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Awareness of Polish society about complications and contraindications in teeth whitening

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Summary:

Introduction and aim: Teeth whitening, which has a positive effect on the quality of life and the human psyche but is associated with side effects and contraindications, is becoming increasingly popular and widespread. The aim of the study was to collect and analyse data concerning the awareness of the Polish population of complications and contraindications to tooth whitening.

Material and methods: A survey conducted using a Google document among teeth whitening and non-whitening individuals. Link to the survey posted on various social groups.

Results: People who whiten their teeth in a dental office are the group that showed the highest awareness about the side effects and contraindications of teeth whitening. People who do not whiten their teeth are more aware than people who whiten outside the dental surgery. The popularised slogans such as the possibility of tooth hypersensitivity, weakening of the enamel or the necessity to follow a "white diet" are known to each study group. The issues connected with the dentist's office were the least popular - persons whitening their teeth outside the dentist's office are not aware of the necessity to professionally clean their teeth before this procedure. None of the study groups have knowledge about the temporomandibular joint problem as a contraindication to teeth whitening.

Conclusions: The Polish population shows an average knowledge of teeth whitening. The basic contraindications and complications are known to a broader group of respondents, but there are aspects of whitening about which the knowledge of respondents is low and requires popularisation. In addition, the survey indicates that more research is needed into the relationship between the temporomandibular joint and tooth whitening.

Keywords: teeth whitening, tooth colour, hypersensitivity

Introduction:

Today's canon of beauty is different from that of a few decades back, however, the human desire to be the most perfect version of oneself is still present and increasingly noticeable. People have always dreamed of a beautiful and snow-white smile - the first historical attempts to remove stains from teeth with urea took place about 2000 years ago [1]. There are many studies looking at the impact of whitening on patients' quality of life, including such a study conducted by Bersezio in 2018. They showed that the application of 10% carbamide peroxide has a positive impact on both oral-related quality of life, but also on psychological and aesthetic perception [2].

Tooth colour depends on many factors - above all, it is determined by the histological structure and composition of the enamel and dentin. However, the natural colour of teeth is modified by all kinds of substances such as food, drinks and stimulants, which are deposited on the enamel surface and form external stains. Intrinsic discolouration is a much bigger dental problem and its causes are e.g. malformation of teeth, general diseases or applied drugs [3].

Among the methods of tooth whitening we can distinguish in-office methods - single-session and overlay methods, as well as more and more popular home methods in the form of whitening strips or pastes. Recently, tooth whitening by beauty salons has also become more and more popular. Among the advantages of "in-office bleaching" we should first of all mention the increased level of safety guaranteed by the dental team, which reduces the risk of changing the structure of the enamel or damaging oral mucosa. Moreover, professional in-office bleaching guarantees a personalised treatment plan, with the use of preparations of higher concentrations, which contributes to faster and more reliable results in the form of a white smile [4]. Home bleaching and cosmetic whitening are associated with lower costs, but also with a possible range of negative effects on the hard tissues of the tooth associated with too frequent and inappropriate use of concentrated products. In addition, the lack of special qualifications of those performing the procedure causes important components to be overlooked, such as contraindications to the procedure [5]. Important contraindications associated with both at-home and in-office bleaching include young age of the patient, pregnancy, breastfeeding, nicotinism, enamel fractures, multiple carious lesions or periodontal disease [6].

Tooth whitening is always associated with a high risk of side effects, such as postoperative hypersensitivity occurring in more than 50% of patients [7]. This hypersensitivity occurs regardless of the whitening method and is mainly dependent on the concentration of the whitening substance [8]. In addition, mucosal irritation, increased enamel fragility, temporomandibular joint problems or problems with current or future fillings are not uncommon [9]. Studies conducted in 2019 show that 'over-the-counter' whitening products cause a much greater change in enamel morphology than professional agents[10].

Teeth whitening has become more popular than teeth treatment, and the prevalence and availability of services is downright frightening. The modern world gives many opportunities to obtain beautiful, white teeth - but are they really healthy? Is modern Polish society aware of possible complications and contraindications to this procedure?

Purpose:

The aim of the study was to collect and analyse data on the awareness of the Polish population about complications and contraindications of teeth whitening.

Material and methods:

A questionnaire was conducted among 468 respondents, among whom 152 respondents were those who had whitened their teeth in the past, both at the dentist's office (108) and by home methods or in a beauty salon (44). The remaining 316 respondents had never undergone a tooth whitening procedure. The survey was conducted online via a Google document and was available between 17/03/2022 and 02/05/2022. A link to the survey was made available on publicly accessible online groups and profiles.

The worksheet contains two sections, the first section is about the demographics and biography of the respondents (1-4) and the second section explores the awareness of complications and contraindications to whitening treatment (5-20).

The questions in the survey were single-choice. There was unlimited time to answer the questions.

Results:

The largest group among the whitening and non-whitening subjects were those aged 18-25 years (42% and 54%). A smaller part were older people; the age between 26-35 years was declared by 36% of the teeth whiteners and 26% of the non-whiteners. 17% of whiteners and 12% of non-whiteners were between 36 and 40 years of age. The oldest group of respondents (over 40 years of age) makes up 3% of those who have undergone a whitening treatment. Slightly more, 5% of the non-whitening respondents were over 40 years of age. The smallest research group was made up of people under 18 years of age - together they accounted for only 2.5% of the respondents. It was mostly women who took part in the study - they constituted as much as 91% of those who had their teeth whitened and 84% of all those who had not undergone the procedure. Men constituted only 9% of the 152 whitening subjects and 16% of the non-whitening subjects. The vast majority of respondents have a university degree - 67% of those who whitened and 56% of those who did not whiten their teeth. Among the whitening subjects 23% have secondary education, 8% post-secondary education and 2% lower secondary education. Among the non-bleachers, 5% have post-secondary education, 2% have primary education and 2% have lower secondary education. Among the respondents who have never whitened their teeth, as many as 28% live in the countryside, 27% in a town with population over 500,000, 17% in a city with population between 100-500,000. A smaller group of respondents lived in cities with up to 50,000 (17%) and 50,000 to 100,000 (11%) inhabitants. Most respondents with whitened teeth live in the countryside (20%) and in a city with more than 500,000 inhabitants (25%), while a smaller group were residents of cities with up to 50,000 (17%) and 100-500,000 (24%). The smallest number of people among this group of respondents were those living in a town with 50-100 thousand inhabitants (14%) [Table 1].

Question	Possible answers	Whiteners [%]	Non-whiteners [%]
Age	under 18	2	3
	18-25 years old	42	54
	26-35 years old	36	26
	36-40 years old	17	12
	over 40	3	5

Sex	female	91	84
	male	9	16
Education	primary	-	2
	lower secondary	2	2
	secondary	23	35
	post-secondary	8	5
	higher	67	56
Residence	village	20	28
	town with up to 50 thousand inhabitants	17	17
	town with 50,000-100,000 inhabitants	14	11
	city with 100-500 thousand inhabitants	24	17
	city with more than 500 thousand inhabitants	25	27

Table 1. Summary of responses to questions on demographics and biography.

73% of whitening patients and 67% of non-whitening patients go regularly to a dentist for check-ups. 20% of respondents were the ones with unbleached teeth and those who attend check-ups less frequently than every 6 months. Those with whitened teeth and visits less frequent than every 6 months account for 20% of all respondents. Respondents who do not go for regular dental check-ups are 5% of those with whitened teeth, and 14% of respondents who did not undergo whitening. Respondents who had their teeth whitened rated their awareness of indications and contraindications to the procedure as follows: definitely aware (36%), rather aware (45%), rather unaware (10%), definitely unaware (3%). Difficulty in assessment was experienced by 6% of respondents. Among the non-bleachers the distribution of answers was different: definitely aware was only 10% of the respondents, rather aware (30%), rather unaware (40%), definitely unaware (13%). 7% of respondents found it difficult to assess. When asked about the place where the treatment is best performed, the dental office was definitely dominant (98%) among the non-whiteners. 1% felt that a beauty salon or home environment was a better option.

For 1% of the respondents the place does not matter much. Among whiteners, 90% consider a dental office to be the best place to whiten their teeth. 7% of respondents chose home conditions, 1% a beauty salon, and for 2% it does not matter much.

The vast majority (94%) of persons whitening their teeth at the dentist's office are aware of the necessity to perform professional dental cleaning before the procedure; also the people never whitening their teeth demonstrate high awareness of this issue (85%). Those who whitened their teeth at home or outside of the dentist's surgery were the most unaware of the need for professional dental cleaning before bleaching; only 47% of the respondents gave an affirmative answer to this question [Figure 1].

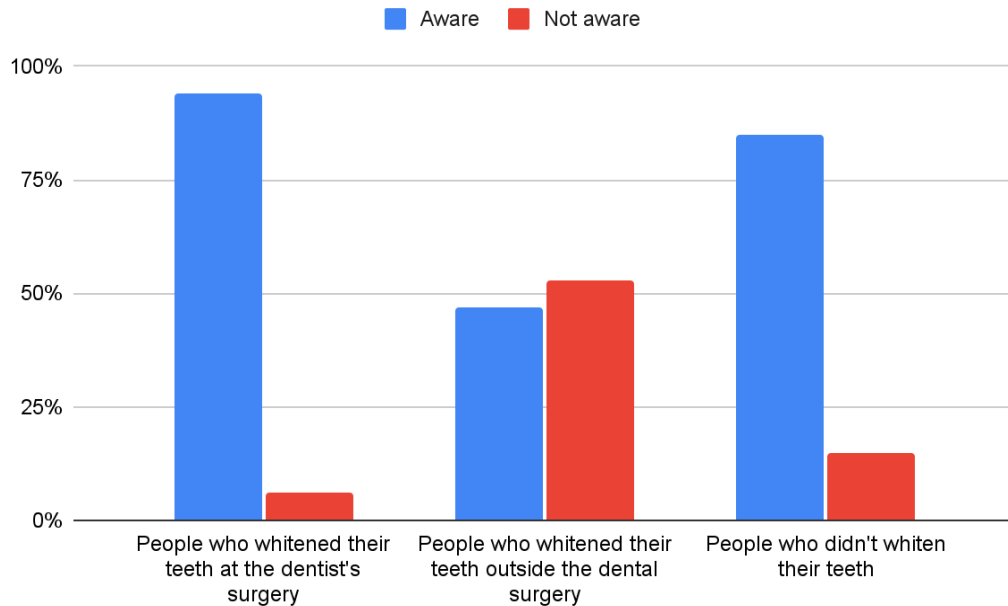


Figure 1. Awareness of the Polish population regarding the need for professional dental cleaning before teeth whitening.

The respondents from each of the study groups demonstrated high awareness of the possible occurrence of tooth hypersensitivity after bleaching. The highest number of affirmative answers was given by persons whitening their teeth outside the dental surgery (95%), slightly less (94%) by persons whitening their teeth at the dentist's, the lowest, but still high awareness was given by the group of persons never whitening their teeth (85%) [Figure 2].

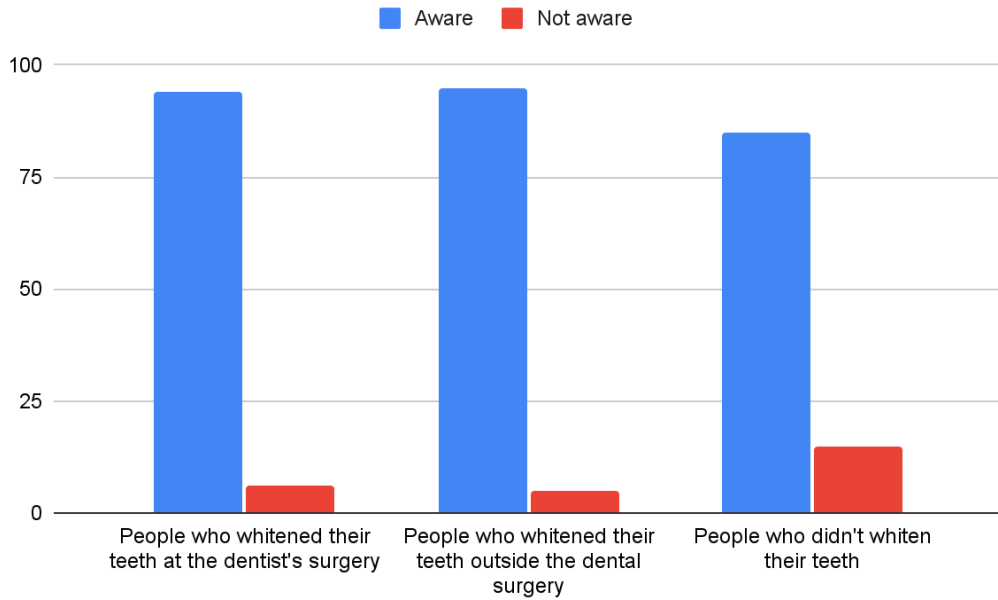


Figure 2. Polish society's awareness of the possibility of tooth hypersensitivity, dentine hypersensitivity or toothache occurrence after teeth whitening.

Teeth whitening can cause weakening and increased brittleness of the enamel. Awareness of this complication is almost equal in all study groups, with 71% of in-office tooth whiteners, 72% of out-of-office tooth whiteners and 72% of non-whiteners responding affirmatively to this question [Figure 3].

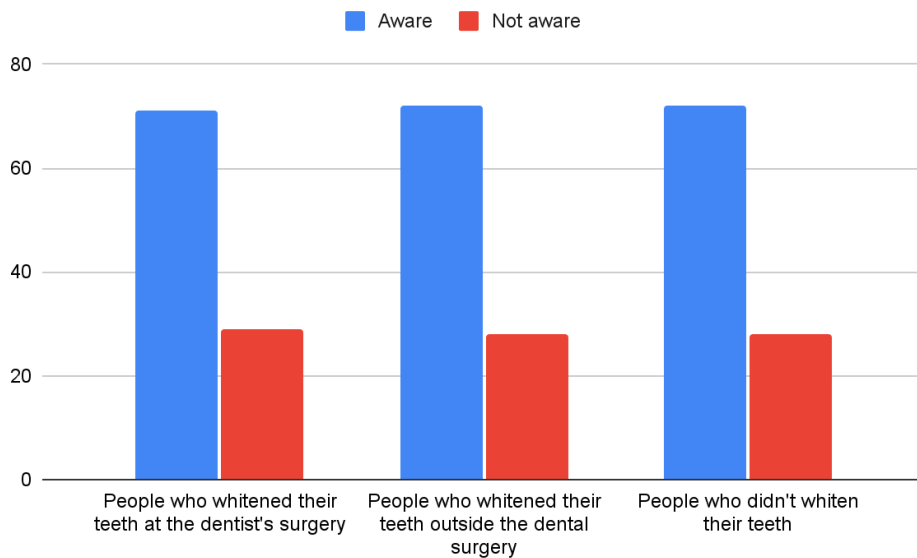


Figure 3. Awareness of the Polish population regarding the possibility of enamel weakening and increased fragility after teeth whitening.

Among those who whitened their teeth at the dentist's office, 84% are aware of the possible irritation of oral soft tissues. The affirmative answer to this question was also given by 67% of those not whitening their teeth. Those who whitened their teeth outside the office were familiar with this possible complication in 63% of cases [Figure 4].

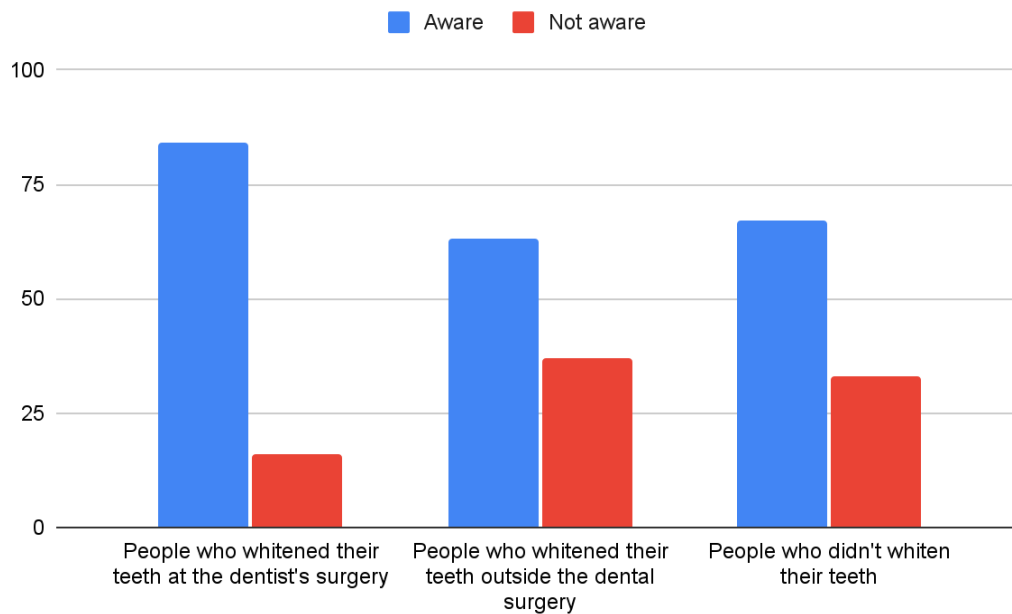


Figure 4. Polish society's awareness of the possibility of irritation of soft tissues in the oral cavity, e.g. gums, tongue during teeth whitening.

People who whiten their teeth at the dentist's office are overwhelmingly (93%) aware of the need to follow a "white diet" after tooth whitening. 82% of those whitening their teeth outside the surgery also gave a positive answer. Those who had never whitened their teeth showed the least knowledge on this subject (73%) [Figure 5].

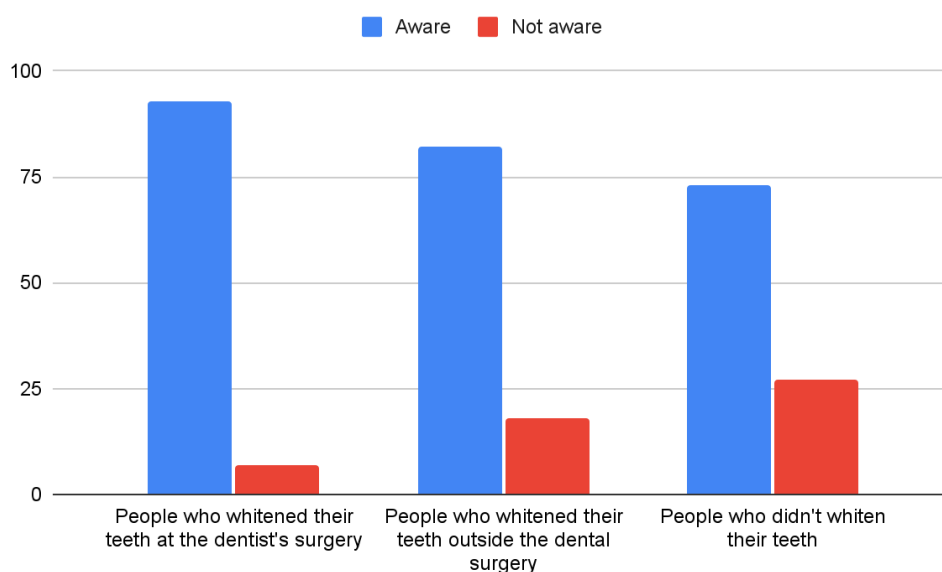


Figure 5. Awareness of the Polish population regarding the need to follow the so-called "white diet" after teeth whitening.

Among those whitening their teeth at the dentist's office, 89% of the respondents were aware of the necessity to treat all carious cavities before bleaching. Those whitening their teeth outside the office showed less awareness of this issue (49%). On the other hand, non-whiteners were more aware (79%). 55% of those who whitened their teeth professionally, 20% of the respondents whitening their teeth outside the office and 33% of those who never whitened their teeth were aware of the necessity to postpone treatment of caries. The possibility of yellow discolouration on composite fillings after tooth whitening was known by 64% of those who whitened their teeth professionally. The respondents who whitened their teeth by methods other than office whitening had a significantly lower awareness of this issue (32%). Those who have never had a teeth whitening procedure showed better knowledge (45%) [Figure 6-8].

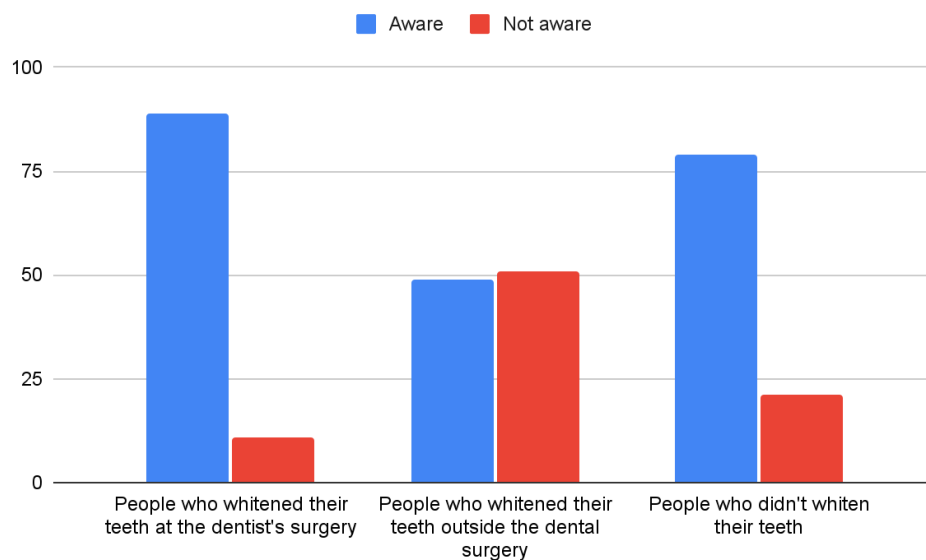


Figure 6. Awareness of the Polish population regarding the need to treat all carious lesions before teeth whitening.

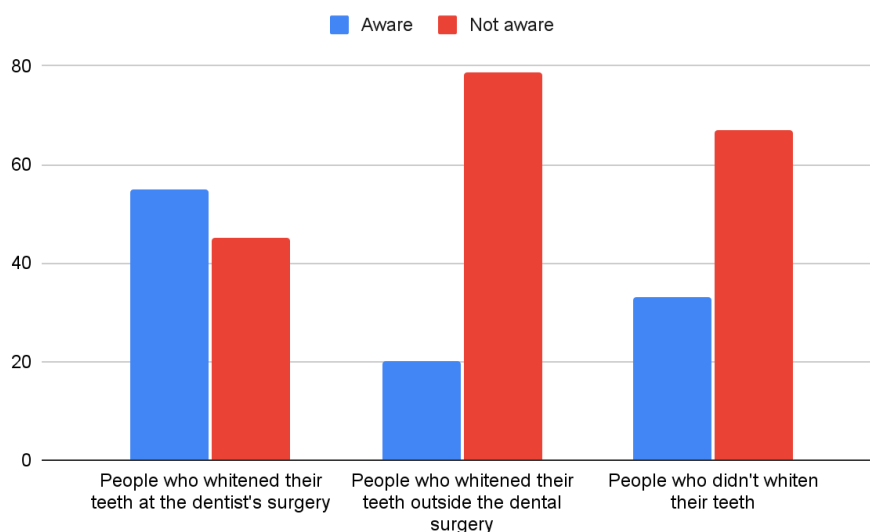


Figure 7. Awareness of the Polish population regarding the need to postpone caries treatment after teeth whitening.

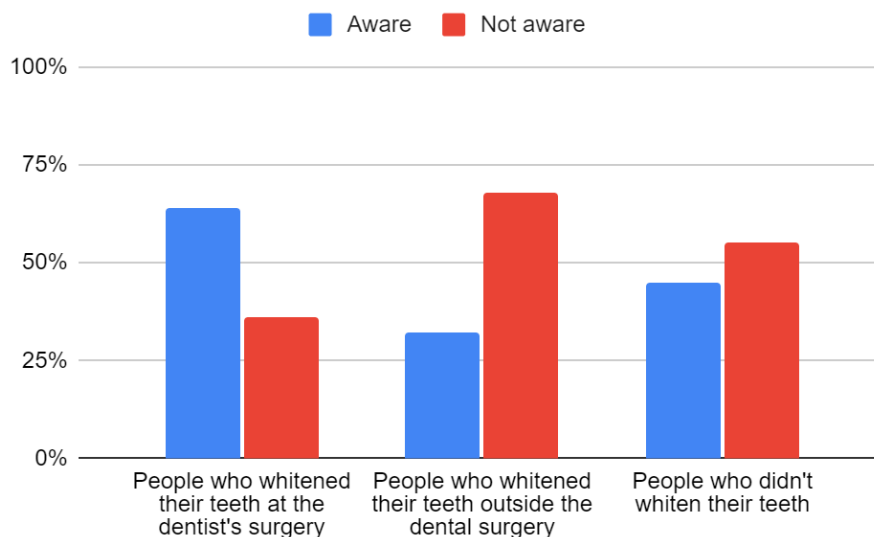


Figure 8. Awareness of the Polish population regarding the possibility of yellow discoloration on composite fillings after tooth whitening.

When asked about their awareness of the possibility of problems with the temporomandibular joint after whitening with the overlay method, 35% of those who whitened their teeth in the office answered affirmatively. Only 16% of those who did not whiten their teeth were aware of the likelihood of this complication. The lowest awareness was demonstrated by those using whitening outside the dental office (5%) [Figure 9].

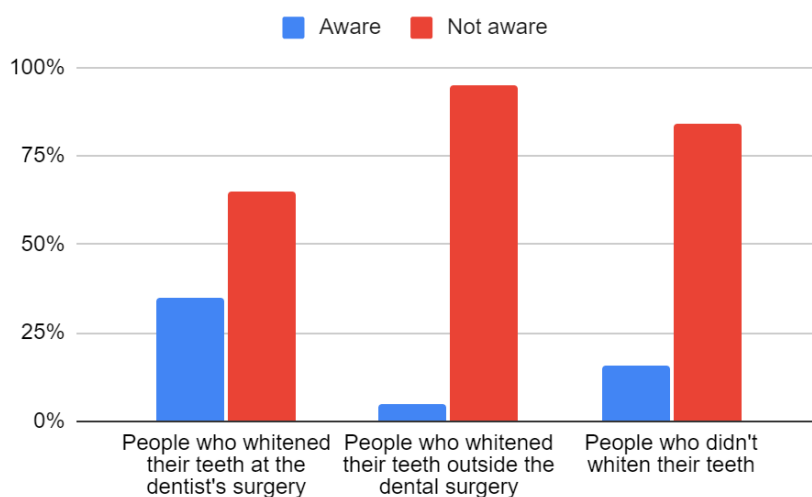


Figure 9. Awareness of Polish society regarding the possibility of temporomandibular joint problems after tray teeth whitening.

Among the group of people who had teeth whitening done in the dentist's office, 81% were aware that compulsive smoking is a contraindication for tooth whitening. Less awareness was shown by 59% of respondents who used this service outside the dental surgery. 64% of respondents who did not undergo tooth whitening are aware of the possibility of this complication.

The young age of the patient (under 16 years) is a contraindication that 70% of respondents who whiten their teeth at the dentist's office have heard of. Non-bleachers ranked second in terms of awareness (61%). Among those whitening their teeth outside the dental office, 43% have knowledge in this area [Figure 10-11].

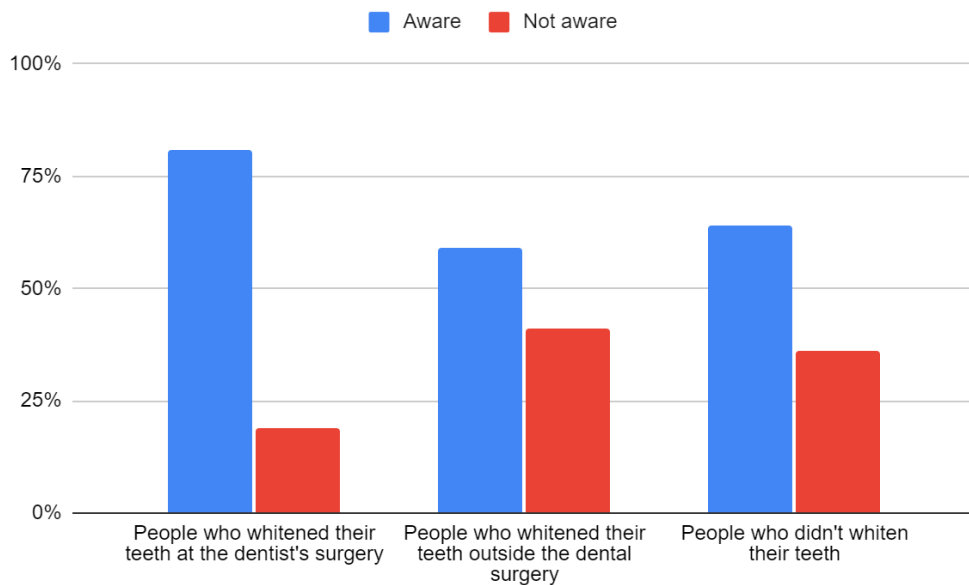


Figure 10. Awareness of Polish society about compulsive smoking as a contraindication for teeth whitening.

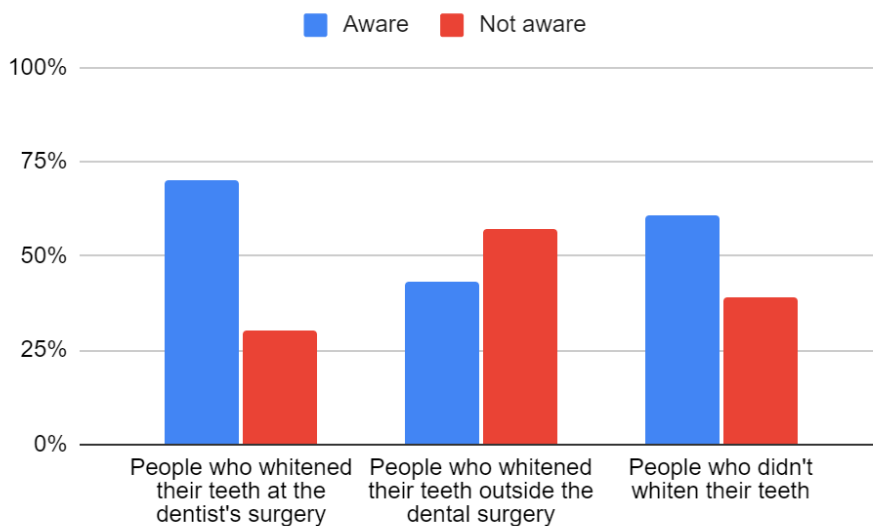


Figure 11. Polish society's awareness of the patient's young age (under 16) as a contraindication for teeth whitening.

The awareness of pregnancy and breastfeeding as a contraindication to tooth whitening in the respective study groups was as follows: 78% for those whitening their teeth at the dentist's office, 61% for those not using professional whitening, and 62% for those not having this procedure done before [Figure 12].

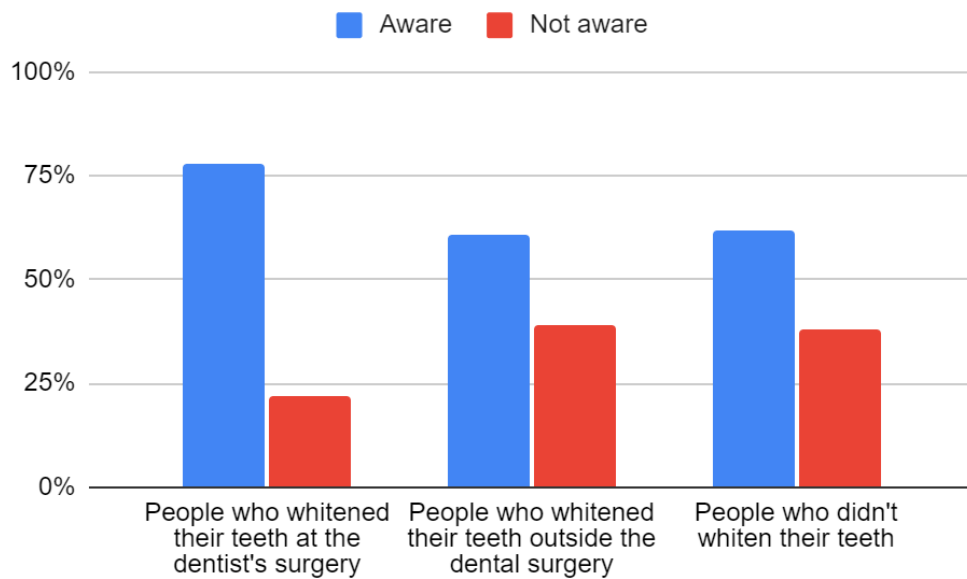


Figure 12. Polish society's awareness of pregnancy and breastfeeding as a contraindication to teeth whitening.

In the group of respondents whitening their teeth at the dentist's office, gum and periodontal diseases are a known contraindication to tooth whitening among 81% of the respondents. 75% of those who have not had their teeth whitened are aware of the aforementioned contraindication. People whitening their teeth without the supervision of a dentist gave the least affirmative answers. (57%) [Figure 13].

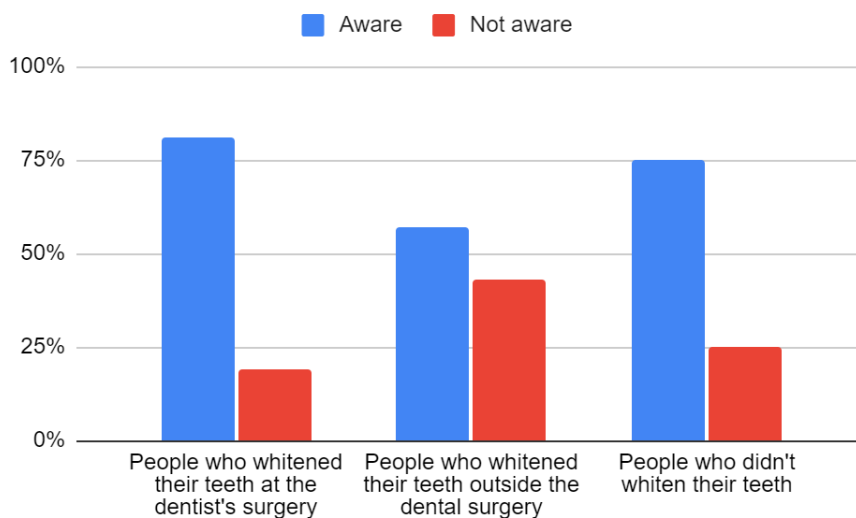


Figure 13. Awareness of the Polish population regarding gingival and periodontal diseases as a contraindication to teeth whitening.

Severe hypersensitivity is also a contraindication for tooth whitening. This answer was given by as many as 84% of respondents whitening their teeth professionally. Respondents who decided to have their teeth whitened outside the dentist's surgery were aware of this at 74%. In the next research group (non-whiteners) 77% of respondents agreed with the above statement. Awareness of temporomandibular joint disorder as a contraindication to teeth whitening is shown by 34% among those who whiten their teeth in a dental office, 23% of respondents who whiten their teeth outside a dental office and 26% of respondents who do not whiten their teeth [Figure 14-15].

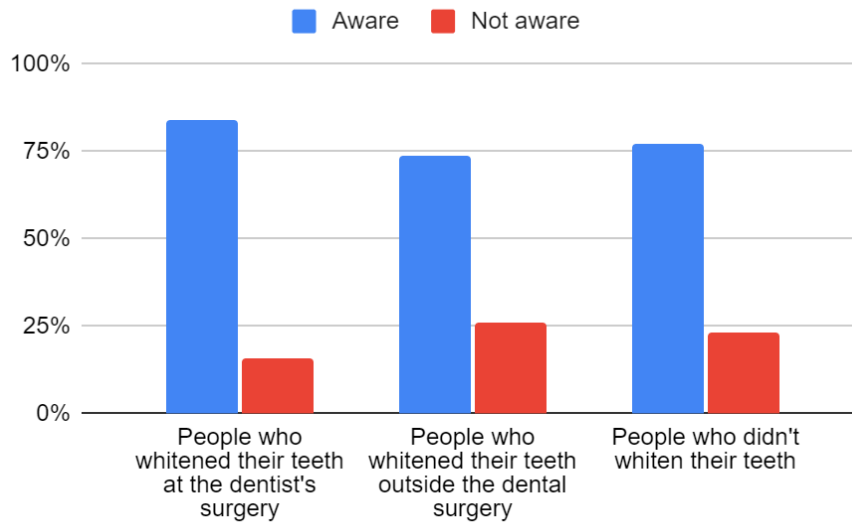


Figure 14. Polish society's awareness of severe tooth hypersensitivity as a contraindication for teeth whitening.

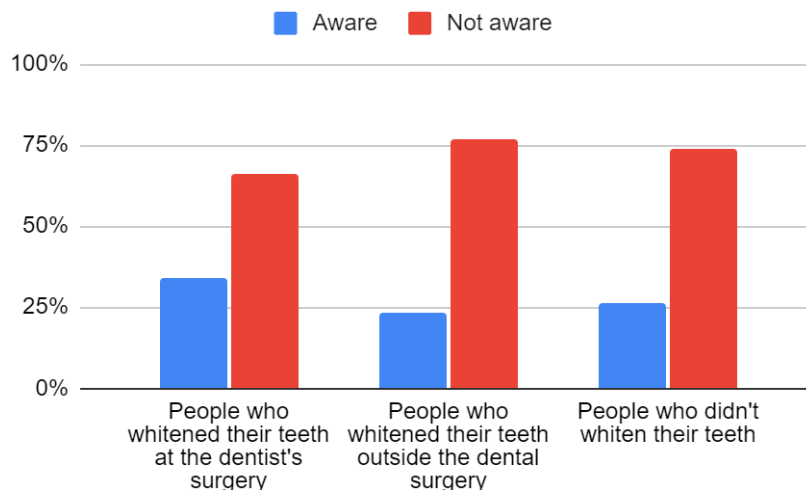


Figure 15. Polish society's awareness of temporomandibular joint disorders as a contraindication to teeth whitening.

Discussion:

Increased patient interest in teeth whitening is associated with the image of a broad, white smile promoted by the media. White teeth are supposed to determine success and attractiveness [11]. It has been shown that 35% of women and 41% of men consider dazzlingly white, healthy teeth as the most important feature for an attractive facial appearance [12]. People who decide to change the colour of their teeth want to achieve the most striking results possible. Before the whitening procedure a professional teeth cleaning should be performed, as the whitening agent is not able to penetrate the plaque and tartar present on the teeth [9]. This includes the selection of an appropriate and beneficial home hygiene programme, mechanical tooth cleaning, supragingival scaling, polishing of the crowns and cervical margins of the teeth and the application of preparations containing fluoride [13]. Professional teeth cleaning alone may significantly improve the appearance of the teeth and prove so satisfactory that the patient decides to forgo whitening [14]. This recommendation is unfortunately sometimes overlooked during home-bleaching methods, as evidenced by the study. Only 47% of people who decided to have whitening done outside the dental surgery were aware of the necessity to prepare the oral cavity before the procedure [Figure 1].

The contemporary canon of beauty presents a perfect, snow-white smile [11,12]. More and more minors decide to have their teeth whitened in order to aspire to their dream appearance. According to a study conducted in 2004, 32% of children from a group of 2495 were dissatisfied with the colour of their teeth, 19% of parents were dissatisfied with the colour of their child's teeth, and only 9% of dentists believed that the subjects had an unsatisfactory tooth colour [15]. It should not be forgotten that the young age of the patient, below 16 years of age, is a contraindication for the teeth whitening procedure [6]. Preparations for whitening outside the dental surgery are readily available. There is a wide range of whitening strips, pastes or even whitening gels available on the market and teeth whitening with their help is becoming more and more popular [9]. Unfortunately, the popularity and universality is also related to the lack of age control of the purchasers. Persons under the age of 16 can easily purchase whitening products and try to whiten their teeth themselves. It should be noted that the American Academy of Pediatric Dentistry advises against cosmetic whitening for patients with deciduous and mixed dentition [16]. Another point worth mentioning is that still relatively few people are aware of the existence of the mentioned contraindication, as shown by the results of this study. In the questionnaire conducted, only 43% of persons whitening their teeth outside the dental surgery are aware of this issue [Figure 11].

Apart from the undoubted improvement of the enamel colour and general aesthetics of the patient, teeth whitening also has its drawbacks and procedures which condition the correct course of the process. More than 60% of the respondents were aware of the necessity to treat all carious cavities before bleaching. However, more than half of the respondents whitening their teeth outside the dental surgery were not aware of this fact [Figure 6]. The bleaching of teeth with carious defects is associated with a higher risk of the bleaching agent entering the tooth through open tubules, which may result in pulp damage or even pulpitis [17].

In addition, surfaces treated with bleaching agent are more susceptible to bacterial colonisation [18], which may result in more rapid caries development and more severe dental complications. And although a 2011 study shows no statistical effect of whitening on caries [19], it is comforting to know that almost 80% of respondents who have not whitened their teeth are aware of the fact that they need to treat their teeth before doing so [Figure 6].

A person undergoing a whitening procedure should be aware that current fillings in the teeth will not change colour and become lighter [9]. Carbamide peroxide and hydrogen peroxide have been shown to affect the physical conditions of dental restorations, for example, surface roughness, hardness and colour. A 2018 study by M. Al-Maklafi confirmed the effect of urea peroxide on composite colour and the need to replace them after the whitening process [20]. In addition, discolouration in the form of yellow spots may appear on fillings present in the oral cavity [6]. As studies have shown - the awareness of the possibility of this complication is at a fairly average level [Figure 8].

The patient should wait at least 2 weeks after the completion of the whitening process before replacing the old composite filling [21]. This has to do with the disrupted bond between enamel and resin, which is the result of inhibition of resin polymerisation by peroxide or oxygen radicals. Although the reduction in bond strength is reversible, tooth filling with composite materials must be postponed. Furthermore, this period is also needed to stabilise the tooth colour obtained in the whitening process [11, 22]. Surprisingly, only more than half of those who whiten their teeth at the dentist are aware of this fact. Even more shocking is the fact that 80% of people whitening their teeth outside the office are unaware of this fact [Figure 7].

Teeth whitening with hydrogen peroxide is not indifferent to body tissues. This substance is a strong oxidant, causing degradation of the extracellular matrix and oxidation of chromophores present in dentin. Moreover, in high concentrations it is carcinogenic [23]. During the teeth whitening procedure, despite precautions taken by the dentist such as protecting the gums with a liquid cofferdam, the whitening agent may penetrate the gingival surface and the oral mucosa, resulting in irritation of these tissues [24]. According to studies, this risk increases when using home whitening strips without professional supervision [25]. Unfortunately, the survey shows that it was those who chose to whiten outside the office who showed the least awareness of this complication [Figure 4]. The use of clearer and more visible labeling of the negative effect of bleaching agents on soft tissues by manufacturers could contribute to an increased awareness of this issue among Polish society.

Enamel is a tissue, which changes its properties during the whitening process. Many studies indicate the probable damage to its structure during tooth bleaching - among other things, its porosity increases and microhardness decreases [9]. This is related to the dissolution of calcium compounds in the enamel and the penetration of harmful acids deep into the hard tissues of the tooth. Analysis using scanning electron microscopy has shown that 35% carbamide peroxide causes typical chemical damage to enamel [18]. The severity of these changes depends on the time of contact between the tooth and hydrogen peroxide, its concentration and the pH of the preparation used. [26, 27, 28]. The majority of respondents (72%) of both tooth whiteners and non-whiteners are aware of the possibility of weakening the hard tissue structure of the tooth [Figure 3].

This result is undoubtedly positive, as a patient aware of this complication is more likely to use remineralizing preparations such as CPP-ACP during or after tooth whitening. Preparations containing casein phosphopeptides-amorphous calcium phosphate applied after or during bleaching neutralise the negative effects of bleaching without affecting the tooth colour achieved [29, 30].

The most controversial questions concerned the awareness of possible disorders of the temporomandibular joint after tray whitening, and the fact that disorders and problems associated with it are a contraindication for tooth whitening [Figure 9,15]. Prolonged whitening with improperly fitted trays to the patient's individual occlusal conditions, or raising of the occlusion by these trays, can cause pain and audible crackling and skipping associated with the temporomandibular joint [9]. This subject has been addressed more than once, among others by Van B. Haywood, who demonstrated a correlation between the presence of a tray and occlusal contacts only in the posterior teeth area - this is related to the lack of simultaneous contact between all teeth, which is essential for correct occlusion [31]. However, a study conducted in 2002 showed the absence of pain related to the temporomandibular joint in a group of respondents whitening their teeth with the tray method. [25] This contradictory information indicates the need for further research in this direction.

Conclusions:

Every person deciding to have their teeth whitened should be previously acquainted with possible complications after the procedure and contraindications to its performance. Unfortunately, as the study shows, Polish society is still not sufficiently knowledgeable in this regard. Popular buzzwords concerning whitening, such as the possibility of tooth hypersensitivity, weakening of the enamel after the procedure or the necessity to follow a "white diet" are known to a wider group of respondents. People who do not whiten their teeth repeatedly demonstrated greater awareness than those who whiten their teeth outside the dental surgery, even though they did not choose to have this procedure done. Respondents who chose unprofessional whitening largely lacked basic knowledge in this area. Issues directly related to the dentist's office and treatment fared the worst. More than half of the respondents (53% and 51% respectively) are not aware of the obligation to complete professional teeth cleaning and cure all carious lesions before treatment. The necessity to postpone the treatment of carious lesions and the possibility of yellow discolouration on composite fillings was mentioned by significantly less persons than in the other study groups (20% and 32% respectively).

Perhaps the problem is that teeth whitening preparations are also very easily available to people who do not have the appropriate knowledge, but only have the desire to have a whiter smile. Reducing the prevalence of these products by allowing them to be purchased only on prescription from a dentist would certainly result in greater public awareness. The specialist would have the opportunity to see the clinical case, choose the right whitening method and the right product and give instructions on its use. It should be emphasised that insufficient knowledge on the part of the patient may prove dangerous to his/her health and contribute to the occurrence of complications after the procedure.

Moreover, the survey conducted indicates the necessity to carry out more detailed analyses investigating the relation between the temporomandibular joint and teeth whitening.

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