

## Temperament and perception of tooth bleaching results

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**A** – Study Design, **B** – Data Collection, **C** – Statistical Analysis, **D** – Data Interpretation, **E** – Manuscript Preparation, **F** – Literature Search, **G** – Funds Collection

**Summary Background.** The neurophysiological process of perceiving the results of tooth bleaching requires the correct interaction between the central nervous system and the organs of sight. Exaggerated beliefs concerning defective facial features may enhance inner attitudes about one's own color of dentition, as well as a feeling of dissatisfaction with the degree of bleaching. **Objectives.** The study aimed to assess the degree of the patient satisfaction with the results of tooth bleaching in relation to their temperament.

**Material and methods.** There were 68 generally healthy volunteers, aged 28–38 years, with external discolorations of the teeth. They had never undergone dental bleaching and their frontal teeth did not have any fillings. After clinical evaluation and the completion of formalities, the patients were asked to fill in Strelau's temperament questionnaire. Questionnaires and visual status were assessed three times by three doctors: before bleaching, and then 24 hours and two weeks after the home-bleaching operation, which was done with the use of Opalescence (Ultradent) in uniform sequence.

**Results.** There were practically no adverse side results, except a periodic dentin hypersensitivity that occurred periodically in 44 patients. The results of the visual assessment performed by the physicians did not differ. The questionnaire data showed that women were more critical of the results in relation to the expectations. Among melancholics, full satisfaction was declared by 41%, whereas among sanguine people, full satisfaction was obtained by 85%. Satisfaction with the aesthetic results was associated with bleaching by at least 4 degrees.

**Conclusions.** Patients' temperament affects their subjective evaluation of the effectiveness of tooth bleaching, which should be taken into consideration in the patient's individual dental treatment plan.

**Key words:** temperament, tooth bleaching, color perception, crown discoloration.

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## Background

The neurophysiological process of perceiving the results of dental bleaching requires correct interactions between the central nervous system and the organs of sight. Exaggerated beliefs concerning defective facial features may enhance inner attitudes towards one's dentition color. The notion of facial beauty is inseparable from fashion and cultural trends. European culture favors a natural look, contrary to the fashion for an immaculately white Hollywood-like smile. According to American Dental Association, in 1994, as many as 81% of dental surgeries offered bleaching procedures, reflecting their patients' needs [1].

Tooth bleaching is one of the most popular procedures in esthetic dentistry and is the least invasive of esthetic procedures. Although it is not a medical procedure, it does play an important role in dentistry in terms of standards of "well-being" [2]. Smoking, some pharmaceuticals (chlorohexadrin and tin and iron salts), and tannins in food are the main reasons for tooth discoloration. The most popular tooth bleaching methods are home methods performed by the patient under supervision of the dentist (so-called home-bleaching) and those performed by the patient alone (using whitening toothpastes and other non-prescription products). Profes-

sional bleaching procedures, such as acid microabrasion, veneers, and denture crowns, require intervention into tooth structure continuity [1, 3].

Visual assessment of the color is not an objective repeatable measurement, but depends on the observer's situation and the research circumstances. Modern colorants that fit dental materials are used in dental practice [4, 5]. Psychological factors determining satisfaction with tooth bleaching results require further studies.

## Objectives

The study aimed to assess the degree of patient satisfaction with the results of tooth bleaching in relation to their temperament.

## Material and methods

There were 68 generally healthy volunteers (34 females, 34 males), aged 28–38 years, with full dental arches, correct occlusion, and external dental discolorations. They had never undergone bleaching or denture treatment, and their frontal teeth did not have any fillings. The exclusion criteria



were dysfunction of the masticatory muscles or temporo-mandibular joints, internal discolorations, bruxism, dental caries, periodontopathy, cementoenamel junction lesions, or suspected mental disorders (verified by the research team psychologist) [6, 7].

The research report was approved by the Bioethics Committee of the University (no. 554-14). Once the patients had undergone clinical selection, they completed Strelau's FCZ-KT questionnaire (Formal Behavior Characteristics: Temperament Questionnaire) [8]. This is a self-descriptive questionnaire with 120 yes-or-no questions. The items are divided into 6 scales referring to: Vigorousness, Perseverance, Sensory Sensitivity, Emotional Responsiveness, Endurance, and Activity. The Regulatory Temperament Theory presented in the works of J. Strelau constitutes the theoretical basis for this questionnaire, which is a category C test, meaning that its standards and results are accessible to psychologists only.

The temperament questionnaire was marked with a random code and secured in the patient's presence.

Both the survey and the visual assessment of the central right upper incisor (performed by three physicians) were conducted three times: prior to bleaching, and then 24 hours and two weeks after the home-bleaching procedure, which was carried out using Opalescence 16% (Ultradent) in a uniform sequence.

Every time, tooth color was assessed by comparing it to the model color from the Bleachedguide 3D-Master (Vita) catalog and dentition brightness was given in degrees.

Then, on the basis of the test results, the psychologist recorded the patient's temperament and passed the data to the research team statistician, who, using the random code, assigned them to those sent by the doctors and began a statistical analysis. Owing to group diversity resulting from the temperament tests (Figure 1), the following aspects were taken into account in the statistical analysis: gender, the four basic temperament types (phlegmatic, choleric, melancholic, and sanguine), the four age subgroups, and the level of satisfaction, as defined on an 11-degree VAS scale (0: lack of satisfaction; 10: full satisfaction). The relation between the patient's temperament type and the level of satisfaction with the bleaching result was examined using Pearson's *C* contingency coefficient. This was also used to describe the influence of the gender on the respondents' satisfaction level. In examining the correlations between 1) the satisfaction level and the age subgroup, and 2) the satisfaction level and the degree of tooth crown brightness after bleaching, Spearman's coefficient for correlation ranks was used. The statistical analysis was carried out using the Statistica PL 12.0 software. The assumed significance level was  $\alpha = 0.05$ .

## Results

38.2% of the subjects were choleric (11 F (females), 15 M (males)), which is a strong unstable type; 35.3% were sanguine (13 F, 11 M), a strong stable mobile type; 16.2%

were melancholic (7 F, 4 M), a weak type; and 10.3% were phlegmatic (3 F, 4 M), a strong stable inert type (Figure 1).

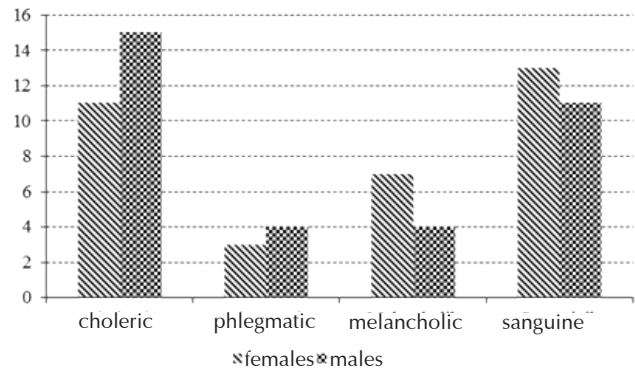


Figure 1. Number of patients by gender and temperament

Except for dentin hypersensitivity, which occurred periodically in 44 patients (64.7%), no other side effects were found. The visual assessment performed by three doctors did not show any considerable differences before bleaching or 24 hours and two weeks after bleaching. Full satisfaction (VAS = 10) with the esthetic results of bleaching was associated with tooth bleaching of at least 4 degrees. A statistical analysis showed that there was no relation between the patients' satisfaction level and the degree of the dentition brightness, as assessed by the doctors (measured as the difference in the brightness degree) with respect to the esthetic results 24 hours ( $r_s = 0.13$ ;  $p = 0.479$ ) and two weeks ( $r_s = -0.07$ ;  $p = 0.714$ ) after bleaching.

No significant correlation was seen between age and satisfaction with the esthetic results of bleaching 1) before bleaching ( $r_s = 0.04$ ;  $p = 0.827$ ), 2) 24 hours after bleaching ( $r_s = -0.15$ ;  $p = 0.401$ ), and 3) two weeks after bleaching ( $r_s = -0.08$ ;  $p = 0.479$ ).

The questionnaires revealed that women were less satisfied with the bleaching results than men. Full satisfaction with the results of tooth brightening was indicated by 30 men (88.2%) and 25 women (73.5%). The only significant correlation (on average) existed between gender and the natural color of the teeth ( $C = 0.513$ ;  $p = 0.033$ ). The level of satisfaction with the natural tooth color prior to bleaching oscillated between 1 (VAS<sub>min</sub>) and 5 (VAS<sub>max</sub>), with an average of 2.3 for men; women were more satisfied with their natural dentition (2, 6, 3.9 respectively). No correlation between gender and the satisfaction level was noted 24 hours after bleaching ( $C = 0.282$ ;  $p = 0.570$ ) or two weeks after bleaching ( $C = 0.373$ ;  $p = 0.358$ ).

The average level incidence of full satisfaction (VAS = 10) was 40.9% in the melancholic group, 55.8% in the choleric group, 78.6% in the phlegmatic group, and 85.4% in the sanguine group. The patients grouped according to their temperament type differed in their satisfaction levels measured both before bleaching and during two the two check-ups (Table 1). Significant correlations were noted between

Temperament type	Satisfaction level before bleaching	Satisfaction level 24 hours after bleaching	Satisfaction level two weeks after bleaching
VAS	VAS <sub>mean</sub> (VAS <sub>min</sub> ; VAS <sub>max</sub> )	VAS <sub>mean</sub> (VAS <sub>min</sub> ; VAS <sub>max</sub> )	VAS <sub>mean</sub> (VAS <sub>min</sub> ; VAS <sub>max</sub> )
Choleric	2.6 (1, 5)	8.8 (7, 10)	8.9 (7, 10)
Phlegmatic	3.5 (2, 5)	8.9 (7, 10)	9.3 (6, 10)
Melancholic	3.8 (2, 6)	7.1 (6, 10)	6.8 (5, 10)
Sanguine	3.2 (1, 6)	9.7 (9, 10)	9.9 (9, 10)

VAS<sub>mean</sub> – mean VAS value for a given group; VAS<sub>min</sub> – minimum VAS value in group; VAS<sub>max</sub> – maximum VAS value in group.

the patient's temperament and 1) their level of satisfaction with the esthetic results 24 hours after bleaching ( $C = 0.638$ ;  $p = 0.025$ ) and 2) the level of satisfaction with esthetic results two weeks after bleaching ( $C = 0.728$ ;  $p = 0.001$ ). The intensity of the two correlations was average. No correlation was found between temperament and the perception of the natural color of dentition before bleaching ( $C = 0.552$ ;  $p = 0.458$ ).

## Discussion

The role of the dentist involves not only bringing relief in suffering, but also in meeting patients' expectations of esthetic dentistry [1]. Aspects such as stronger motivation, better life-style assessment, better mood, and the patient's self-assessment – as well as proper dentist–patient relations – all influence therapy results [9]. The role of the patient's temperament, which refers to the relatively permanent personal features determining the energetic level and behavior, cannot be underestimated [8, 10].

The patient who comes to a dental surgery to have their teeth bleached for the first time needs to be aware of the correct sequence of treatment. The primary focus should be to treat any defects of the oral cavity, and next to deal with any problems relating to the proper functioning of the organ of mastication. Only then can the esthetic effect be dealt with. At the beginning, the patient's expectations and the achievable degree of dentition brightness should be determined [4, 9]. This is exactly what was done in our research. Individuals suffering from general diseases were excluded as those with mental disorders (such as body dysmorphic disorder), since these could have intensified any hypochondriac attitude on the part of the patient towards the color of their dentition or any feeling of permanent deficiency in the degree of whiteness [6, 7, 11]. Patients' esthetic expectations continue to rise. According to Kielbassa and Zantner, over 35% of women and 41% of men consider "immaculately white healthy teeth" a vital feature in determining an attractive facial look [12].

The job of a dentist is both art and craftsmanship, and tactfulness and empathy are vital to the job. Some consider that the beauty of a face can be objectively defined only on the basis of mathematical calculations [4, 13, 14]. It is worth mentioning that anthropometric tests are not always synonymous with face attractiveness, which makes the issue almost unpredictable. Women show twice as much of the surface of their front teeth than men do, and difficulties in planning improvements in smile esthetics are far more common in patients with a gummy smile [12, 14].

Very few scientific studies have been carried out on the relation between the perception of dentition bleaching results and patients' temperament structures as assessed by the Strelau instrument; it is thus difficult to assess our results in full. Because of the random selection of temperament in the test group, as well as the insufficiently small number of temperament subtypes (i.e. choleric I, choleric II, mixed choleric I, mixed choleric II, mixed melancholic), it was decided

to statistically analyze the results in terms of the four main temperament types (choleric, phlegmatic, melancholic, and sanguine) [8]. The melancholic temperament is described as weak, pessimistic, reserved, and unsociable, which may explain (to a certain extent) why only 41% of our melancholic subjects were fully satisfied with the bleaching results. The bleaching results were better assessed by the choleric; the reasons for their dissatisfaction may lie in their changeable, impulsive, and temporarily touchy behavior, although they are generally strong and optimistic people. As for the phlegmatic group – a strong, stable, gentle, conciliatory, cautious and serious type – 78.6% of them were fully satisfied. The sanguine participants – who are strong, stable, sociable, though sensitive – were fully satisfied twice as often as the melancholics [8].

No significant differences were found in the dentition color assessment performed independently by three doctors. In examining the dentition color, the dentists used their own experience; however, their perceptions were not identical to those of the patients. Professional color marking is one of the most difficult tasks in dentistry, as tooth color results from the interaction of light and the tooth structure (enamel, dentin, and cement), which incorporates such phenomena as reflection, dispersion, transmission, absorption, and fluorescence. The role of psychological factors is stressed when tooth color is being determined, but these factors are the least studied elements of the assessment. The reception of stimuli depends on expectations, experience, motivation, tiredness, day-time, and activities performed. Sensory adaptation – a decrease in sight organ sensitivity caused by a constant or unchanging stimulus – is another important factor [4]. The patients who systematically and more frequently paid attention to their brightening dentition (home-bleaching may take around two weeks) might have developed chromatic adaptation. Getting used to brighter and brighter teeth may have affected the perception of bleaching results and the results of our study. Women, in comparison to men, have higher expectations of bleaching. Some authors have claimed that women's higher esthetic demands occur due to their closer observation (more frequent use of a mirror), higher sensitivity, and even changes in female hormone levels [4, 7–10].

We are aware of the research limitations that stem from the differences in patients' personalities (varying environment conditions, eating habits, diets, hygienic habits, etc.), as well as from the difficulties in supervising whether the patients followed the doctors' recommendations. This study has shown that there exists a relation between the level of satisfaction with the bleaching results and patient temperament, which suggests a possibility of continuing the research on larger groups and with respect to other variables.

## Conclusions

Patient temperament affects the subjective evaluation of the effectiveness of tooth bleaching. This should be taken into consideration in the patients' individual dental treatment plans.

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