

THE IMPACT OF TOOTH WHITENING PROCEDURES ON THE QUALITY OF LIFE:  
A TOPIC REVIEW

O IMPACTO NA QUALIDADE DE VIDA DO PROCEDIMENTO DE CLAREAMENTO  
DENTAL: UMA REVISÃO SOBRE O TEMA

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### Resumo

A estética em odontologia é uma das metas a ser alcançada visando à melhoria da qualidade de vida do paciente. O clareamento dental é um procedimento de baixo custo que pode ser realizado no consultório ou pelo próprio paciente em casa. Vários trabalhos científicos comprovaram sua eficácia e outros estudos foram realizados para avaliar essa eficácia com o impacto psicossocial. Entre as ferramentas que têm sido utilizadas para esse fim estão os questionários Oral Health Impact Profile (OHIP), Oral Impact on Daily Performance (OIDP) e Psicossocial Impact of Dental Esthetics (PIDAQ). O presente estudo tem como objetivo fazer uma revisão da literatura sobre o impacto do clareamento dental na qualidade de vida dos pacientes. As bases de dados PubMed, Cochrane Central, Scopus e Embase foram pesquisadas. Foram identificados 224 artigos e selecionados 40, dos quais 13 eram estudos clínicos. Parece haver um consenso na literatura pesquisada em relação ao clareamento dentário e à melhora da qualidade de vida. Por outro lado, sensibilidade dentária e irritação gengival também foram relatadas, o que pode levar a um impacto negativo na vida das pessoas. Porém, esse efeito negativo pode ser evitado ou minimizado pela associação do diagnóstico correto da mudança de cor, a utilização da técnica ideal e a concentração do agente clareador recomendada pelo dentista.

**Palavras-chave:** Clareamento dental; Qualidade de vida; Organização Mundial da Saúde; Saúde bucal.

### Abstract

One of the goals to be achieved in cosmetic dentistry is the improvement of a patient's quality of life. Tooth whitening is a low-cost procedure that can be performed either in-office or by the patients themselves, at home. Several scientific papers have proven its effectiveness and other studies have been conducted to evaluate its psychosocial impact. Among the tools that have been used for this purpose are the questionnaires Oral Health Impact Profile (OHIP), Oral Impact on Daily Performance (OIDP) and Psycho-social Impact of Dental Aesthetics (PIDAQ). The present study aims to review the literature regarding the impact tooth whitening has on a patients' quality of life. PubMed, Cochrane Central, Scopus and Embase databases were searched. 224 articles were identified, and 40 articles were selected, of which 13 were clinical studies. There seems to be a consensus in the literature researched associating tooth whitening to improvement in quality of life. On the other hand, some negative impacts have been reported, such as dental sensitivity and gingival irritation. However, these negative effects can be minimized or even avoided with the combination of correct diagnosis of the color change, ideal technique application, and the appropriate concentration of whitening agent as recommended by the dentist.

**Keywords:** Tooth Bleaching; Quality of life; World Health Organization; Oral health.

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## INTRODUCTION

One of the main objectives of esthetic restorative procedures in dentistry is to improve the quality of life and self-perception of the patient (1-14). Quality of life is defined by the World Health Organization Quality of Life Group (WHOQoL), as the perception of an individual about his position in life, in the context of the culture and value systems in which he lives and in relation to his goals, expectations, standards and concerns (15).

For many years, factors such as function, structure and biology have been priority in dental treatments. Nowadays, however, if a treatment plan does not include a clear view of its esthetic impact on the patient, the result can be disastrous (1,16-20). In many cultures, the color of teeth has been associated with beauty (17-19). Consequently, whitening treatments have become a demand in esthetic dental treatments (1,21,22).

The coloring of teeth is the result of intrinsic presence of dyes on its surface. Several methods can be applied to intervene in both the intrinsic and the extrinsic staining (22,23). The emergence of new materials and techniques seeking to meet the demand for an ideal treatment (determined by society), increases the possibility of intervention in the staining of teeth (24,25).

Based on the premise that esthetic values are subjective, and are shaped to cultural and temporal contexts, the absence of esthetic satisfaction can cause important social and psychological impacts on the quality of life (25,26). Several scientific studies have been carried out using tools seeking to quantify this degree of satisfaction and consequent improvement in quality of life (2-14). Among those used for this purpose are the Oral Health Impact Profile (OHIP), Oral Impact on Daily Performance (OIDP) and Psycho-social Impact of Dental Aesthetics (PIDAQ) questionnaires (15, 16). The aim of this study is to review the literature that addresses the relationship between tooth whitening and improvement in patients' quality of life, using the OHIP, OIDP, and PIDAQ questionnaires.

## LITERATURE REVIEW

This review evaluated only articles that were available electronically. The searches were carried out in the PubMed, Cochrane Central, Scopus and Embase databases with the keywords Tooth Bleaching; Quality of life; World Health Organization; Oral health. After screening the database and removing duplicates, 224 articles were identified. Then, after the titles were selected according to the inclusion criterion, as well as a careful examination of the abstracts and/or the full texts, this number was reduced to 40, of which 13 were clinical studies that used the OHIP, PIDAQ and OIDP questionnaires. The selection criteria included articles that addressed the following aspects: the influence on dental esthetics; the validation of the OHIP and PIDAQ questionnaires in different societies; reviews on whitening techniques; reviews on side effects of the different products and techniques used in tooth whitening; clinical studies with different whitening techniques; and the use of questionnaires assessing the improvement in quality of life.

Estimating subjective values of aesthetics in a society is not a simple task. Measuring the psychosocial impact that these values cause on individuals further increases the complexity of the topic (7). The World Health Organization (WHO) noted the need to create a Quality-of-Life Group, WHOQoL, in order to develop tools capable of assessing quality of life from a cross-cultural perspective (15). From that point on, new questionnaires emerged, such as OHIP and PIDAQ (15,16,27).

### Validation of questionnaires

Assessing and measuring subjective values influenced by intrinsic issues of different societies in a temporal-cultural context requires several studies following the natural dynamics of changes occurring in society. Thus, these tools need to be constantly validated and updated. Several scientific studies have been carried out with this purpose and the OHIP-14, (ANNEX 1) PIDAQ, and OIDP questionnaires have been applied and validated in different cultures, presenting acceptable and satisfactory psychometric values. These questionnaires cover several

domains that involve sensory perceptions, such as pain and discomfort; and functional aspects, such as the ability to chew and swallow food without difficulty, and to speak and pronounce words correctly. They also involve psychological aspects, such as appearance and self-esteem; and social aspects, such as social interaction and communication with people. Questionnaires must also be brief, simple, easy to administer, evaluate, and reproduce (15,16,27-29).

## Factors that influence treatment

The face is the main perception we have of ourselves and others, and, as such, the smile plays an important role in this social interaction. The interest in dental esthetics arises within this context, becoming the main reason people seek treatment in the specialties of orthodontics, prosthesis, and dentistry. Various factors such as color, shape and positioning of teeth in dental arches are correlated with the perception of esthetics, which, in turn, are influenced by individual, cultural, and socio-economic conditions, as well as by age and smoking habits, among others (1,19,30,31).

Studies show that dental esthetics directly influences quality of life (2-13). The consequences of a negative impact can include loss of work, decreased social activity, broken relationships, and psychological changes (31). Visual experience in a given culture can be considered pleasant and beautiful for one individual and unpleasant for another. Sociocultural conditions, gender, age and education levels are factors that influence the type of treatment a patient chooses to improve their dental esthetics (1,19,20).

Studies that researched the prevalence of tooth discoloration and self-satisfaction with tooth color concluded that age and gender were the most prominent factors associated with tooth color. Dissatisfaction with tooth color is significantly greater in women than in men, while education and smoking had a statistically significant association with self-satisfaction with tooth color. Self-satisfaction with tooth color decreased with increasing severity of pigmentation (1,30). According to Kovacevic et al., women are more sensitive to the appearance of their teeth than men. They

have different demands and needs regarding the appearance of their anterior maxillary teeth. Women tend to report greater psychosocial effects than men regardless of their tooth color (32). These data are in line with values found in other studies (30,31).

Regarding age, Bruhn et al., conducted a randomized blind trial evaluating tooth whitening and quality of life in adults, who were 50 years old or more. These authors concluded that white teeth positively influenced the quality of life of this group, as well as an increase in their social activities (2).

Herrera et al. concluded that there are personality differences between those who decide to whiten their teeth and those who do not. Patients that decide on whitening, tend to be more sociable, outgoing, and concerned with esthetics and cleanliness (33). In another study, Martin et al. correlated the personality of patients wanting to whiten their teeth with wanting an improvement in quality of life, confirming the influence of this factor (34).

## Dental whitening

Tooth whitening is a low-cost procedure when compared to other esthetic treatments that aim to change the color of the tooth. It can be performed in the office or by the patient himself at home, with or without professional guidance. Scientific works have proven its effectiveness (2,14-25). Several studies have evaluated this effectiveness with the psychosocial impact (2-14).

In the clinical studies reviewed in this work, the different application protocols for home bleaching were: 10% and 16% carbamide peroxide (CP) (3,4,7) or 6%, 14% and 15% hydrogen peroxide (HP) (2,3,14). The application protocols were 2 hours, once a day, for 2 weeks, or for 3 weeks; 1 h a day, for 3 weeks; 2 times a day for 3 weeks; or to follow the manufacturer's recommendations (2-4,7,14). When bleaching was performed on vital teeth in the office, different concentrations of (HP) were used: 6%, 15%, 35%, and 37.5% (6,8-10). When bleaching was performed on non-vital teeth, the substances used were 35% (HP) and 37% (CP) (5,11-13). These protocols are shown in Table I.

**Table 1** - Summary of clinical studies that evaluated improvement in quality of life through dental whitening

<b>AUTHORS</b>	<b>QUESTIONNAIRE APPLIED</b>	<b>BLEACHING AGENT</b>	<b>BLEACHING METHODS</b>
Bruhn et al. <sup>2</sup>	OHIP	14% HP	At-home bleaching
Goo et al. <sup>3</sup>	OHIP	10% CP and 15% HP	At-home and in-office
Bersezio et al. <sup>4</sup>	OHIP and PIDAQ	0% CP	At-home bleaching
Bersezio et al. <sup>5</sup>	OHIP and PIDAQ	35% HP and 37%CP	In-office
Angel et al. <sup>6</sup>	OHIP and PIDAQ	6 and 37,5% HP	In-office
Meireles et al. <sup>7</sup>	OIDP	10 and 16% CP	At-home bleaching
Kelly et al. <sup>8</sup>	OIDP	6 and 15% HP	In-office
Bersezio et al. <sup>9</sup>	OHIP and PIDAQ	6 and 35% HP	In-office
Fernández et al. <sup>10</sup>	OHIP and PIDAQ	6 and 35% HP	In-office
Bersezio et al. <sup>11</sup>	OHIP and PIDAQ	35% HP and 37%CP	In-office
Bersezio et al. <sup>12</sup>	OHIP and PIDAQ	35% HP and 37%CP	In-office
Bersezio et al. <sup>13</sup>	OHIP and PIDAQ	35% HP and 37%CP	In-office
McGrath et al. <sup>14</sup>	OHIP	6 - 14% HP	At-home bleaching

## Dental whitening and quality of life

A treatment that seeks to improve the quality of life of individuals should observe the safety and satisfaction of the patient, as well as the goal of long-term success (1,19,20,32,34). Of the studies reviewed, some evaluated the improvement in quality of life by using the OHIP and PIDAQ questionnaires (4,5,6,9-13), a few only used the OIDP (7,8), and other only the OHIP (2,3,14). There is a consensus in the literature researched relating tooth whitening to the improvement in quality of life.

There were no reports of side effects in studies that evaluated whitening in non-vital teeth with improvement in quality of life. All of them reported a positive result in the patients' esthetic self-perception and psychosocial self-perception after intracoronary whitening. In these studies, (HP) at 35% and (CP) at 37% were used as the bleaching agent (5,11-13).

In the studies that evaluated tooth whitening with vitality and quality of life, in which the whitening was done in the clinic, using (HP) at 6% (6,8-10), 15% (8) and 37,5% (6), all

influenced positively the improvement of quality of life, increasing satisfaction with dental appearance. Of the studies that evaluated tooth whitening with vitality and quality of life, in which the procedure was done at home, the product used was (CP) at concentrations of 10% and 16% (4,7) and (HP) at 14% (2). All reported a positive effect on the improvement of quality of life in the psychological and esthetic dimensions.

When comparing the research studies in which whitening was performed in vital and non-vital teeth both reported an increase in the improvement of quality of life. When we evaluated the results obtained in the studies that investigated in-office and at home whitening, the authors revealed that both situations influenced positively the overall esthetic and psychosocial self-perception (2-14).

Kelly et al. evaluated the influence on quality of life of dental whitening performed in the office and reported that, despite the higher frequency of sensitivity, (HP) at 15% showed greater bleaching efficacy at the end of treatment and greater color stability at 6 months of follow-up, compared to (HP) at 6% (8).

Bersezio et al. evaluated the esthetic perception of patients at 6 months after whitening non-vital teeth with 35% (HP) and 37% (CP) using an outpatient whitening technique. They also evaluated the psychosocial effect, as well as the clinical efficacy and color stability. They concluded that both agents were highly effective and maintained color stability at 6 months. This result positively affected the patients' esthetic perception and psychosocial effect. This improvement in quality of life remained stable over the time evaluated (11). Bersezio et al., in a one-year follow-up to the aforementioned study, concluded that the outpatient whitening technique was highly effective, showed minimal color retreat in non-vital teeth, and influenced positively the psychological effect on patients (12).

Angel et al., evaluated the color stability, the psychosocial effect, and the effect on self-perception of dental whitening esthetics using low concentration (HP), 6%, compared to the same substance at 35%. The whitening was performed in a clinic and had a follow-up for three months. This study concluded that both (HP) concentrations were effective and stable up to 3 months after whitening, and that there was an increase in self-confidence and psychological well-being when compared with the beginning of treatment (6). In the follow-up of this study, Bersezio et al., concluded that both groups had equal color longevity, and bleaching was effectively maintained for 24 months. Whitening had a positive effect on the psychosocial impact scores and on the aesthetic self-perception. Furthermore, the latter positive effect was maintained after 24 months (9).

Goo et al. evaluated the change in tooth color and consequent satisfaction of the patient after whitening in an office with HP 15%, and at home with CP 10%, with follow-up for six months. They concluded that tooth whitening was observed in both groups and the survey conducted showed a significant increase in patient satisfaction. However, a slight reduction in color was observed at 6 months after whitening. There were significant differences in tooth color before and after bleaching in both the home and office bleach groups, therefore, long-term observation of color reduction is required (3).

## Adverse effects

Quality of life is a complex theme that involves different areas. Although several studies have reported a positive influence on the esthetic and psychosocial self-perception of patients that underwent tooth whitening, dental sensitivity and gingival irritation have also been reported and this can lead to a negative effect on people's lives (7,23). In a review on the efficacy and side effects of various dental whiteners, Majeed et al. cited dental sensitivity and gingival irritation as the most frequent adverse effects (25).

In a systematic review to assess the occurrence, severity, and duration of tooth sensitivity – during and after vital tooth whitening – Kielbassa et al. concluded that currently no bleaching system can claim not to have this side effect. Therefore, a thorough scientific investigation is considered an important step to try to resolve this sensitivity symptom that occurs during and after the whitening treatment (35).

According to Rezende et al., the dental whitening technique is a significant predictor of dental sensitivity, and the whitening performed in the office, compared to the home, has 120% more chance of promoting some sensitivity (36). Other side effects include changes in the enamel surface (37,38). Some studies also reported negative effects on enamel and dentin microhardness (37). One such study found that whitening products found in clinic treatments, such as 35% (HP) and 35% (CP), reduced the hardness of the enamel and dentin more than the 10% (CP) used for in-home bleaching (38).

In non-vital tooth whitening, one of the reported side effects is external root resorption. Bersezio et al. evaluated the effect of HP at 35% and CP at 37%, observing an increase in cytokine levels present in most inflammatory processes. These increases were associated with several pathological processes, such as periodontitis and marginal bone loss (39).

Soares et al. evaluated the efficacy and cytotoxicity of a whitening gel with (HP) at 35% after short periods of application on dental enamel, and they concluded that the diffusion of HP through the dental structure, as well as the trans-enamel and trans-dentin cytotoxicity effects of the whitening gel, is proportional to

the time of contact of the product with the tooth surface. Despite the intense change of tooth color caused by the whitening gel HP at 35% applied for 45 min on the enamel, this whitening protocol produced a greater diffusion of HP through dental tissues promoting the most severe toxic effects to the pulp cells. On the other hand, the total whitening times of 5 or 15 minutes resulted in less diffusion of trans-enamel and trans-dentinal HP, which minimized the cytopathic effects on Odontoblastic cell cultures (40).

## DISCUSSION

Several studies conducted in different cultures show an increase in satisfaction and consequent improvement in the quality of life of individuals that underwent the dental whitening procedure (3,7,26). However, this positive influence should be analyzed with caution, considering possible side effects that may arise from the procedure (7).

Whitening can have either positive or negative effects on oral health-related quality of life. Positive effects are related to improvements in esthetics and appearance, which increase the ease of smiling (21,30). Positive effects on quality of life are detected when large color changes occur, especially when the teeth are no longer yellowish (10-14).

The negative effects are related to pain, discomfort and difficulty of oral hygiene caused by sensitivity or gingival irritation (7,23,25,35). The need to be accepted by their peers causes the individual to choose to undergo treatment. These individuals still have a positive perception of improved quality of life, despite the adverse effects of the therapy (40).

Currently, esthetic dentistry tends to perform minimally invasive treatment, which includes dental whitening treatments. Consequently, the possible negative effects can be better controlled, and even avoided, by the combination of a correct diagnosis of the color change, indication of ideal technique, and concentration of the whitening agent as recommended by the dentist (6,9).

## CONCLUSION

The literature on self-perception of the esthetic and psychosocial effect generated by

tooth whitening is limited. However, this review has concluded that while tooth whitening improves people's quality of life, it has also been associated with tooth sensitivity and gingival irritation, which can lead to a negative effect. New studies that assess not only immediate success, but also long-term success, as well as patient safety and satisfaction, are necessary.

The authors declare no conflict of interest.

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Questions	Answers					CHIP-14  (do not fill out)
1. Have you had problems pronouncing words due to mouth or teeth issues?	Never (0)	Rarely (1)	Sometimes (2)	Constantly, almost always (3)	Always (4)	<b>Item 1</b> (0) (1) (2) (3) (4)
2. Have you felt that food tastes worse due to mouth or tooth issues?						<b>Item 2</b> (0) (1) (2) (3) (4)
3. Have you felt pain in your mouth or teeth?						<b>Item 3</b> (0) (1) (2) (3) (4)
4. Have you felt uncomfortable to eat any food due to mouth or tooth issues?						<b>Item 4</b> (0) (1) (2) (3) (4)
5. Have you been worried due to issues with you tooth or mouth?						<b>Item 5</b> (0) (1) (2) (3) (4)
6. Have you felt stressed due to tooth or mouth issues?						<b>Item 6</b> (0) (1) (2) (3) (4)
7. Has your nourishment been affected due to mouth or tooth issues?						<b>Item 7</b> (0) (1) (2) (3) (4)
8. Have you had to stop your meals due to tooth ou mouth issues?						<b>Item 8</b> (0) (1) (2) (3) (4)
9. Have you had trouble relaxing due to tooth or mouth issues?						<b>Item 9</b> (0) (1) (2) (3) (4)
10. Have you felt ashamed due to tooth or mouth issues?						<b>Item 10</b> (0) (1) (2) (3) (4)
11. Have you been irritated with other people due to tooth or mouth issues?						<b>Item 11</b> (0) (1) (2) (3) (4)
12. Have you had difficultie performing daily tasks due to tooth or mouth issues?						<b>Item 12</b> (0) (1) (2) (3) (4)
13. Have you felt that your life has gotten worse due to teeth and mouth issues?						<b>Item 13</b> (0) (1) (2) (3) (4)
14. Have you become incapable of performing your daily activies due to tooth or mouth issues?						<b>Item 14</b> (0) (1) (2) (3) (4)