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Dental bleaching: patient perception and satisfaction

Francesco S. LUDOVICHETTI ¹ *, Nicoletta ZERMAN ², Edoardo STELLINI ¹,
Giulia ZAMBON ¹, Sergio MAZZOLENI ¹, Andrea ZUCCON ¹

¹Section of Dentistry, Department of Neurosciences, Padua, Italy; ²Department of Pediatric Dentistry, University of Verona, Verona, Italy

*Corresponding author: Francesco S. Ludovichetti, Department of Neurosciences, Section of Dentistry, University of Padua, Padua, Italy. E-mail: francesco.ludovichetti@unipd.it

ABSTRACT

BACKGROUND: Teeth bleaching is a common practice performed by dental hygienists and dentists to correct aesthetic problems due to dental discoloration. Patients' opinions on this procedure may be different according to their personal experiences, expectations and individual sensitivities. The aim of this study is to assess the degree of satisfaction and related sensitivity of patients to professional and home bleaching treatment.

METHODS: A questionnaire consisting of 12 multiple-choice questions was submitted to 625 subjects among general population. These were related to: 1) patient's age and whether the patient is a smoker; 2) personal satisfaction; and 3) post-treatment tooth sensitivity. Descriptive analyses of all variables in the questionnaire were performed, and statistical analyses between variables were carried out by Chi-square test and Fisher's Exact test.

RESULTS: Of the people surveyed, 66% performed home bleaching, while the remaining performed the treatment in a dental office. Thirty-three percent of patients had previously undergone teeth bleaching and the 95.7% stated that they were satisfied with the treatment. Of these, only 36.4% reported experiencing postoperative hypersensitivity. Most patients (91.3%) received professional scaling before undergoing bleaching treatment.

CONCLUSIONS: Patient satisfaction with tooth whitening treatment can vary from patient to patient and represents a strong indicator of treatment efficacy and suitability. A proper communication, careful management and individualized patient assessment are key to maximizing satisfaction and ensuring a positive and fulfilling patient experience.

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KEY WORDS: Tooth bleaching; Tooth bleaching agents; Patient reported outcome measures.

Teeth play a decisive role in a person's appearance. This occurs during smiles but also in speech and facial expressions. Teeth can express beauty, support the lips and be decisive for phonetics.¹ The self-perception of personal appearance is much related to the aesthetics of their smile: shape, size, position and color are considered.² The teeth color and appearance are a complex phenomenon, with many factors influencing the overall perception. It is influenced by the combination of their intrinsic color and the presence of extrinsic stains that may occur on the tooth surface. Intrinsic color of a tooth color can be described, according to the Munsell

color space, through three basic attributes: hue, value and chroma. Hue distinguishes between color families (red, blue, green), value indicates brightness (from pure black to pure white) and chroma is the degree of color saturation (color intensity).³ In addition to these, other secondary optical properties can influence the overall appearance of the of the tooth, including translucency, opacity, iridescence, surface gloss and fluorescence. Translucency and opacity are both particularly important, as they indicate the quality and quantity of light reflection.⁴

Younger people have been shown to place more importance on the appearance of teeth than

older people, with women placing a higher value on it.⁵ Furthermore, younger subjects report a stronger preference for white teeth compared to older subjects. A wide range of adult and teenage populations have reported being dissatisfied with the color of their teeth, ranging from 19.6% to 65.9%.⁶ This dissatisfaction about the color of teeth is linked to a greater demand for procedures that enhance dental aesthetics, such as teeth whitening. Thanks to this trend, tooth whitening has become a very popular and requested procedure nowadays.⁷

Teeth bleaching is a common cosmetic practice performed by dental hygienists and dentists to correct aesthetic problems due to dental discoloration. During the bleaching process, a bleaching agent, usually hydrogen peroxide-based, is applied. The mechanism involved is the result of a chemical oxidation-reduction reaction, achieved due to the high permeability of enamel and dentin.⁸ The treatment can be performed in the dental office, performed by clinicians using high concentrations of hydrogen peroxide, or at home, performed by patients using customized trays that deliver peroxide (usually carbamide peroxide) at low concentrations.⁹ In-office bleaching is particularly recommended for treating patients who have some contraindications, such as gingival retraction or gastric disease. In addition, the fact that practitioners do not have to rely on the patient's cooperation and have more control over the procedure is a further advantage of in-office bleaching.¹⁰ Whitening toothpaste options can be found in the market; however, concerns have been raised regarding their impact on the roughness of tooth surfaces.¹¹

One of the most well-known side effects of these methods is the onset of dentinal hypersensitivity due to the penetration of peroxide into dentinal tubules. This is a temporary discomfort that regresses with no residual damage to dental pulp. The severity of this adverse effect is directly related to: concentration of the bleaching component, duration of treatment and composition of the product used.¹²

Patients' opinions on tooth bleaching may be different according to their personal experiences, expectations and individual sensitivities.

Some patients may be very satisfied with the results obtained from tooth whitening, while others may have less positive reactions. Some benefits include a brighter and more attractive smile, increased self-confidence, improved appearance and a general feeling of wellness. On the other hand, some patients may complain of tooth sensitivity after treatment, which may be temporary or more persistent. Others may have too high expectations of the results obtained or may find that the whitening effect does not last as long as desired. The aim of this study is to assess the degree of satisfaction and related sensitivity of patients to professional and home bleaching treatment.

Materials and methods

Study design

A questionnaire was created and administered to all participants. It consisted of a total of 12 multiple-choice questions. A short introductory section in which the objectives of the study were briefly explained was provided. The questionnaire consisted of questions regarding: 1) patient's age and whether the patient is a smoker; 2) personal satisfaction; and 3) post-treatment tooth sensitivity.

The questionnaire was administered in Italian *via* a link leading to the Google Forms platform. Data collection started in May 2022 until March 2023.

Subjects

Sample of this study consisted of 625 participants. The questionnaire was open to the general population over 18 years of age and the link was communicated *via* social media. It was anonymous and all participants were guaranteed complete confidentiality of information.

Statistical analysis

All statistical tests used in this study were performed through the statistical program R. Descriptive analyses of all variables in the questionnaire were performed, and statistical analyses between variables were carried out by Chi-square test and Fisher's Exact test.

Results

The study sample consisted of 625 participants from the general population over 18 years of age.

Contingency tables based on the answers to the 12 questions in the questionnaire were performed. For each table, missing data were excluded to avoid results distortion. Frequency between the variables “Smoker” and “Are you satisfied with the result achieved?” is described in Table I. Of the people surveyed, 73.4% (215) were non-smokers. Of the 293 participants, 170 were satisfied with the result and of them 74% were non-smokers. However, the relationship between being a smoker and the degree of satisfaction is not statistically significant ($P>0.05$). Frequency between the variables “Did you perform a home bleaching treatment?” and “If you performed a home bleaching treatment, did you have postoperative sensitivity?” is shown in Table II. In total, the number of patients with complete answers to these two questions was 198. Of these, 66% (131) performed home bleaching. 132 of the 198 participants stated that they had no postoperative sensitivity after performing home bleaching. The association between home whitening and postoperative sensitivity

was demonstrated to be statistically significant ($P<0.05$).

Of the people surveyed, 33% (97) had previously undergone teeth bleaching and 67% (193) stated that they had never had their teeth bleached before (Table III). Also, among all patients who had undergone bleaching before, 70 said they were satisfied while only 3 said they were not, thus the association between having previously undergone tooth bleaching and the degree of satisfaction is established ($P<0.05$). According to Table IV, for a total of 196 answers, 62.2% of the respondents had never had teeth bleaching performed before, while 37.8% had already done this procedure. It is also shown that approximately 36.4% of those who had already had teeth bleaching reported experiencing postoperative sensitivity (Table IV). However, there is no evidence of an association between having previously bleached teeth and postoperative sensitivity ($P>0.05$).

Table V presents information on the performance of a professional dental cleaning (scaling) before undergoing tooth bleaching treatment. Data show that the majority of patients (91.3%) had a professional cleaning performed before undergoing treatment. However, a significant

TABLE I.—Contingency table between the variables “Smoker” and “Are you satisfied with the result achieved?”.

| Smoker | Are you satisfied with the result achieved? | | | Total |
|---------|---|----|-----|-------|
| | Enough | No | Yes | |
| No | 67 | 22 | 126 | 215 |
| Yes | 26 | 8 | 44 | 78 |
| Total | 93 | 30 | 170 | 293 |
| P value | 0.9359 | | | |

TABLE II.—Contingency table between the variables “Did you perform a home bleaching treatment?” and “If you performed a home bleaching treatment, did you have postoperative sensitivity?”.

| Did you perform a home bleaching treatment? | If you performed a home bleaching treatment, did you have postoperative sensitivity? | | Total |
|---|--|-----|-------|
| | No | Yes | |
| No | 62 | 5 | 67 |
| Yes | 70 | 61 | 131 |
| Total | 132 | 66 | 198 |
| P value | 0.00008 | | |

TABLE III.—Contingency table between the variables “Have you previously performed teeth bleaching?” and “Are you satisfied with the result achieved?”.

| Have you previously performed teeth bleaching? | Are you satisfied with the result achieved? | | | Total |
|--|---|----|-----|-------|
| | Enough | No | Yes | |
| No | 67 | 27 | 99 | 193 |
| Yes | 24 | 3 | 70 | 97 |
| Total | 91 | 30 | 169 | 290 |
| P value | 0.0007925 | | | |

TABLE IV.—Contingency table between the variables “Have you previously performed teeth bleaching?” and “If you have performed a home bleaching treatment, have you suffered any postoperative sensitivity?”.

| Have you previously performed teeth bleaching? | If you have performed a home bleaching treatment, have you suffered any postoperative sensitivity? | | Total |
|--|--|-----|-------|
| | No | Yes | |
| No | 80 | 42 | 122 |
| Yes | 50 | 24 | 74 |
| Total | 130 | 66 | 196 |
| P value | 0.891 | | |

percentage of patients (8.7%) did not get professional cleaning. In addition, it is shown that most patients were between 18 and 30 years of age (44.3%), followed by the 30-40 age group (32.7%), although there is no association between the variables "Age" and "Did you have a professional teeth cleaning (scaling) before undergoing tooth bleaching?" ($P>0.05$) (Table V). Additionally, no association between smoking and professional scaling prior to bleaching treatment was found (Table VI). Patients who carried out a home bleaching treatment amounted to 44.5%. Of these, only VI did not receive professional scaling prior to treatment (Table VII). Table VIII shows that 84.1% of all patients who

TABLE V.—Contingency table between the variables "Age" and "Did you have a professional teeth cleaning (scaling) before undergoing tooth bleaching?".

| Age | Did you have a professional teeth cleaning (scaling) before undergoing tooth bleaching? | | Total |
|---------|---|-----|-------|
| | No | Yes | |
| 18-30 | 12 | 121 | 133 |
| 30-40 | 7 | 91 | 98 |
| 40-50 | 4 | 31 | 35 |
| >50 | 3 | 31 | 34 |
| Total | 26 | 274 | 300 |
| P value | 0.831 | | |

TABLE VI.—Contingency table between the variables "Smoker" and "Did you have a professional teeth cleaning (scaling) before undergoing tooth bleaching?".

| Smoker | Did you have a professional teeth cleaning (scaling) before undergoing tooth bleaching? | | Total |
|---------|---|-----|-------|
| | No | Yes | |
| No | 17 | 202 | 219 |
| Yes | 9 | 72 | 81 |
| Total | 26 | 274 | 300 |
| P value | 0.493 | | |

TABLE VII.—Contingency table between the variables "Have you performed a home bleaching treatment?" and "Did you have a professional teeth cleaning (scaling) before undergoing tooth bleaching?".

| Have you performed a home bleaching treatment? | Did you have a professional teeth cleaning (scaling) before undergoing tooth bleaching? | | Total |
|--|---|-----|-------|
| | No | Yes | |
| No | 20 | 147 | 167 |
| Yes | 6 | 127 | 133 |
| Total | 26 | 274 | 300 |
| P value | 0.0249 | | |

TABLE VIII.—Contingency table between the variables "Have you performed a professional bleaching treatment in a dental practice?" and "Would you like to repeat it?".

| Have you performed a professional bleaching treatment in a dental practice? | Would you like to repeat it? | | Total |
|---|------------------------------|-----|-------|
| | No | Yes | |
| No | 13 | 47 | 60 |
| Yes | 37 | 196 | 233 |
| Total | 50 | 243 | 293 |
| P value | 0.3842 | | |

had received professional bleaching treatment in a dental practice would like to repeat the treatment. Only 50 would not want to repeat it and of these 37 had already been subjected to professional bleaching before (Table VIII).

Discussion

The present study was designed to define the relationship between different aspects of tooth bleaching procedures, degree of satisfaction and patient perception.

Most of the patients interviewed (74%) were non-smokers. However, the non-correlation between smoking and patient satisfaction with the result achieved after bleaching was demonstrated (Table I). This result agrees with what has been described in current literature: according to the prospective clinical study conducted by Silva *et al.*, tooth bleaching is effective on both smoking and non-smoking patients.¹³ The clinical study evaluated two groups of participants, smokers and non-smokers, who underwent bleaching treatment for a period of 14 days. Although extrinsic smoking stains are difficult to remove and smoking adversely affected color stability after tooth whitening, the changes observed were clinically acceptable and patients were satisfied with the result achieved.

Dental hypersensitivity after bleaching treatment is one of the most frequently reported adverse effects. It may manifest as mild discomfort or short-term pain. Of the people surveyed, 66% had performed home bleaching and most of them stated that they had no post-operative sensitivity after the treatment (Table II). This association is confirmed by the study conducted by Browning WD *et al.*¹⁴ in 2007. The purpose of this double-

blind study was to report the degree of sensitivity of the 172 participants after 14 days of treatment. They assert that there is great variability in sensitivity levels from person to person and that temperature sensitivity tends to occur later in the 14-day home whitening cycle, while sensitivity to heat and cold tended to manifest together; Tredwin *et al.*¹⁵ compared the adverse effects of hydrogen peroxide bleaching reported in cell, animal and human studies. They include: cervical root resorption associated with bleaching, increased tooth sensitivity, altered enamel surface topography, reduced adhesion strength of resin-based materials and possible carcinogenic or tumor-promoting capabilities. In contrast to the data presented in Table IV, this literature review shows that a correlation exists between post-operative sensitivity and tooth bleaching. As recently demonstrated, home bleaching is more effective compared to ambulatory bleaching and the rate of tooth sensitivity is similar for the two techniques.¹⁶

It can be observed that 33% of subjects (Table III) had repeated the bleaching treatment other times, being satisfied with the result achieved. Indeed, several studies confirm correlation between tooth whitening and patients' perceived oral health, as well as their satisfaction with their smile and teeth whiteness: In a randomized clinical trial of Siddhart *et al.* 2020 examined patient satisfaction post-whitening treatment, determining a significant improvement in perceived oral health and satisfaction with the brightness of teeth and smile.¹⁷

Similarly, Martin *et al.* in 2016, the Authors aimed at identifying personality characteristics determined by the Millon Index of Personality Styles among participants seeking teeth whitening and correlating them with treatment satisfaction. Forty participants aged between 18 and 40 were included, each completing the Millon Index of Personality Styles questionnaire before treatment.

The study revealed that almost all patients desired a moderate change in tooth color, achievable after a single application of a whitening agent, resulting in generally satisfactory treatment outcomes.¹⁸

Almost all patients desire a moderate change in tooth color, achievable after a single applica-

tion of a whitening agent, with a result that is usually satisfactory.¹⁸ Teeth whitening is an aesthetic treatment, but to best enhance the color of natural teeth, it must be performed on a clean and healthy mouth. Professional oral hygiene therefore becomes a priority to prepare the surfaces for the treatment, removing all extrinsic stains that could alter the result. Most patients of any age (91.3%, Table V), indeed, performed professional oral hygiene before undergoing whitening treatment. It is also necessary to carry out a proper anamnesis and inspection of the hard and soft tissues of the oral cavity, making it possible to detect possible complications in both the tooth structure and the supporting tissues. This topic is also well discussed in the literature review of Sulieman MA in 2008 where professional oral hygiene it is suggested to be performed at least 7-10 days prior to bleaching treatment, whether professional or at home.¹⁹ As mentioned above, extrinsic stains most difficult to remove by bleaching include tobacco smoke. Chemicals present in smoke can settle on the surface of teeth, creating a coating that hinders the whitening process and thus limits its effectiveness. Even if a whiter smile can be achieved through teeth bleaching, smokers are more prone to a rapid recurrence of stains and discoloration. This means that the achieved white smile may not last long and may require more frequent maintenance treatments as also confirmed by a study conducted by de Geus *et al.*¹⁵ in 2015, where the longevity of color was evaluated after one year of at-home whitening with 10% carbamide peroxide in 60 patients, 30 smokers, and 30 non-smokers. The study revealed that whitening is effective in smokers even after a year, but dental prophylaxis may be necessary to remove extrinsic stains caused by diet and smoking.²⁰ In addition, smoking is a risk factor for gum diseases such as gingivitis and periodontitis. Most smokers (88.9%, Table VI) performed professional oral hygiene before undergoing tooth bleaching treatment. The higher the level of oral hygiene, the greater the control of biofilm, plaque and calculus, which affect the long-term durability of whitening and consequently patient satisfaction which is also affected by its perception of the dental practice overall hygiene.^{21, 22}

Data show that 84.1% of patients who have undergone professional teeth bleaching treatment are eager to repeat it (Table VIII). Teeth whitening can affect patient satisfaction in the long term by improving their aesthetic appearance, self-esteem and confidence. Patients are more confident and satisfied with their smile after successful treatment and the level of satisfaction resulting from dental whitening procedures is significantly influenced by the proper alignment of teeth, underscoring the importance of orthodontic intervention to ensure optimal close contact.^{23, 24} It is crucial to emphasize that the effectiveness and results of tooth bleaching treatment can considerably vary from patient to patient. This is due to individual differences in tooth structure, cause of staining or discoloration and general dental conditions. Therefore, proper evaluation and counselling by a dental professional remain essential to ensure that the treatment meets the patient's expectations and is safe and effective.

Conclusions

Patient satisfaction with teeth bleaching treatment is a crucial issue and a strong indicator of treatment effectiveness and suitability. Treatment success can vary considerably from patient to patient: satisfaction depends on various factors, including outcomes achieved, initial expectation, expectations, post-treatment sensitivity and impact on patient self-esteem. A proper communication, careful management and individualized patient assessment are key to maximizing satisfaction and ensuring a positive and fulfilling patient experience.

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Conflicts of interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors' contributions

Francesco S. Ludovichetti: conceptualization, validation, writing final draft. Nicoletta Zerman: visualization, validation. Edoardo Stellini: validation. Giulia Zambon: writing original draft and methodology. Sergio Mazzoleni: visualization, validation. Andrea Zuccon: validation. All authors read and approved the final version of the manuscript.

History

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