleasant, 14.4% as definitely unpleasant, and 2.9% considered them traumatic.

DISCUSSION

Our research includes one of the largest group of patients who underwent cataract surgery under topical anesthesia. It also investigates the influence of ophthalmic diseases, non-ophthalmic diseases and vision defects, while other studies embraced only ophthalmic diseases or none of the mentioned above [7–11]. Biró & Schvöller [9] took into consideration ophthalmic diseases, non-ophthalmic diseases and vision defects, calling them ophthalmic pathological conditions but without dividing them into groups. They were present among 38.6% of patients. In our research the percentage of patients with non-ophthalmic diseases and ophthalmic diseases with vision defects was significantly higher –78.4% and 85.1% respectively.

Our study indicated that patients have a wide range of visual experiences during their cataract surgery, which is consistent with prior research papers [7–11]. However, for the first time patients were asked so accurately about their visual experiences. In our research we divided visual experiences into two groups – light and visual impressions and then into particular images, while other studies concentrated only on colours and shapes [7], colours, shapes and light intensity [9, 11], colours, shapes and movements [8]. 56.7% of patients did not have any visual experiences which is significantly higher compared to other studies [7–9, 11]. The percentage of patients experiencing colourful visions during the cataract surgery varies in different researches from 23.0% in this study to 95.5% [9]. In most studies the number of these patients is over 65% [7, 8, 11]. What is interesting, the colours themselves are also completely different. In our study yellow and red were dominant, in others – blue and red [7], white and blue [8], yellow and red [9]. 5.8% of all the patients in our study experienced the vision of geometric shapes compared to 7.5% in paper by to Chaudhry et al. [8]. Significantly higher numbers were present in Biró & Schvöller [9] and Wenzel & Schwering [7] (74.2% and 75.5% respectively). As far as gender and level of education are concerned, no statistically significant differences were found, which is consistent with prior research papers [7–9, 11].

This is one of the first studies describing the relation between the non-ophthalmic diseases, ophthalmic diseases, vision defects and the character of visual experiences. Ophthalmic diseases seem to have no influence on the visual sensations, in contrast to vision defects and non-ophthalmic diseases. We suspect that the reason for non-ophthalmic diseases' influence on intraoperative visual experiences is the fact that autoimmune diseases, hypertension and diabetes can have an impact on patients' eye structures. However, no data about the exact courses of these diseases were gathered, e.g. about the stadium, duration or medication. It is inconsistent with previous research papers, where no relationship between ophthalmic diseases or vision defects and the character of visual experiences was present [9]. Future studies should raise the issue in an effective way.

More than 60% of patients experienced stress, and more than 50% claimed that the most stressful period was before the surgery, which is a consistent result with Wenzel & Schwering [7]. Tranos et al. [11] found that people under 65 were more distressed, which is similar to our results comparing people under and over 60. Chaudhry et al. [8] found that patients under 60 were more likely to experience frightening visual sensations, however it was statistically insignificant.

The majority of patients found the visual experiences either pleasant or neutral, which is similar to Wenzel & Schwering [7], however, in this research the percentage of pleasant feelings was much higher compared to our research (61% vs 14%). It is worth mentioning that all of the patients taking part in that research had a 20-minute appointment with an explanation of the whole procedure while in our study less than 70% received preoperative counselling. According to Chaudhry et al. [8], the percentage of frightening visual sensations in the research was over 25% and lack of proper preoperative counselling is mentioned as one of possible reasons.

Taking into consideration the fact that the younger group of patients had visual experiences more often than the group over 60, it is inconsistent with previous literature [7], where no association between the patients' age and visual sensations was found. What is worth mentioning, the younger group of patients was more likely to have both visual experiences and feel anxiety, so it bears asking what the association between the occurrence of both light and visual impressions and stress is. In our study stress was mostly preoperative, therefore we assume that stress is the factor that enhances the frequency of occurrence of visual experiences. Moreover, lack of visual experiences happened more often to patients with positive or neutral rating of their feelings during surgery. It can be a basis for discussion whether the presence of visual experiences heightens the stress level, causing some kind of a vicious circle. Presumably the brain can perceive those impressions as a hazard for one's eyesight.

It is also worth stressing that among those patients who received direct preoperative counselling, less than 40% felt less anxious afterwards. It can be caused by the patient's preparedness for possible side effects or failed surgery. On the other hand it should also raise the issue of proper doctor–patient communication. According to the literature, proper preoperative counselling can lessen the level of fear [8]. The doctors' awareness of the existence of visual sensations during the cataract surgery and their knowledge about their character may let them improve the doctor–patient communication. It is also vital for doctors to understand the patients' feelings and experiences before and during the surgery. All of the mentioned above lead to better psychological preparation for the surgery.

CONCLUSIONS

What was not known before is that age, stress and some medical conditions can influence the occurrence of some light and visual impressions. Splitting the visual sensations into 16 various light and visual impressions can also provide the doctors with a deepened insight into the patients' experiences.

We conclude that patients experience a variety of visual sensations, which are usually pleasant or neutral, however, they occur more often among stressed patients and can

also raise the stress level. Proper preoperative counselling is needed to help patients cope with the stress before surgery.

Acknowledgments
We want to thank our colleagues – Magdalena Grys and Agata Kasprzyk – for helping us to collect the data.

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Authors' contributions:
Dorota Pojda-Wilczek came up with the idea of this research, supervised the whole project and corrected the manuscript.
Zofia Kampka coordinated the research, designed the questionnaire, performed the research and the analysis and worked on the manuscript.
Emila Senderek designed the questionnaire, perfomed the research and worked on the manuscript.
Przemysław Urbaniec designed the figures and tables, performed the research and worked on the manuscript.
All authors provided critical feedback and helped shape the research and manuscript.

Conflict of interest:
None.

Financial support:
None.

Ethics:
The content presented in the article complies with the principles of the Helsinki Declaration, EU directives and harmonized requirements for biomedical journals.