



# Effect of Benson's Relaxation Technique on Propofol Consumption and Preoperative Anxiety of Patients Undergoing Cataract Surgery

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## Abstract

**Background:** Benson's relaxation (BR) technique is a suitable non-pharmacological approach to reduce preoperative anxiety (PA).

**Objectives:** This study aimed to investigate the effect of BR therapy on PA and the induction and maintenance dose of propofol during cataract surgery (CS).

**Methods:** Seventy-two patients were randomly divided into two experiments or BR and control groups. The Amsterdam and Spielberger State-Trait Anxiety inventory (STAI) scores were used to assess PA directly two days and a half-hour before the CS. The control group did not receive any preoperation intervention or relaxation. Benson's relaxation method was performed three times, each time for 20 minutes, including two days before surgery, a night before surgery, and an hour before the surgery in the presence of a researcher by an audio file. The induction and maintenance dose of anesthetic drug was recorded and compared between the two groups.

**Results:** The mean propofol consumption was significantly reduced during the induction of anesthesia in the intervention group compared to the control group ( $0.99 \pm 0.29$  versus  $1.29 \pm 0.49$ ;  $P = 0.005$ ) as well as the maintenance of anesthesia ( $84.66 \pm 17.98$  versus  $108.33 \pm 34.38$ ,  $P = 0.001$ ). The results of the post-intervention Amsterdam anxiety score showed a significant decrease in the intervention group compared to the control group ( $P = 0.032$ ,  $F = 9.61$ ,  $Eta2 = 0.12$ ). The control group showed a higher Spielberger state score compared to the intervention group as well as the Spielberger trait ( $P < 0.001$ ,  $F = 14.78$ ,  $Eta2 = 0.18$ ).

**Conclusions:** The BR method effectively reduces the level of PA in patients undergoing CS. Moreover, it reduces the need for anesthetic drug, propofol, during surgery.

**Keywords:** Cataract Surgery, Benson's Relaxation, Spielberger State-Trait Anxiety Inventory, Preoperative Anxiety, Anesthetic Drug

## 1. Background

Psychological factors, such as preoperative anxiety (PA), are thought to trigger inter-patient variations in terms of anesthetic requirements as well as postoperative pain experiences (1). Preoperative anxiety is an unpleasant subjective feeling of uneasiness or dread that affects patients who undergo anesthesia, hospitalization, surgery, and the feeling of imminent death. The incidence of PA in adult patients ranges from 11% to 80%, depending on gender, the setting of surgery, and motives for surgery (2). It has been demonstrated that the negative effects of stress correlate with a number of diseases and disorders. Moreover, the effects of PA on pre-surgery outcomes, such as blood pressure, heart rate, and neuroendocrinological changes, as well as post-surgery outcomes, such

as behavioral recovery, pain, and analgesic requirements, have been shown (3). The scientific validity of the association between increased PA and increased anesthetic drug requirements has been questionable (4, 5). Failure to control anesthetic depth during the surgical procedure is attributed to pain sensitivity and PA, which are independent predictors of sevoflurane and propofol requirements in general anesthesia (5). Preoperative anxiety can result in extended recovery times and increased requirements for postoperative medical intervention. Reducing PA without under-emphasizing surgical risk is challenging for even the most experienced surgeon (6). Despite advances in the induction technique and administration of anesthesia, most patients undergoing cataract surgery suffer from PA due to loss of visual sensations and blindness (4). These outcomes result in harmful implications,

both clinically and economically (7). Several pharmacological and non-pharmacological methods that are being developed address the problem of PA. The adverse effects of medical anxiolytics drugs include hypotension, bradycardia, bradypnea, nausea, hypersensitivity, and shock. Therefore, an appropriate non-pharmacological management method is required to reduce PA. Benson's relaxation technique is a suitable non-pharmacological approach to reduce PA, which is simple, easy to learn and implement, and is not costly.

## 2. Objectives

The purpose of this study was to investigate the effect of Benson's technique (a non-pharmacological relaxation therapy) on preoperative anxiety and propofol consumption dosage during cataract surgery.

## 3. Methods

### 3.1. Sample Size Determination

According to the following formula, the sample size was estimated at 29 patients in each group. However, we have included 36 patients in each group.

$$n = \frac{[s_1^2 + S_2^2] [Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}]^2}{[m_1 - m_2]^2}$$

Confidence interval: 95%;  $\alpha = 0.05$ ;  $Z_{1,\beta} = 80\%$ ;

Standard deviation of difference anxiety in two intervals:  $S_1 = S_2 = 3.5$ .

The difference anxiety score in two intervals in the control group:  $m_2 = 0.12$ .

The difference anxiety score in two intervals in the intervention group:  $m_2 = -2.53$ .

A total of 72 patients were randomly divided into the two groups, including experiment or Benson's relaxation (BR) and control groups. All of the patients aged 30 to 60 years old, in physical status I and II based on American Society of Anesthesiologists (ASA) physical status classification, tolerated insertion of laryngeal mask airway, were able to read and fill the questionnaires and were candidate for elective cataract surgery were included in this study. The patients with a history of any comorbidities, leading to ASA III or IV, psychiatric disorders such as anxiety, a history of alcohol/substance abuse, a history of antipsychotic and sedative medication or behavior therapy within the past 3 months before enrollment to this trial, untreated thyroid disorders, lack of tolerance to insertion of laryngeal mask airway were excluded from the study. The patients who underwent retinal surgery were also excluded

from the study. Demographic data and clinical records, including demographic quantitative variables (ASA status, weight, age, body mass index (BMI), a history of neurological and psychiatric problems, a history of taking sedative drugs), as well as a history of surgery, alcohol or opioid consumption were provided from each patient. In this study, the data were collected using a questionnaire consisting of five parts, including demographical data, informed consent form, anxiety evaluation using Spielberger's State-Trait Anxiety inventory (STAI) and Amsterdam preoperative anxiety scores 48 hours and a half-hour prior to the surgery (as baseline), and administered anesthetic drug during the induction and maintenance surgery (8). Benson's relaxation method was performed three times, each time for 20 minutes, including two days before the surgery, a night before surgery, and an hour before the surgery in the presence of a researcher by an audio file for all patients of this group. Moreover, all of the patients were examined by an anesthesiologist two days before the surgery. The control group did not receive any preoperative intervention or relaxation.

Neither the control nor the intervention groups received tranquilizer. The patients were not aware of the effect of anxiety on the dose of administered anesthetic drugs. The experts who analyzed the data were blind to the study. Moreover, the personnel who prescribed the medicine and calculated the required dosage of the drug were not aware of the degree of preoperative anxiety and the experimental group to which the patient belonged. In order to prevent data contamination, the intervention was conducted in the presence of a trainer and a private room for each patient of the intervention group individually, and there was no possibility for the participants in the control group to observe and learn the intervention. The participants who were already using relaxation methods were excluded from the study.

The level of anxiety was evaluated for each patient using STAI and Amsterdam questionnaire two days before surgery. Benson's relaxation technique was taught to the patients of the intervention group for 20 minutes using an audio file followed by performing the technique by the patients for the first time. Subsequently, the relaxation method was performed twice before the surgery (once in the evening of the day before and the other time in the morning of the day of surgery) in the presence of an expert. Half an hour prior to the surgery, the STAI and Amsterdam forms were completed by the patients in a quiet isolation room in order to evaluate their levels of anxiety. In the operating room, all of the patients underwent routine monitoring, including measurement of baseline heart rate (HR), mean arterial blood pressure (MBP), peripheral oxygen saturation ( $SpO_2$ ), and bispectral (BIS) index. To evalu-

ate anesthetic depth, BIS was monitored and recorded. BIS value ranging from 40 to 60 is indicative of the adequate anesthetic depth and its higher levels indicate inadequate anesthetic depth (9). Prior to the surgery, the patients were asked to close their eyes, be quiet, and stay still for the evaluation of BIS and undergoing routine monitoring. Any annoying sound was prevented. A similar method, including receiving a standardized anesthetic regimen of midazolam 0.02 mg/kg and fentanyl 2  $\mu$ g/kg intravenously, was applied to induce anesthesia in all of the patients.

Propofol was administered at a dosage of 1 mg/kg to initiate the induction of anesthesia. Propofol is then administered at a dose of 0.5 mg/kg at intervals of three minutes to reach the appropriate depth of anesthesia. At anesthesia depth of 60 - 40, 0.5 mg/kg of atracurium is administered, followed by insertion laryngeal mask airway after three minutes. The BIS was monitored continuously and recorded every 5 min, and the anesthetic infusion was reduced to 80% when BIS < 40. However, propofol titrate was continued till the achievement of target BIS when BIS > 60. The mean BP was monitored every 5 min and an increase in BP more than 20% below baseline was followed by fentanyl administration (1  $\mu$ g/kg), which was repeated in case of failure to respond after 10 min, even if adequate anesthetic depth was maintained. At the end of the surgery, the administration of propofol was stopped and its consumed amounts were calculated. Considering that these results were related to the comparison of the scores without controlling the effect of primary scores in the Amsterdam and the Spielberger's questionnaires evaluating the prevalence of trait and state anxiety, the ANCOVA method was applied for further examination and comparison of the controlled Amsterdam scores. In this double-blind permuted block randomization study, the patients and the person who measured anxiety were blind.

### 3.2. Ethical Statement

The Ethics Committee of Deputy of Research, Shahid Beheshti University of Medical Sciences (SBMS) approved the study, and the researchers obtained written informed consent from all patients (code: IRCT20120430009593N10).

## 4. Results

Totally 72 patients were enrolled in this study. There was no significant difference between the two groups with respect to age ( $P = 0.23$ ). The mean propofol consumption was significantly reduced during the induction of anesthesia in the intervention group compared to control group ( $0.99 \pm 0.29$  versus  $1.29 \pm 0.49$  mg/kg;  $P = 0.005$ )

as well as the maintenance of anesthesia ( $84.66 \pm 17.98$  versus  $108.33 \pm 34.38$   $\mu$ g/kg/min,  $P = 0.001$ ). The mean anxiety score of pre- and post-intervention (Benson's relaxation) was assessed using Amsterdam and Spielberger State-Trait anxiety questionnaires (Table 1). The results of the pre-intervention Amsterdam anxiety score showed no significant difference between the two groups. While post-intervention Amsterdam anxiety score showed a significant decrease in the treatment group compared to the control group ( $P = 0.032$ ,  $F = 9.61$ ,  $\text{Eta}^2 = 0.12$ ) (Table 1). The results of the pre-intervention Spielberger state and trait anxiety score showed no significant difference between the two groups ( $P < 0.05$ ). While post-intervention Spielberger state and trait anxiety score showed a significant difference compared to the control group ( $P = 0.006$ ,  $F = 25.13$ ,  $\text{Eta}^2 = 0.27$ ,  $P < 0.001$ ,  $F = 14.78$ ,  $\text{Eta}^2 = 0.18$ ) (Table 1). The qualification analysis of anxiety was also investigated using Spielberger questionnaires, which is presented in Table 2.

**Table 1.** Anxiety Score of Both Control and Case Groups Pre- and Post-Intervention<sup>a</sup>

Variable	Control	Case	P Value
Age	58.91 $\pm$ 10.68	55.8 $\pm$ 11.127	0.23
Pre-intervention AS	16.49 $\pm$ 4.78	16.09 $\pm$ 5.87	0.81
Post-intervention AS	17.66 $\pm$ 4.69	14.49 $\pm$ 5.84	0.03
Pre-intervention SSS	38.23 $\pm$ 7.39	40.77 $\pm$ 8.94	0.19
Pre-intervention STS	40.17 $\pm$ 8.09	41.66 $\pm$ 7.57	0.41
Post-intervention SSS	41.71 $\pm$ 9.54	35.23 $\pm$ 9.21	0.006
Post-intervention STS	42.06 $\pm$ 0.90	37.13 $\pm$ 0.90	<0.001

Abbreviations: AS, Amsterdam score; SSS, Spielberger state score; STS, Spielberger trait score.

<sup>a</sup>Values are expressed as mean  $\pm$  SD.

## 5. Discussion

The primary aim of this study was to investigate the effect of Benson's non-pharmacological relaxation therapy on preoperative anxiety and the amounts of propofol consumption for the induction and maintenance of anesthesia during cataract surgery. One of the most surgeries in ophthalmology is cataract surgery (10, 11). Based on the obtained results, it can be concluded that Benson's relaxation method effectively reduced preparative anxiety in patients of this study who underwent cataract surgery. Benson's relaxation, by balancing the inferior and posterior hypothalamus functions, reducing the activity of the sympathetic nervous system and the secretion of catecholamines, reduces muscle tension, which is followed by reduced blood pressure, stabilized respiration, and reduced heart rate.

**Table 2.** Chi-Square Test for Evaluating Descriptive Variables in the Wo Groups<sup>a, b</sup>

Descriptive Variable	Control	Case	P Value
<b>Sex</b>			0.473
Female	15 (42.9)	18 (51.4)	
Male	20 (57.1)	17 (48.6)	
<b>ASA</b>			1.00
1	16(45.7)	16(45.7)	
2	19(54.3)	19(54.3)	
<b>Anxiety</b>			0.65
Mild	2 (5.7)	2 (5.7)	
Moderate	28 (80)	25 (71.4)	
Severe	5 (14.3)	8 (22.9)	
<b>Anxiety A</b>			0.734
Mild	3(8.6)	2 (5.7)	
Moderate	28 (80)	27 (77.1)	
Severe	4 (11.4)	6 (17.1)	
<b>Anxiety B</b>			0.002
Mild	2 (5.7)	9 (25.7)	
Moderate	20 (57.1)	24 (68.6)	
Severe	13 (37.1)	2 (5.7)	
<b>Anxiety C</b>			0.022
Mild	1 (2.9)	4 (11.4)	
Moderate	24 (68.6)	29 (82.9)	
Severe	10 (28.6)	2 (5.7)	

<sup>a</sup>Values are expressed as No. (%).

<sup>b</sup>A, the quality Amsterdam anxiety score; B, the quality Spielberger state score; C, the quality Spielberger trait score.

Benson's relaxation method is preferred to other muscle relaxation methods used to reduce preoperative anxiety, especially in the elderly, since this method requires no muscle contraction that increases heart rate, respiratory rate and blood pressure. Learning and teaching Benson's relaxation method is easy and requires no specific knowledge and skills and can easily be done by the patient. Cataract surgery is one of the most common surgeries in the elderly. The prevalence of preoperative anxiety has been reported to be present in up to 50% of cases (2).

High levels of anxiety trigger endocrine system responses followed by an enhanced cardiovascular activity, and increased hemodynamic baseline, which results in the administration of higher doses of anesthetic and analgesic drugs that induce destructive effects on anesthetic induction, reaching an adequate depth of anesthesia and recovery, followed by longer hospitalization and reduced patient satisfaction (2). The anxiety complication in older

patients, due to co-existing diseases, should be carefully taken into consideration as it increases the levels of catecholamines, adrenocorticosteroids, prostaglandins, prolactin, and cortisol, leading to increased heart rate, risk of arrhythmias, acute myocardial infarction, heart failure, and pulmonary edema (5). The cost and side effects of anxiolytics drugs such as hypotension, vomiting, allergy, shock, and the possibility of developing interactions with anesthetic drugs have highlighted the necessity of developing and applying non-pharmacological and non-invasive approaches to prevent or treat preoperative anxiety.

Ramirez et al. (1) reported that the highest anxiety related to the surgical process and surgical outcomes occurs in the patients who underwent cataract surgery. They have suggested that the steps of the surgery itself and the expected visual outcomes should be explained to the patients in order to reduce their anxiety (1). Ertug et al. (12) have compared the effectiveness of using nature sounds and relaxation exercises to alleviate PA in the patients who were about to undergo planned surgery with general anesthesia. They have observed a significant difference between the intervention and control groups (12). Benson's relaxation method has been reported to reduce anxiety in patients under radial angiography (13) and hemodialysis (14). In addition, Poorolajal et al. (15) have shown that BR is a safe method with significant beneficial effects without any adverse effects on PA and hemodynamic responses in patients who were candidates for surgical procedures.

Another hypothesis of this study was that Benson's relaxation method effectively reduces preoperative trait anxiety in patients undergoing cataract surgery. The findings of this study indicated that there was a significant difference between the mean score of post-intervention trait anxiety between the two groups ( $F = 14.784$ ,  $P \leq 0.01$ ), and the calculated effectiveness of  $\text{Eta}^2 = 0.181$  indicated the significant effect of Benson's relaxation method in reducing the preoperative trait anxiety. The findings of this study demonstrated that Benson's relaxation method reduces preoperative trait anxiety in patients undergoing cataract surgery. These results are consistent with those reported by other researchers (5, 12).

The third hypothesis of this study was that the preoperative state anxiety is reduced by performing Benson's relaxation method in patients undergoing cataract surgery. The findings of this study demonstrated that there was a significant difference between the mean scores of state anxiety in the two groups ( $F = 25.135$ ,  $P \leq 0.01$ ), and the calculated effectiveness of  $\text{Eta}^2 = 0.273$  indicated the major effectiveness of Benson's relaxation method in reducing the preoperative state anxiety. Considering the results of this study, it can be concluded that Benson's relaxation method re-

duces the preoperative state anxiety of the patients. Parsa Yekta et al. (16) have compared the effects of two relaxation methods, namely Benson's relaxation method and deep breathing, on reducing preoperative anxiety in patients undergoing mastectomy. Their results have demonstrated that deep breathing reduces both somatic and cognitive anxieties, while Benson's relaxation method only reduces somatic anxiety (16). Cline (17) has investigated non-pharmacological interventions against drug interventions in reducing preoperative anxiety in juvenile students. His findings indicated no significant difference between the anxiety levels of the two groups. He has suggested that further investigations are required to explore the effect of non-pharmacological interventions in reducing preoperative anxiety (17).

The fourth hypothesis of this study was that performing Benson's relaxation method reduces the amount of required propofol for anesthesia induction in patients undergoing cataract surgery. Comparing the mean values of the two groups indicated that the average amount of propofol used to induce anesthesia in the patients of the control group was higher than that of the experimental group. Therefore, the patients treated with Benson's relaxation method required less propofol during cataract surgery. These findings are consistent with those of Ali et al. (18), Chung et al. (19), Kil et al. (5), and Singh (20).

Ali et al. (18) investigated the effect of preoperative anxiety on recovery from postoperative anesthesia and postoperative pain in patients undergoing laparoscopic cholecystectomy. They found a significant relationship between the length of postoperative hospitalization and preoperative anxiety. Furthermore, it took shorter for patients with less anxiety to wake up from anesthesia, and they required less postoperative analgesia administration (18).

Chung et al. (19) investigated the effect of anxiety prior to undergoing colonoscopy on the requirement to use sedative medications during the procedure. The results of the Beck anxiety inventory questionnaire did not indicate any significant correlation between the level of anxiety and the need for sedative medications during the procedure. Moreover, they suggested that further studies are required to obtain conclusive results. The findings of their study are inconsistent with those of the present study, which can be due to the difference in the type of applied questionnaire and procedure (19). It has been conducted in some studies in order to determine the role of preoperative anxiety and pain sensitivity in enhancing the need for two anesthetic drugs, namely propofol and sevoflurane (5, 21). Their results indicated that patients with a higher state and trait anxiety score required significantly more propofol to reach light and moderate anesthetic levels. However, only the patients with high trait anxiety

score required a greater amount of propofol to achieve a deep anesthetic level. Therefore, predicting the amounts of anesthetic drugs required for each patient can lead to better management of the preoperative period, which in turn, results in better outcomes (5, 21).

The fifth hypothesis of this study was that Benson's relaxation method significantly reduces the amount of propofol required to maintain anesthesia in patients undergoing cataract surgery. Comparing the mean values of the two groups indicated that the patients treated with Benson's relaxation therapy required fewer medications to maintain anesthesia during cataract surgery. This finding is consistent with those of Ali et al. (18), Chung et al. (19), and Singh (20). Singh (20) has investigated the relationship between stress responses and anesthesia in a review article and found that stress-induced changes are well-tolerated by normal patients without associated illnesses (18-21). Stress is a life-threatening condition for patients with one or more associated illnesses. It has also been demonstrated that anxious patients require higher doses of anesthetic drugs to achieve an adequate level of anesthetic depth. Benson's relaxation method is preferred to other relaxation methods used to reduce preoperative anxiety, especially in the elderly since this method requires no muscle contraction that increases heart rate, respiratory rate, and blood pressure (20).

Considering the findings of this study, it can be concluded that Benson's relaxation (BR) method, as a non-pharmacological method, effectively reduces the level of preoperative anxiety in patients undergoing cataract surgery. Moreover, it reduces the need for anesthetic drug, propofol, during surgery.

#### 5.1. Limitation

Some of the patients were excluded due to the delay of surgery and retinal surgery.

#### Footnotes

**Authors' Contribution:** EM and AB designed the study. AB, AY, and AB contributed to data collection, data analysis and writing the manuscript. All of the authors read and approved the study.

**Clinical Trial Registration Code:** The clinical trial registration code was IRCT20120430009593N10.

**Conflict of Interests:** The authors have no conflict of interest.

**Ethical Approval:** The Ethics Committee of Deputy of Research, Shahid Beheshti University of Medical Sciences (SBMS) approved the study (code: IRCT20120430009593N10).



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**Informed Consent:** The researchers obtained written informed consent from all patients.

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