

# Is personality relevant in the choice of bleaching?

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## Abstract

**Objectives** The purpose was to administer the NEO-FFI personality test to patients who did and did not want to have their teeth bleached and before and after bleaching to the participants who accepted the treatment. The research question is to correlate styles and personality factors with bleaching.

**Materials and methods** There were 128 patients eligible for bleaching; 58 accepted (AB) while 70 refused (RB). The test was administered to both groups (AB-RB). The group AB was administered before and 1 week after the end of the bleaching. For each personality domain comparison, the Mann-Whitney test was used. For the group AB, the results for each domain before and after bleaching were compared using the Wilcoxon test.

**Results** There was a significant difference between the groups (AB-RB) in the extraversion factor ( $p=0.01$ ). There was no significant difference between any of the personality items before and after bleaching ( $p>0.1$ ). The comparison between groups by sex revealed significant differences in extraversion and neuroticism factors. Males who AB scored higher in extraversion than males who RB ( $p<0.05$ ). Females scored higher in neuroticism than males who AB ( $p<0.05$ ).

**Conclusions** There were personality differences between people who decided to bleach compared with those who did not want the bleaching, which was mainly in the extroversion factor. This stereotypes the patients, who could be described as more sociable, extroverted, and concerned about esthetics and cleanliness. The bleaching protocol, however, cannot modify any of the personality factors.

**Clinical significance** It is important to understand a patient's behavior to meet their needs and to determine the type of patients who would like to have their teeth bleached.

**Keywords** Personality · Teeth bleaching · NEO-FFI · Extroversion

## Introduction

In recent years, the focus of dentistry has shifted from “functional demand,” where routine dental treatment is repairing the destructive effects of dental caries, to “esthetic dentistry,” where patients are concerned with having better-looking teeth [1]. Dental appearance is an important characteristic related to facial attraction, and it has consequences associated to self-image, social interaction, and psychological health. A smile has a tremendous impact on the perception of attractiveness and personality, transmitting vitality, self-assurance, and friendliness. Facial attractiveness is correlated with personality traits such as extraversion and self-confidence [2].

When dental diseases destroy the smile, the result is a loss of self-esteem and damage to physical and mental health. Factors affecting dental appearance are influenced by individual preferences and cultural and socio-demographic factors. Dental color has been shown to be one of the most important factors in determining satisfaction with self-appearance [3]. Dental vital bleaching is a cosmetic technique that provides

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immediate results improving the patient's appearance and self-perception esthetics [3].

In dental whitening, patients' expectations (i.e., what patients expect from the treatment) are higher than that of dentists [4]. In some cultures or places, patients search for a monochromatic unrealistic white color and a perfect dental appearance as seen in the visual media because whiter teeth are positively correlated with high levels of social competence, intellectual ability, psychological adaptation, and sociability indices [5]. There are no studies in the literature correlating styles and personality factors with esthetic treatments in dentistry such as teeth bleaching. This information could be of relevance to clinicians, although it has not been explored by researchers yet. Also, it is clear if the gender influence in the patients' expectations related to the treatment.

The NEO-FFI (inventory five factors of NEO) is a 60-item questionnaire that measures the individual's normal adult personality [6]. This index identifies five personality factors, all of which are presented to varying degrees in individuals [7]. This questionnaire was validated in Spanish [8, 9]. The objective of this study was to apply the NEO-FFI personality test to patients who wanted to have their teeth bleached and to those who do not wish this cosmetic treatment. The NEO-FFI was also applied before and after bleaching in the participants who accepted bleaching. Our first null hypothesis is that there are no differences in personality factor scores between patients who accept bleaching and those who did not, and the second null hypothesis is that bleaching does not change any personality factor in patients who were submitted to the bleaching protocol.

## Materials and methods

This study was approved by the Ethics Committee of the Faculty of Dentistry (NCT02330614), and the present article was reported according to the recommendations of the STROBE statement [10, 11].

This study included 128 patients aged between 18 and 76 years who attended the Operative Dentistry Clinic at the dental school from the local university and were eligible for bleaching (see eligibility criteria in the next item). Dental bleaching, free of charge, was suggested to the patients as a way to improve the patient's smile. From the 128 patients, a total of 58 patients accepted the suggested bleaching protocol while 70 patients refused the cosmetic bleaching protocol. The patients were informed about the benefits and possible side effects of the procedure in a standardized manner.

### Eligibility criteria for dental bleaching

Participants were evaluated in a dental chair and after prophylactic dental treatment with pumice and water. To be eligible

for dental bleaching, participants should have good general and oral health. Each subject should have at least one central incisor shaded A2 or darker, assessed by comparison with a value-oriented shade guide (Vita classical; Vita Zahnfabrik, Bad Säckingen, Germany). Patients who had undergone previous dental bleaching procedures, under orthodontic treatment, who were pregnant or lactating, or who had bruxism habits were not eligible for dental bleaching. Participants with restorations on the labial surfaces of their anterior teeth, non-carious cervical lesions, veneers, full crowns, gingival recession, spontaneous tooth pain, internal tooth discoloration, and teeth with endodontic treatment or fluorosis were also not included as they could not be immediately eligible for dental bleaching.

### Application of the NEO-FFI personality test

Patients from both groups (those that refused and those that accepted bleaching) were informed of the study benefits and each participant signed an informed consent form. Each received a copy of the NEO-FFI personality test [8] and an answer sheet for marking answers. The NEO-FFI contains 60 items, being 12 items for each of the five domains of personality. At each domain, items are summed to measure personality at the domain level only. The five domains measured by the NEO-FFI comprised neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. The answer format is a five-point Likert-type scale. Answers ranging from strongly disagree (0) to strongly agree (4) for each item and 0 to 48 for each domain, with higher scores indicating a higher level of the personality trait.

A clinician explained how to complete the test and gave the participants 30 min to complete it. The researcher did not interfere in the process but was available to clarify anything for the patient.

### Bleaching procedure

For the participants who accepted the bleaching procedure, we made alginate impressions of each subject's maxillary and mandibular arches, and these were filled with dental stone. We did not apply block-out material to the labial surfaces [12]. A 1-mm soft vinyl material, provided by the manufacturer (FGM Dental Products, Joinville, SC, Brazil), was used to fabricate the custom-fitted tray to hold the bleaching gel. The bleaching tray was trimmed 1 mm beyond the marginal gingiva, and we delivered 10 % carbamide peroxide (CP) gel (Whiteness Perfect, FGM, SC, Brazil) to each participant. We give them verbal instructions to apply the product 1 h daily for 3 weeks [13]. After each application, the patient should remove the tray, wash it with water, and brush teeth as usual. Verbal instructions for oral hygiene were also given,

encouraging regular brushing with fluoridated toothpastes that did not contain whitening components.

For these participants, the NEO-FFI personality test was applied before and 1 week after the end of the bleaching procedure and they were also given 30 min to complete it.

### Color evaluation

Color evaluations were performed using subjective and objective methods. For the subjective evaluation, the 16 tabs of the Vita shade Classical guide Vita classical (Vita Classical Guide, Vita Zahnfabrik, Bad Säckingen, Germany) were arranged from highest (B1) to lowest (C4) value and used to determine tooth color. Although this scale is not linear in the truest sense, it was treated as continuous with a linear ranking [14]. Two calibrated evaluators with an agreement of at least 85 % (using weighted kappa statistics) recorded the shade of the middle area of the labial surface of the upper central right incisor according to the American Dental Association guidelines [15]. Color was registered at the baseline and during treatment (after the first, second, and third week of bleaching) and 1 week and 1 month after the end of the bleaching protocol to corroborate the effectiveness of bleaching procedure. The color change between baseline and each recall time was calculated as the change in the number of shade guide units ( $\Delta$ SGU), which occurred toward the lightest end of the value-oriented list of shade tabs. In case the operators disagreed on the color, a consensus was reached before dismissing the patient.

In the objective evaluation, a digital spectrophotometer (Vita Easyshade, Vita Zahnfabrik, Bad Säckingen, Germany) with a reliability of 97 % was used [16]. An impression of the maxillary arch was taken with dense silicone paste (Coltoflax and Perfil Cub, Vigodent, Rio de Janeiro, Brazil), and a window was created on the labial surface of the silicone guide using a metal device with a radius of 6 mm to allow adaptation of the tip of the spectrophotometer device and to standardize the spectrophotometric color evaluation across all recall periods.

The color coordinates ( $L^*$ ,  $a^*$ , and  $b^*$ ) were recorded. The value for  $L^*$  represented the value from 0 (black) to 100 (white), and  $a^*$  and  $b^*$  represented color along the red green axis and yellow blue axis, respectively. The difference between baseline and each recall period ( $\Delta E$ ) was calculated using the formula (CIE, 1978)  $\Delta E = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$ .

### Tooth sensitivity evaluation

The patients were asked to keep a daily record during the bleaching procedure until 1 week control of whether they experienced tooth sensitivity (TS). The participants were instructed to indicate their daily pain using a visual analog

scale (VAS) [14, 17, 18]. This scale is a 10-cm horizontal line labeled *no tooth sensitivity* at one end and *unbearable tooth sensitivity* at the other end. The patient should mark with a vertical line across the horizontal line of the scale the intensity of the tooth sensitivity. Then, the distance in millimeters from the zero ends was measured with the aid of a millimeter ruler. Calculating the absolute risk was considered if there was ever sensitivity by patient or not, and the average intensity was calculated considering only the highest value per week during the bleaching procedure.

### Sample size calculation

Based on previous study [19], we considered a difference of 4 units in any of the domains to be clinically important. With a significance level of 5 % and a power of 90 %, a minimum sample size of 58 participants per group would be required to detect a difference of 4 units in one of the domains of the NEO-FFI questionnaire between groups.

### Data collection and statistical analysis

Data from the NEO-FFI were collected on a spreadsheet and analyzed by a psychologist (AH) that was blind to the group assignment. The internal consistency of each domain of the NEO-FFI questionnaire was evaluated using Cronbach's alpha. The test–retest reliability ( $n = 58$  participants that accepted bleaching) was evaluated using the intra-class correlation coefficient.

The baseline features of the participants who refused and accepted bleaching were compared using the chi-square test. For each personality domain, the group of participants who refused and the group of participants who accepted bleaching were compared using the Mann-Whitney test. For the group of participants that accepted bleaching, the results for each domain before and after bleaching were compared using the Wilcoxon signed rank test. The comparison of the group of participants who refused and accepted bleaching by gender was also performed with the Kruskal-Wallis and Mann-Whitney tests.

Normality of the data bleaching and the homogeneity of the variance-covariance matrix were evaluated with the Kolmogorov-Smirnov test. As data was not normally distributed, treatment efficacy ( $\Delta E$  and  $\Delta$ SGU) was evaluated with respect to color change using the Wilcoxon signed rank test.

The intensity of tooth sensitivity in VAS scale was reported. The percentage of patients who experienced tooth sensitivity at least once during the bleaching therapy was considered the absolute risk of tooth sensitivity, reported as percentage with the 95 % confidence interval.

All statistical analyses were performed using SPSS 22.0 (SPSS Inc., Chicago, IL, USA) at a level of significance of 5 % ( $\alpha = 0.05$ ).

**Table 1** Baseline features of the participants who accepted and refused bleaching

Baseline features	Groups	
	Accepted bleaching	Refused bleaching
Age (years; means $\pm$ SD)	28.8 $\pm$ 9.1	36.1 $\pm$ 15.6
Minimum age (years)	19	18
Maximum age (years)	55	76
Male (%)	50	54.3
Baseline SGU (mean $\pm$ SD)	7.26 $\pm$ 1.7	
<i>L*</i> (mean $\pm$ SD)	84.4 $\pm$ 3.84	
<i>a*</i> (mean $\pm$ SD)	-0.12 $\pm$ 0.63	
<i>b*</i> (mean $\pm$ SD)	22.00 $\pm$ 2.8	

SD standard deviation

## Results

The demographic characteristics of the participants from both groups are presented in Table 1. The mean age of the participants who accepted bleaching was 7.4 years younger than that of the participants who refused bleaching. No statistically significant difference was detected between the baseline features of both groups ( $\chi^2$  test;  $p > .05$ ).

Table 2 shows the means and standard deviations of the sum of the scores of each personality factor for participants who refused and accepted bleaching. Table 2 also shows the means and standard deviations before and after bleaching for participants that accepted bleaching. There was no statistically significant difference between the groups except for the extraversion factor ( $p = 0.01$ ). Participants that accepted bleaching were more extrovert. The Wilcoxon signed rank test showed no statistically significant difference for any of the personality items before and after bleaching ( $p > 0.1$ ).

Table 3 shows the distribution of factor scores by group and gender. The comparison between groups and sex revealed significant differences in neuroticism and extraversion factors. Males that accepted bleaching scored more in extraversion

than males that refused bleaching ( $p < 0.05$ ). Females scored more in neuroticism than males that accepted bleaching ( $p < 0.05$ ).

Table 4 reports the means and standard deviations of the color change at the different assessment points. Efficient whitening was observed after 3 weeks at-home bleaching both in the  $\Delta$ SGU and  $\Delta E$ . The color remained stable at 1 month post-bleaching.

The internal consistency of the test, measured using Cronbach's alpha, was 0.74, and the repeatability, using intra-class correlation coefficient, was 0.74 with a 95 % confidence interval ranging from 0.667 to 0.818.

## Bleaching-induced tooth sensitivity

Thirty out of the 58 participants submitted to bleaching reported pain at least once during bleaching. Therefore, the absolute risk of sensitivity was 51.7 % (95 % confidence interval of 39.2 to 64.1 %). In general, the tooth sensitivity was mild with a mean intensity of  $0.5 \pm 0.49$  [median = 0.0 (min = 0.0, max = 2.4)] by VAS scale reported only during the bleaching procedure (within 3 weeks treatment).

## Discussion

It is interesting for dentists to know and understand the patient's behavior to meet their needs. Poor training on human behavior complicates predictions or interpretations of the patient's behavior surrounding election for a type of treatment such as teeth whitening [20].

In this way, it is necessary to increase the knowledge about the association of personality traits and oral health behaviors. There are few studies about personality traits in dentistry and even less reports about the effect of the choice of dental treatment or dental interventions on personality. Most of studies have focused on orthognatic surgeries and its effect on patient'

**Table 2** Medians (minimum/maximum) of the sum of NEO-FFI score per personality factor for each group of participants (refused and accepted bleaching) and before and after bleaching

Personality factors	Groups of participants		Mann-Whitney test	Participants that accepted bleaching		Wilcoxon Signed Rank test
	Refused bleaching	Accepted bleaching		Before bleaching	After bleaching	
Neuroticism	17 (0–44)	16 (1–40)	n.s.	16 (1–40)	16 (1–31)	n.s.
Extraversion	30 (11–48)	34 (14–48)	significant	34 (14–48)	33 (15–48)	n.s.
Openness	28.5 (13–46)	30.5 (15–46)	n.s.	30.5 (15–46)	29 (14–45)	n.s.
Agreeableness	31 (8–44)	30.5 (14–42)	n.s.	30.5 (14–42)	30 (13–43)	n.s.
Conscientiousness	33 (14–48)	35 (17–48)	n.s.	35 (17–48)	35 (14–46)	n.s.

Significant at  $p < 0.05$

n.s. non-significant at  $p > 0.05$

**Table 3** Medians (minimum/maximum) of the sum of NEO-FFI score per personality factor for each group of participants (refused and accepted bleaching) by gender

Personality factors	Refused bleaching		Accepted bleaching	
	Female	Male	Female	Male
Neuroticism	18 (0–44) a	17 (7–26) a	22 (11–40) a	12 (1–39) b
Extraversion	30 (17–45) a	30 (13–45) a	33 (20–43) a	35 (14–48) b
Openness	28 (19–43) a	32 (13–46) a	30 (15–44) a	31 (15–46) a
Agreeableness	33.5 (6–43) a	30 (19–40) a	30 (16–42) a	31 (14–40) a
Conscientiousness	33.5 (16–47) a	33 (14–43) a	35 (23–43) a	36 (17–48) a

Comparisons are valid only within rows. The *same letter* indicates groups with statistically similar means ( $p > 0.05$ )

satisfaction. In spite of that, these studies support the relation between personality and oral health.

Some findings show that neuroticism, extraversion, and openness may influence dental perceptions and play a significant role in shaping satisfaction with dentition in younger people [21]. Takeshita et al. [22] reported that neuroticism was negatively correlated with oral health quality of life (OHRQoL), and extraversion was positively correlated with OHRQoL in Japanese patient between 69 and 71 years.

One study reported personality factors measured by NEO-FFI on patients who received complete and partial prosthodontics rehabilitation [23]. They found that before treatment, the neuroticism and openness factors were associated with dental satisfaction and impacts on daily living and after treatment with conscientiousness and extraversion factors.

We have hypothesized that there was no difference in personality factors between patients who refused and accepted bleaching; this hypothesis was rejected because the extraversion factor was found to differ statistically between these two groups.

We observed that people who decide to whiten their teeth are more extrovert. This means that not only were they seeking esthetic changes but to use the effect of teeth whitening to achieve a more active social life or obtain more friends [24]. In contrast, people who choose not to bleach are also concerned about their inner world without neglecting the external and more assertive aspects [6].

**Table 4** Median (min-max) of color change in  $\Delta$ SGU and  $\Delta$ E in the different assessment points

Assessment points	Color change	
	$\Delta$ SGU	$\Delta$ E
Baseline vs. 3 weeks bleaching	3 (0–6)a	5.7 (1.5–22.1)A
Baseline vs. 1 week after bleaching	3 (0–6)a	6.2 (2.3–11.0)A
Baseline vs. 1 month after bleaching	2.5 (0–6)a	5.8 (1.4–11.8)A

Comparisons are valid only within columns. The same letter indicates statistically similar means ( $p > 0.05$ )

We must consider that these differences were predominantly found in males, with lower values in the extraversion factor in patients who refused to whiten their teeth. One explanation for this is that men tend to be more reserved pending their thoughts and inner world, losing interest in their esthetic appearance [25]. Extraversion is characterized by sociability, outgoingness, assertiveness, tendencies to engage in more social interaction, to spend more time interacting with others, and to seek and attract more social attention than individuals who are more introverted [26, 27].

On the other hand, males that accepted bleaching were considered less neurotic than females and there is no logical explanation for this finding. As neuroticism is characterized by anxiety, fear, moodiness, worry, envy, frustration, jealousy, and loneliness [28], we expected that male would be considered more neurotic than female, and future studies need to be done to explain this differences.

Smillie et al. [29] reported that high scores in this dimension reflect tendencies toward being bold, assertive, gregarious, and talkative. Extraversion, also, is associated with less severe feelings of stress [22], energetic engagement with the world [29–31], and the tendency to perceive their health status more positively [22] probably because the extravert people tend to experience high levels of positive emotions [29–31]. This may be a key point in the discussion because more than its esthetic self-perception, patients seek a better esthetic perception of the social environment around them, a positive feedback that should be considered by clinicians, who should match the whitening results with that of patient expectations or what the patient wants to hear, so post-whitening controls will be a key to understand how the patients feel in their social environment, an effect showed by Reilly et al. [32] on patients submitted to facial rejuvenation surgery.

The greater participation of extraverts in social activities [33] could explain why these participants accepted bleaching. Their appearance is important in social meeting, and the extraverts are concerned with social impact [34]. Extraverts tend to elicit more positive reactions from others than introverts; they also report a greater frequency of both giving and receiving support from others [31, 35].

Interestingly, the results showed no differences in the openness factor, which is a personality factor that involves greater esthetic sensitivity [9].

We also hypothesized that there was no difference between the personalities of patients before and after bleaching treatment, and based on the statistical analysis, we did not gather enough evidence to reject this hypothesis. These results were expected because the personality is structural (i.e., it is a dimension that remains constant over time). While there may be changes in personality, these changes do not occur over short periods of time [36]. It worth to mention that the results in terms of tooth whitening and sensitivity observed in the present study after 3 weeks of at-home bleaching are comparable with the previous literature [37–39].

Regarding to the bleaching procedure, 10 % carbamide peroxide was selected as several clinical studies indicated that 10 % carbamide peroxide has a low risk of tooth sensitivity than 15–20 % carbamide peroxide with comparable whitening efficacy after 3 or 4 weeks of treatment [40–44]. The specific reason to avoid greater sensitivity was to eliminate it as possible confounding factor in the results of the psychological post-whitening questionnaire [45]. The sensitivity produced by bleaching in the group of patients studied is within the ranges and intensity reported in the literature [46]. Although tooth sensitivity could be considered an important adverse effect, no correlation (not shown data) was observed between tooth sensitivity and personality factors or sex. However, this should be the focus of future studies due to the low power of these statistical correlation tests. Thus, future studies should be conducted to evaluate the impact of more concentrated gels on neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness of the patients.

Within the limitations of this study, we mention the classic limitations of psychometrics and applications of questionnaires. The problems arise from answering the questionnaire, alertness of the patient, or simply their interest in answering something that may not be pleasing; however, instruments such as the NEO-FFI are widely used and validated by the scientific community [7, 27] and are used in many studies in medicine and could be a good tool for future studies in dentistry.

## Conclusions

There are differences in personalities between people who decide to bleach versus who do not. These differences were mainly in terms of the extraversion factor. This makes them more stereotyped, and they could be described as very sociable, extroverted, and very concerned about esthetics and cleanliness. The bleaching protocol however is not capable to modify the personality of the patients on the short term.

## Compliance with ethical standards

**Conflict of interest** A. Herrera declares that she has no conflict of interest, J. Martín declares that he has no conflict of interest, F. Pérez declares that he had no conflict of interest, E. Bonafé declares that she has no conflict of interest, A. Reis declares that she has no conflict of interest, A. Loguercio declares that he has no conflict of interest, and E. Fernández declares that he has no conflict of interest.

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**Ethical approval** This clinical study was approved by the Ethics Committee of the Faculty of Dentistry at the University of Chile (PRI-ODO 15/01 and FIOUCH 13/18) and was conducted according to the Consolidated Standards of Reporting Trials Statement and Helsinki Declaration of 1975 revised in 2000.

**Informed consent** All persons gave their informed consent prior to their inclusion in the study. Details that might disclose the identity of the subjects under study were omitted.

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