

GRADUATION PROJECT
Degree in Dentistry

**Effects of whitening on tooth sensitivity and
possible treatments.**

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ABSTRACT:

Introduction: Through the years the image that we reflect is more and more important. Dental bleaching is a process in which a bleaching agent is used to break down external or internal agents that cause pathological color of the tooth. Most of the time two methods are used. One performed in the office by a dental surgeon or one realized by the patient at home. **Objectives:** The first objective was to assess the effects of tooth sensitivity resulting from tooth whitening at home or at dental office in insert population sample and age range, depending on a population of interest. The second objective was to analyse the different treatments and advances to treat the effects of tooth whitening. **Material and Methods:** A questionnaire was created using Google Forms and distributed to participants. Then a literature review was conducted in order to provide further background with twenty-one articles in English and five articles in French were gathered from PubMed and Google Scholar regarding the effects of whitening on tooth sensitivity and potential treatments. **Results:** A total of 102 participants were recruited for this study. We observed that 84,5% have experienced dental sensitivity after using tooth whitening products whereas 15,5 % did not. We saw that 33,3 % have noticed not effective at all the treatment whereas 33,3 % have noticed it effective and 1,3 % very effective. **Conclusions:** Teeth whitening performed in clinic produces more sensitivities than that done at home. The use of Ibuprofen or Paracetamol has not proven to be effective in reducing postoperative dentinal sensitivities in this research.

KEYWORDS: Dentistry; Tooth whitening; Sensibility; At home; At dental office.

RESUMEN :

Introducción: A lo largo de los años la imagen que reflejamos es cada vez más importante. El blanqueamiento dental es un proceso en el que se utiliza un agente blanqueador para descomponer los agentes externos o internos que causan el color patológico del diente. La mayoría de las veces se utilizan dos métodos. Uno realizado en el consultorio por un cirujano dentista o uno realizado por el paciente en casa.

Objetivos: El primer objetivo fue evaluar los efectos de la sensibilidad dental resultante del blanqueamiento dental en el hogar o en el consultorio dental en la muestra de población de inserción y el rango de edad, en función de una población de interés. El segundo objetivo fue analizar los diferentes tratamientos y avances para tratar los efectos del blanqueamiento dental. **Material y Método** Se creó un cuestionario utilizando Google Forms y se distribuyó a los participantes. A continuación, se realizó una revisión bibliográfica con el fin de proporcionar más antecedentes con veintiún artículos en inglés y cinco artículos en francés fueron recogidos de PubMed y Google Scholar en relación con los efectos del blanqueamiento en la sensibilidad dental y los posibles tratamientos. **Resultados:** Un total de 102 participantes fueron reclutados para este estudio. Observamos que el 84,5 % ha experimentado sensibilidad dental tras utilizar productos de blanqueamiento dental, mientras que el 15,5 % no. Vimos que el 33,3 % ha notado nada efectivo el tratamiento mientras que el 33,3 % lo ha notado efectivo y el 1,3 % muy efectivo. **Conclusiones:** El blanqueamiento dental realizado en clínica produce más sensibilizaciones que el realizado en casa. El uso de Ibuprofeno o Paracetamol no ha demostrado ser eficaz para reducir las sensibilidades dentinarias postoperatorias en esta investigación.

PALABRAS CLAVE : Odontología; Blanqueamiento dental; Sensibilidad; En casa; En la clínica dental.

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I/ Introduction:

Kirk describes dental bleaching is a process in which a bleaching agent is used in combination with the material that discolors the teeth. This reaction works to break down the discoloring material, resulting in the removal of its coloring (1).

The premises of lightening date back to antiquity. The Egyptians, 4000 years ago, used a paste to lighten their teeth by mixing a pumice stone powder with wine vinegar. On other hand, the Romans used urine to whiten their teeth, because of the lightening effect of ammonia in the urine. Then 3000 years ago people used chew sticks to scrape their teeth. The effects of peroxide were first discovered incidentally during the First World War. It was used as an antiseptic to treat periodontal diseases such as acute necrotizing ulcerative gingivitis (ANUG) and then by Klusmier in 1962 to reduce inflammation of the periodontium after orthodontic treatment. This finally led to the revelation of the whitening power of peroxide and its use in tooth whitening (2) .

At the beginning of the 20th century, in 1918, Abbot demonstrated the effectiveness of hydrogen peroxide on dental stains, activated by a light source. Dental bleaching is performed at the chairside with high concentrations of hydrogen peroxide, up to 30%, used over a short period of time (about one hour). Finally, in 1984, Torres updated the technique of hydrogen peroxide activated by light or heat and Goldstein did the same with the concentrations. During the same years Haywood and Heymann revolutionized thinning techniques by developing ambulatory bleaching. The lightening agent is now in contact with the teeth, via flexible polyvinyl trays thermoformed on the teeth's mold (3).

Through the years the image that we reflect is more and more important. Patients are aware of their appearance and are looking for a perfect smile. Since the 21st century,

dental aesthetics has evolved and scientists have developed new non-invasive treatments such as teeth whitening to achieve this new goal and replace invasive ones like veneers or crown (only aesthetics goal) (2).

I/ A: Natural color of the tooth:

The color of a tooth is defined by three factors: brightness, saturation and hue, as shown in Figure 1.

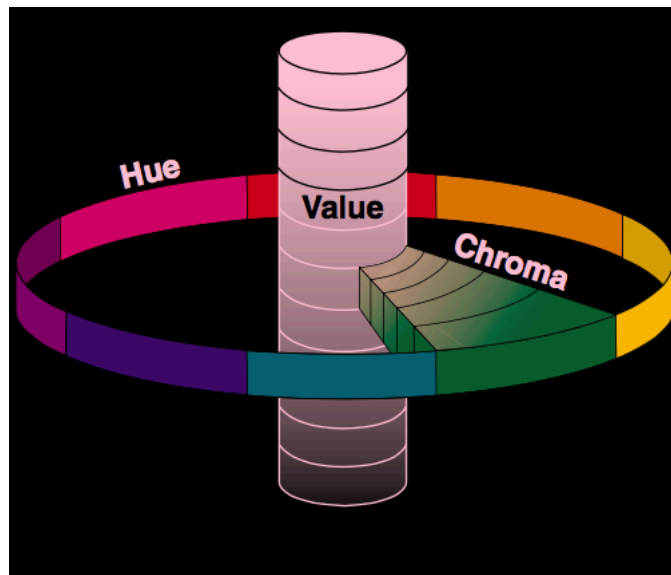


Figure 1. Illustration of the three- dimensional color theory according to Munsel (4).

- Brightness:

Brightness is also called luminous value, luminance, brightness, or clarity. It corresponds to the amount of light reflected by the tooth and allows to distinguish a light color from a dark color. Thus, white has a maximum brightness and black a zero brightness. In this interval, depending on the amount of light, the object appears more or less gray.

Its determination involves the rods that constitute about 95% of these cells and are only sensitive to the difference between dark and light, they do not perceive the colors but the white, black and shades of gray. This is why brightness is the primary factor it is the first variable that we see. (5)

- Saturation:

This variable represents the degree of intensity or concentration of a color. The saturation is the quantity of pure pigment contained in a color.

A color can be desaturated in two ways:

- by adding white, it lightens the color,
- by adding black, it darkens the color.

Saturation is the second factor to consider when determining color.

- The hue:

It is also called chromatic tone. It is related to the dominant wavelength of light reflected by the object. It is the least important factor (4).

Other optical properties can be added to specify the color of the tooth.

- Translucency:

It is the capacity of the material to let the light pass. It is 70% for enamel and 40% for dentin. The translucency varies according to the location and age of the individual.

The teeth of young subjects have a very translucent enamel and an opaque dentine. However, with age, the enamel wears and becomes thinner, the tooth becomes less translucent because the dentin becomes more visible.

- Opalescence:

Opalescence is an optical effect allowing the tooth to present different colors depending on the position in which it is viewed.

- Fluorescence:

Fluorescence is the capacity of the tooth to absorb a non-visible ultraviolet radiation and to restore it quickly in the form of visible light in a spectral band of short wavelength and bluish color.

In natural teeth, dentin is responsible for this bluish-white appearance. This property fades with age due to the hypermineralization of dentin (6).

- Surface texture:

The surface state influences the way in which the light ray is reflected and thus influences the perception of the color.

A young tooth has a rough surface (important micro-geography with pits, horizontal striations...), the reflection of the light is then done in several directions whereas an old tooth has a smooth surface, thus the reflected ray is single (6).

I/ B: Structure of the tooth:

- The dental enamel:

Enamel is the hardest and most mineralized tissue in the human body. In fact, it is composed 96% mineral matter, the rest being composed of water and organic matter. Its mineral part is mainly composed of calcium hydroxyapatite crystals organized in a complex way in the form of prisms and interprismatic substance.

Enamel is an inert, non-innervated, translucent tissue. Radiologically, it is the opaquest dental tissues. Its optical properties depend on several factors such as its composition, its thickness, its translucency, its opalescence and its surface condition. With age, these parameters will change with age.

The color of enamel ranges from yellow to light gray. Because of its translucency, the color of the dentin under the enamel strongly affects the appearance of the tooth. Indeed, the more mineralized the enamel is, the more transparent it is and the more the color of the underlying dentin is visible.

This is the case for older people. Conversely, on deciduous teeth, the enamel being less mineralized and thicker, the tooth appears lighter (7).

- The dentin:

Dentin, yellowish in color, is the dental tissue that has the largest volume. It is covered by the enamel at the coronal level and by the cementum at the root level. Dentin is less solid than enamel: it is mineralized at 70% by hydroxyapatite crystals, it is also composed of 20% organic matter and 10% water. The organic part is mainly composed of proteins that will play a major role in the pulp healing process. Its X-ray opacity is lower than that of enamel.

Being less mineralized than enamel, this gives it a more important opacity and makes it responsible for the color of the tooth. The dentin tissue evolves, the composition and the structure of the different layers of the dentin modify their optical behavior. In fact, three types of dentin can be distinguished and are the expression of the evolution of the tooth during the life:

- Primary dentin: It represents in mass the major part of the dentin, it is formed by the primary odontoblasts during the development of the tooth and until the complete edification of the root. It presents a more important organic component and a lesser mineral phase, it appears opaquer.

- Secondary dentin: It is elaborated in a second time also by the primary odontoblasts. The formation process will continue, but will slow down throughout life.

This dentin is considered to be responsible for the progressive reduction of the canal lumen, called "calcification". It is more mineralized than the first one and its translucency is greater.

- Tertiary dentin: It is a repairing dentin produced in response to the carious aggressions or traumas. It is more saturated than the other two types of dentin and remains localized at the affected site. Its quantity is proportional to the quantity of primary dentin destroyed, with the aim of protecting the underlying pulp (8).

- The pulp:

The pulp is a non-mineralized, innervated and vascularized connective tissue. At the coronal level forms the pulp chamber and is called the coronal pulp, and at the root level it extends from the neck to the apices and is called root pulp.

The pulp has a dark red color. In the young subject, the pulp volume being more important, it can give a pinkish color to the tooth. With age, its volume decreases and the pulp chamber becomes mineralized.

The crown of a tooth consists of three layers with different optical properties:

- enamel which forms the outer layer.
- the dentin which forms the intermediate layer.
- the pulp in its innermost part.

The color of the tooth depends on the thickness and structure of these three tissues (8).

I/ C: Pathological color of the tooth/ Tooth discolorations:

The reasons for tooth discoloration are either due to internal or external agents. Internal agents produce internal stains located on the inside of the tooth and occur during the formation of the tooth. These ones are harder to removed. The causes are antibiotics such as tetracycline (as shown in Figure 2) during the first semester of pregnancy or used in children less than 8 years, metabolic disease and high level of fluorosis (3, 8).



Figure 2. Tetracycline coloration class III (10).

Then, external agents produce external stains located on the outside of the tooth and are due to environmental factors such as coffee, tea, cigarettes, red wine, highly pigmented foods and juices or metals, as shown in Figure 3. The colored components

are called chromophores, they absorb light in the visible range and reflect mainly the complementary color that is recognized by the eyes, typically yellow or brownish (10)



Figure 3. Staining due to iron-containing drugs (11).

I/ D: Indications and contraindications in tooth whitening:

Tooth whitening is indicated for dyschromias due to aging, this is the ideal indication where the best results are obtained, genetic staining, post-traumatic staining, fluorosis and tetracycline staining classes I and II.

It can also be performed before and after a prosthetic restoration in order to harmonize the differences in coloration between natural teeth and prosthetic teeth. Finally, it can be performed at the end of an orthodontic treatment in order to improve the positive impact of the treatment (12).

But it is contraindicated in, minor patients, this is a legal contraindication, pregnant women or women who are breastfeeding, excessive dentinal sensitivity, allergies to one of the constituents of the lightening products, general pathologies such as

erythroblastosis fetalis, congenital porphyria, hemolytic jaundice, patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency, patients with unreasonable expectations, patients with joint dysfunction disorders, teeth with tissue alterations such as fractures, cracks and multiple caries leaky fillings and severe periodontal damage, extensive restorations on anterior teeth and during orthodontics treatment. Furthermore, there is no contraindication for smokers. After lightening, extrinsic dyes are redeposited more quickly but air polishing allows to eliminate them the thinned part. (1,12). Moreover, during bleaching, the smoker's habits do not affect the effectiveness of the whitening treatment (13).

I/ E: Composition and action of the tooth whitening:

Composition:

The most commonly used whitening agents are hydrogen peroxide and carbamide peroxide.

- Hydrogen peroxide:

It is also called dihydrogen dioxide with a formula H_2O_2 . It's simply mechanism is based on the weak bond in its molecule.

Two decomposition reactions of hydrogen peroxide are accepted and triggered by the action of light, heat or chemical activators.

The "photodissociation" reaction is promoted by an acid pH. A release of water and oxygen occurs. Native O_2 has a low oxidizing power: $2H_2O_2 \rightarrow 2H_2O + O_2$

The "anionic dissociation" reaction is promoted by a basic pH. HO_2^- ions with high oxidizing power are produced: $H_2O_2 \rightarrow HO_2^- + H^+$, as shown in Figure 4.

Thus, hydrogen peroxide whitening is faster in a basic system.

Passage through enamel and dentin is easy due to the low molecular weight of these decomposition products.

No matter which reaction is triggered, the hydrogen peroxide decomposed which lead to and oxidation of the chromophores and lighten the teeth (3, 11).

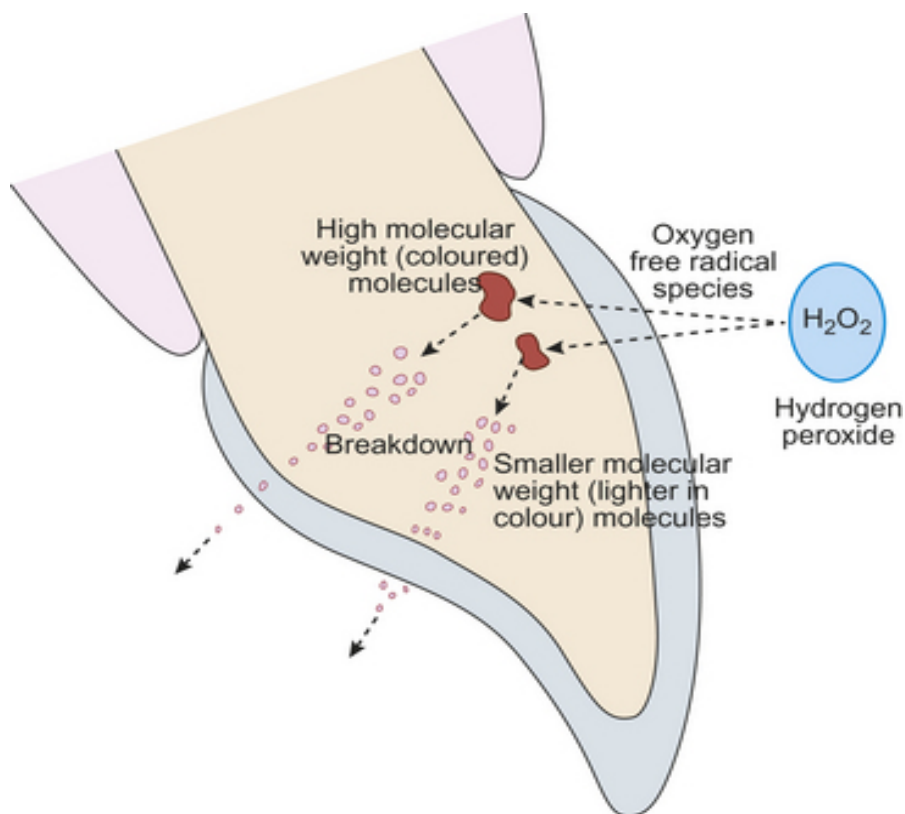


Figure 4. Diagram illustrating the free radical oxygen species entering the tooth, the chemical reaction therein and the products of the reaction leaving the tooth. (14)

- Carbamide peroxide:

It is now the most commonly used tooth whitening product on pulp teeth and initially used as a disinfectant. It is also called urea peroxide with the formula [CO(NH₂)₂ - H₂O₂] and composed of a hydrogen peroxide molecule coupled to a urea molecule.

When it contacts with saliva and oral temperature, it slowly transforms into 2/3 urea and 1/3 of hydrogen peroxide: CO(NH₂)₂- H₂O₂ → CO(NH₂)₂+ H₂O₂

The hydrogen peroxide released plays his role of discolors the chromophoric substances via a redox reaction.

The urea breaks down into carbon dioxide (CO₂) and ammonia, which raises the pH, facilitating the whitening process by increasing the release time of the hydrogen peroxide and allowing better penetration into the tooth surface, as shown in Figure 5. Thus, a 10% solution of carbamide peroxide is equivalent to about 3.5% hydrogen peroxide and contains about 6.5% urea. Moreover, the use of carbamide peroxide can be toxic when used in too high a concentration.

Apart from the active agent to improve the condition, the bleach contains glycerine as a carrier, carbopol as a thickening agent, and finally, a number of flavouring agents.
(2).

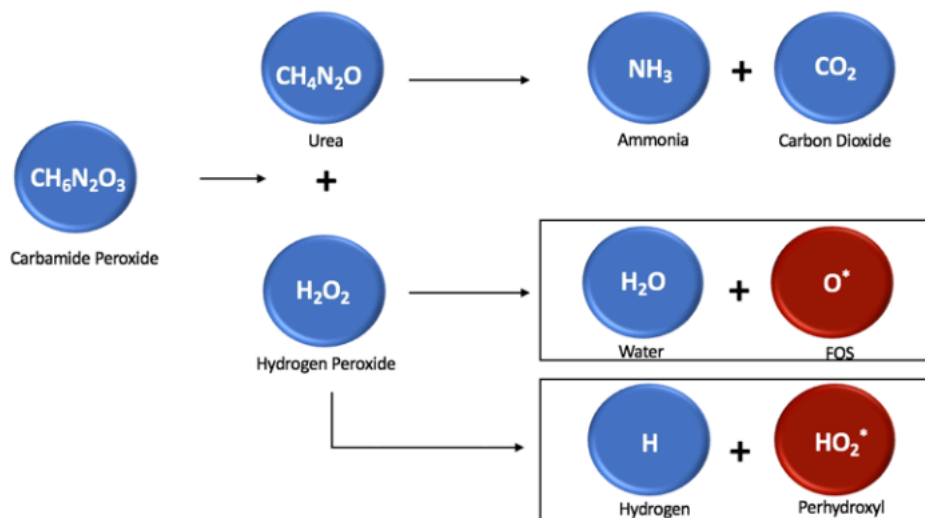


Figure 5. Illustrates the process of decomposing CP into hydrogen peroxide and urea. Hydrogen peroxide subsequently breaks down into water and free oxygen species (FOS), which actively degrade chromogens. When the pH level is above 7, there is a higher likelihood of HP breaking down into hydrogen and perhydroxyl, resulting in superior whitening outcomes compared to FOS (2).

- Action of the tooth whitening:

So, the purpose of tooth whitening is to brighten tooth by destroying the chromophores.

It is the result of a redox reaction between an active principle (hydrogen or carbamide peroxide) and the colored molecules.

The peroxide is kept in contact with the tooth for a long period of time, allowing the hydrogen peroxide to diffuse and penetrate through enamel and dentin. As it passes through, it oxidizes chromophores.

Hydrogen peroxide produces free radicals with unpaired electrons, such as HO₂ and O. These radicals are unstable, so they capture electrons from the double bonds of chromophores, causing their destruction and changing the color of the pigment. As chromophores group together and form complexes, teeth become less and less luminous. This means that the whitening process will take longer the more complexes are present. Consequently, younger teeth are easier to lighten since the chromophores haven't had a chance to regroup into large complexes, while older teeth are more difficult to whiten because they have had more time to do so.

It penetrates the enamel and disintegrates the chromophores. The oxygen molecules in the whitening agents react with these color-changing molecules in the teeth, breaking the bonds that hold them together making brighter and lighter smile (15).

I/ F: Techniques of bleaching:

Before starting any brightening treatment, some preoperative measures are necessary:

- Perform anamnesis, identifying the patient's request and expectations.
- Carry out a rigorous clinical examination to diagnose and treat cavities, re-evaluate existing fillings and identify possible caries reoccurrence and repair them.
- Evaluate hot and cold sensitivities, as lightening may increase them.
- Record tooth wear by identifying cracks, fissures, abrasions and significant erosions.
- Take radiographs to eliminate any apical problems and to evaluate the pulp cavities and to prevent pulpal responses.
- Perform a cleaning, polishing and air polishing to remove tartar and any staining.

There are several techniques to whiten teeth:

- At home
- At office
- Combined

- **At home:**

This technique was first described by Haywood and Heymann in 1989.

It is easy to implement and simple to use for the patient and the practitioner.

The in-home technique consists of keeping the lightening agent in contact with the teeth in a thermoformed flexible polyvinyl aligner made from a mold of the dental arches, as shown in Figure 6 and 7. For this technique, carbamide peroxide is most often used, at a concentration of 10% or 16%. Usually, the aligner should be worn during sleep for the whole night or at least two hours a day depending on the concentration. It is worn until the desired color is obtained, under the supervision of the dentist, with a treatment duration from two to six weeks, depending on the severity of the dyschromia. The effectiveness of the lightening products being identical whether it is a low or a high concentration, the use of the low concentrations is privileged because of the post-operative risks appearing lower, in the interest of the patient (16, 18).



Figure 6. Thermoformed flexible polyvinyl aligner on a mold (1).



Figure 7. Thermoformed flexible polyvinyl aligner after cutting following the contour of the tooth necks (1).

- **At office:**

In-office whitening involves the use of hydrogen peroxide, applied directly to the teeth, which allows for a visible change in color to be observed quickly and a complete control of the treatment by the dentist. In the past, higher concentrations of hydrogen peroxide (20-35%) or carbamide peroxide were used; however, current regulations state that bleaching products may not exceed 6% for hydrogen peroxide or 16% for carbamide peroxide. This has led to less effective results than before. Spacers and rubber dams are used to protect the soft tissue, and the duration of application is dependent on the appearance of sensitivity and the manufacturer's instructions. Generally, it is between 5 and 15 minutes, with 3-4 applications during the same session. After the session is complete, the isolation is removed, the teeth are rinsed, cleaned, and polished. Many in-office whitening products contain desensitizing agents to reduce sensitivity and remineralizing agents to remineralize dental tissue. Additionally, in-office lightening can be catalyzed by laser, compressive technique, and UV lamp use (19).

- **Combined:**

The combined or mixed technique corresponds to the combination of the two previous techniques. It allows the patient to benefit from the advantages of each of them. Thus, the patient begins with an in-office session with the application of more concentrated products and continues his treatment in-home with the wearing of his aligners with less concentrated agents (20).

I/ G: Secondary effects and new treatments:

- Secondary effects:

Besides of brighten tooth the major secondary effect is the hypersensitivity. Whitening products must penetrate deep into the enamel and open the dentinal tubules that lead to the dental nerve, thus creating sensitivity to cold and heat (17, 19, 21).

This hypersensitivity can be explained by two factors:

- Brannström's hydrodynamic theory.

In the 1960s, Brannström and his colleagues demonstrated that stimuli such as thermal, chemical and mechanical can cause rapid fluid movements within the dentinal tubules, resulting in a nerve response. This effect is further amplified by the dehydration of the glycerol found in bleaching products. This is why water is often included in the adjuvants used in bleaching products (22).

- The diffusion of peroxides to the pulp:

It is dependent on the concentration and duration of hydrogen peroxide application. Higher concentrations of the substance result in faster penetration and diffusion to the pulp chamber, which in turn leads to a reversible pulp inflammation accompanied by the release of nerve stimuli causing transient dental sensitivities.

- New treatments:

To reduce this intensity, desensitizing agents such as potassium nitrate, sodium fluoride (23), and ibuprofen can be used. Studies by Wang et al have shown that when

employed before, during, or after treatment, such agents reduce the intensity of sensitivities and decrease the number of patients reporting them. Additionally, these agents do not interfere with the long-term effectiveness of lightening, as fluorides reduce fluid movement through their mineralizing action. Potassium nitrate produces a sedative effect on the pulp due to its neutralizing properties, while ibuprofen acts as an anti-inflammatory to lessen the intensity of pain, though it has no influence on the frequency of dental sensitivity occurrence (24).

Then high- concentration carbamide peroxide greatly reduces the likelihood and intensity of tooth sensitivity, to the point where it is almost non-existent (18). Meanwhile, after 24 hours, there is no discernable difference between the various bleaching agents tested. The hydrogen peroxide agent was found to be particularly effective at reducing discoloration, while participants reported experiencing less sensitivity with carbamide peroxide. However, there was no significant difference in comfort level between the two techniques (25).

Finally, the direct use of the propolis extract, a natural substance produced by honeybees, reduces pain related to dentinal hypersensitivity after teeth bleaching (26).

II/ Objectives:

1. To assess the effects of tooth sensitivity resulting from tooth whitening at home or at dental office in insert population sample and age range, depending on a population of interest
2. To analyse the different treatments and advances to treat the effects of tooth whitening.

Hypothesis:

Teeth whitening performed in clinic produces more sensitivities than that done at home.

III/ Materials and Methods:

The present study has the approval of the Pre-Clinical Departement of the Faculty of Biomedical and HealthSciences under code CI.23.224, as well as the approval of the Research Ethics Committee of the EuropeanUniversity under code CI.23.224.

A questionnaire was created using Google Forms and distributed to participants. They were asked to answer questions about their experiences with tooth whitening procedure and post-treatment sensitivities and treatments. The collected data was analyzed and descriptive statistics were used to analyze the data

Description of the sample: General adult population, 5th year dental students.

Date of implementation: The survey was available from 9th of March to 11 of April

Description of data storage: Data were store in Google Forms

The collected data was analyzed and descriptive statistics were used to analyze the data.

Description of the questionnaire: Social networks, group chats.

Then a literature review was conducted in order to provide further background.

Twenty articles in English and five articles in French were gathered from PubMed and Google Scholar regarding the effects of whitening on tooth sensitivity and potential treatments.

IV/ Results:

Final number of participants: 102 people participated in the questionnaire.

Demographic description: As many men as women in the range of 22-25 y.o (39,2%)

Survey description: The method with the highest post treatment sensibilities observed was at-home tooth bleaching.

In the question 1, the percentage of male is 50% and female is 50%.

Indicate your sex.

102 réponses

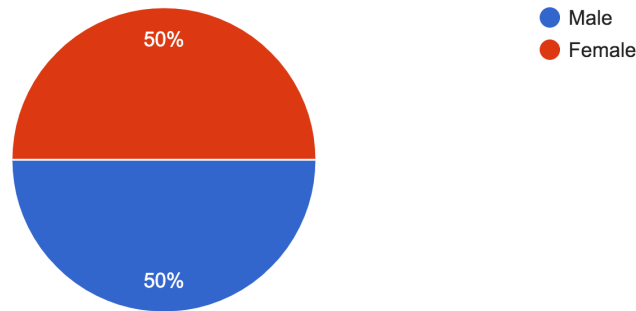


Figure 8. Pie chart of gender.

In the question 2, 39,2 % is between 22 and 25 y.o, 21,6 % is between 26 and 29 y.o, 22,5 % is between 30 and 33 y.o, 7,8 % is between 34 and 37 y.o and 8,8 % between 38 and 41 y.o.

Indicate your age.

102 réponses

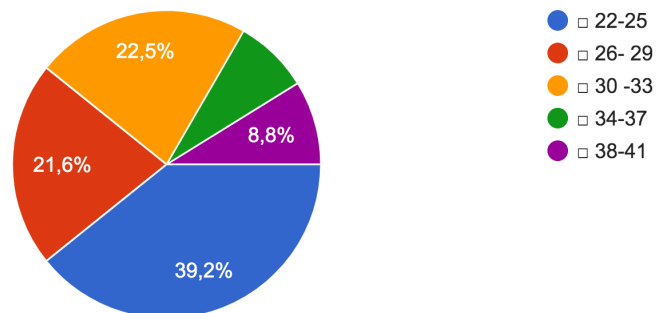


Figure 9. Pie chart of age.

In the question 3, 95% of the sample is French, 4% Italian, 2% English.

Indicate your nationality.

102 réponses

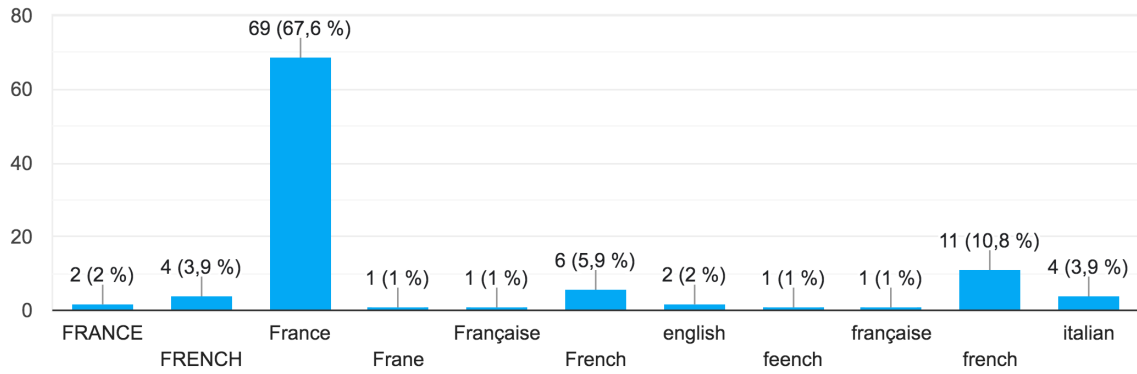


Figure 10. Bar chart of nationalities.

In the question 4, 31,4 % brush their teeth once a day ,64,7 % twice a day and 3,9 % over 3 times a day.

How many times do you brush your teeth a day?

102 réponses

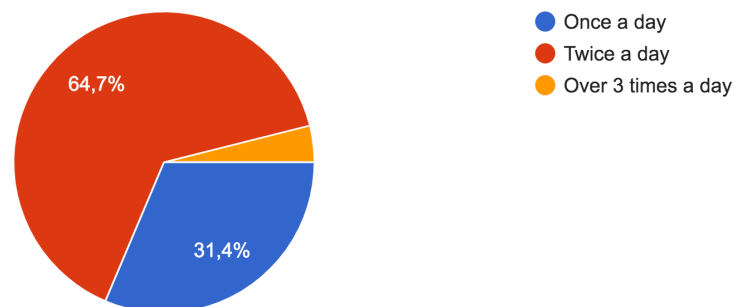


Figure 11. Frequency of tooth brushing.

In the question 5, 24,5 % go to the dentist every 6 months, 66,7 % once a year and 8,8 % once in 2 years or more.

How often do you go to the dentist?

102 réponses

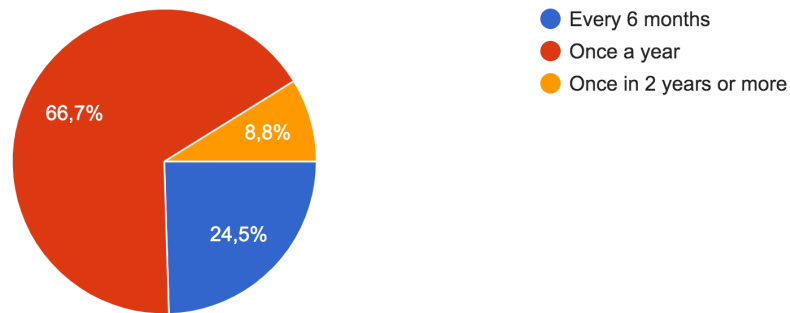


Figure 12. Frequency of dental visits.

In the question 6, 28,4 % has their last dental cleaning within the last 6 months, 54,9 % last year, 13,7 % 2 years ago or more and 2,9 % can't remember.

When was your last dental cleaning?

102 réponses

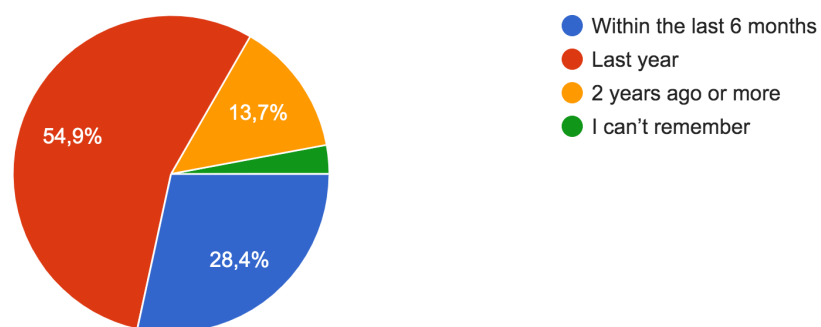


Figure 13. Frequency of on last dental cleaning.

In the question 7 with 1 being never a week and 5 being several times a day, 56,4 % drink alcohol never a week, 28,7 % have responded 2, 9,9 % have responded 3, 4 % have responded 4 and 1 % drink alcohol several times a day.

How often during the week do you usually drink alcohol, with 1 being "never a week" and 5 being "several times a day"?

101 réponses

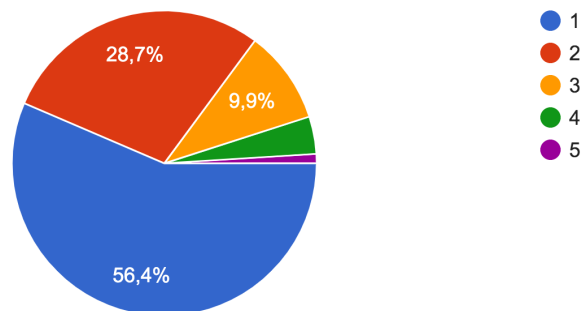


Figure 14. Frequency of alcohol intake.

In the question 8 with 1 being never a week and 5 being several times a day, 65,3 % don't smoke, 17,8 % have responded 2, 10,9 % have responded 3, 2 % have responded 4 and 4 % smoke several times a day.

How often during the week do you usually smoke cigarettes, with 1 being "never a week" and 5 being "several times a day"?

101 réponses

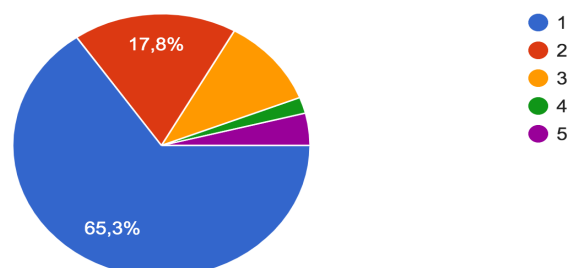


Figure 15. Frequency of cigarettes intake.

In the question 9 with 1 being never a week and 5 being several times a day, 48,5 % don't drink coffee, 20,8 % have responded 2, 17,8 % have responded 3, 7,9 % have responded 4 and 5 % drink coffee several times a day.

How often during the week do you usually drink coffee, with 1 being "never a week" and 5 being "several times a day"?

101 réponses

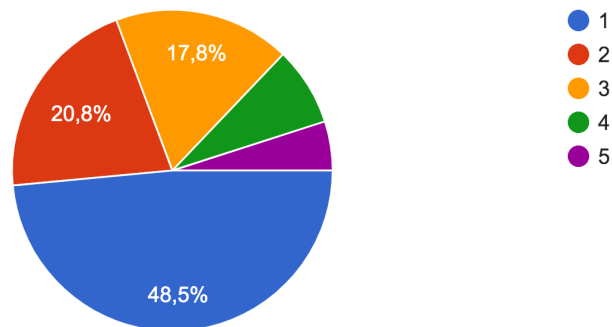


Figure 16. Frequency of coffee intake.

In the question 10, 13,7 % never had tooth had tooth whitening, 77,5 % once and 8,8 % several times (more than 3).

Have you ever had a tooth whitening treatment?

102 réponses

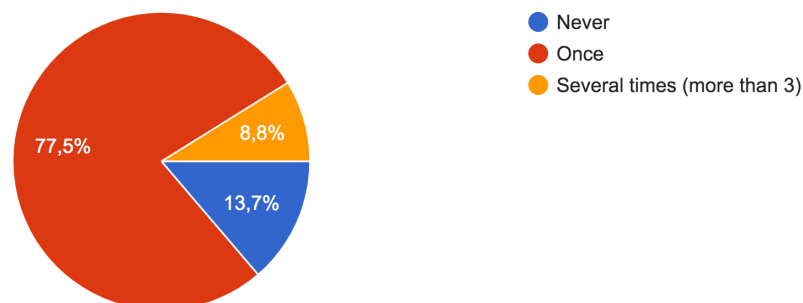


Figure 17. Frequency of tooth whitening treatment.

In the question 11, 80,4 % have done tooth whitening in a dental office, 29,9 % at home and 6,2 % with products.

If last question was affirmative, what kind of whitening did you have? (You can select more than one option):

97 réponses

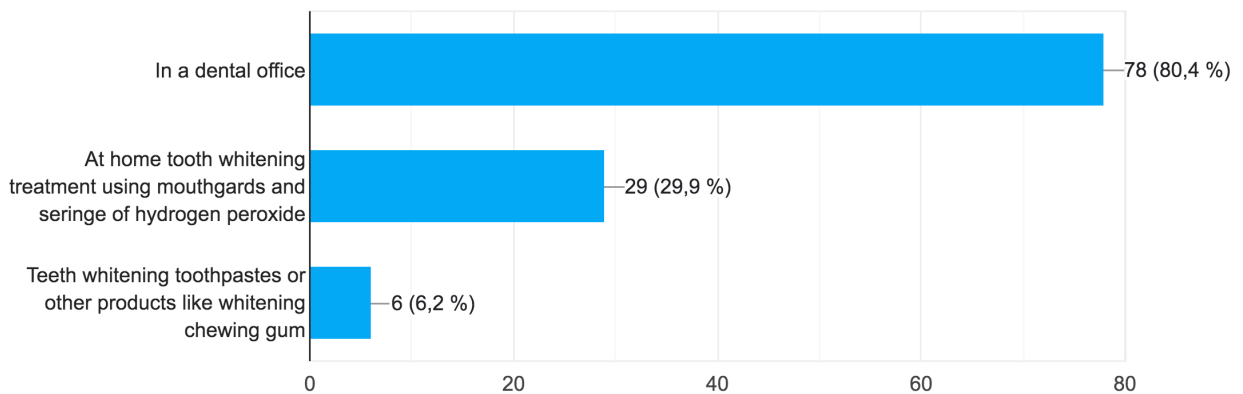


Figure 18. Frequency of all different bleaching methods.

In the question 12, 71,1 % have done tooth whitening because they wanted a white smile, 22,7 % because they were influence by a trend on social media and 6,2 % because their dentist recommended it.

Why have you done tooth bleaching?

97 réponses

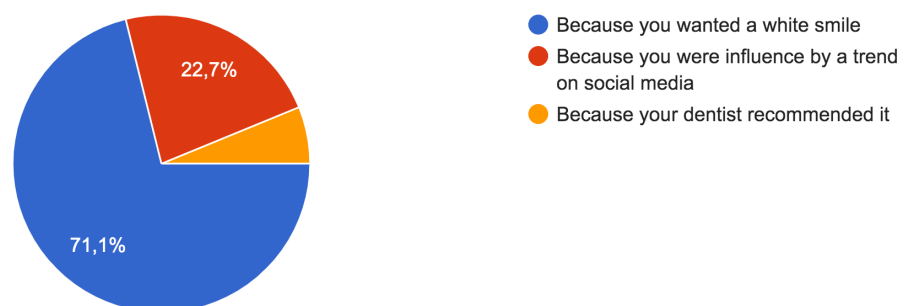


Figure 19. Reasons of tooth bleaching.

In the question 13, 84,5% have experienced dental sensitivity after using tooth whitening products whereas 15,5 % did not.

Have you ever experienced dental sensitivity after using tooth whitening products?

97 réponses

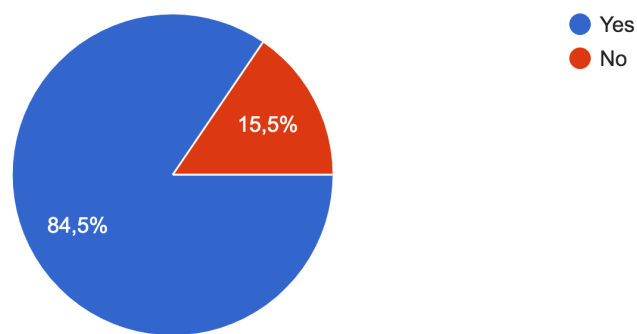


Figure 20. Frequency of tooth sensibilities after tooth whitening products.

In the question 14 with 1 being the side effects did not affect me at all and 10 being the side effects affect my day-to-day life, 19,6 % have responded 1, 15,5 % have responded 2, 34 % have responded 3, 24,7 % have responded 4 and 6,2 % have responded 5.

On a scale from 1 to 5, with 1 being “the side effects did not affect me at all” and 10 being “the side effects affect my day-to-day life”, how would you rate sensitivity since having teeth whitening treatments?

97 réponses

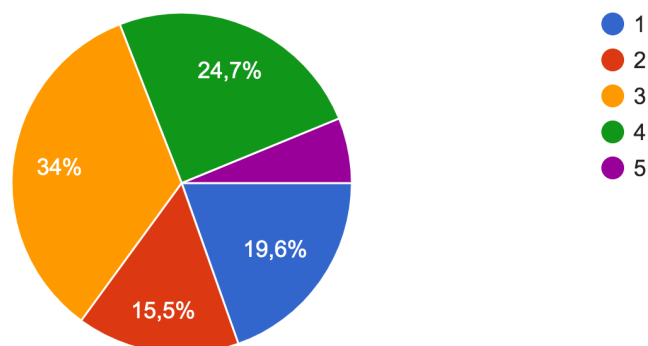


Figure 21. Pie chart on the severity of sensitivities

In the question 15, 89,7 % were aware that tooth bleaching can cause sensitivity before doing the treatment whereas 10,3% were not.

Were you aware that tooth bleaching can cause sensitivity before doing the treatment?

97 réponses

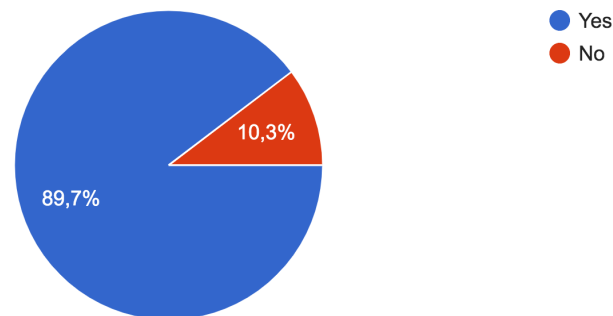


Figure 22. Frequency of awareness of secondary effect before doing the treatment

In the question 16 both type of tooth whitening has been performed, 11,7 % have experienced more sensitivity with tooth whitening at home whereas 88,3 % at dental clinic.

If you have tried a bleaching treatment both in a dental office and at home, when did you experience more dental sensitivity?

77 réponses

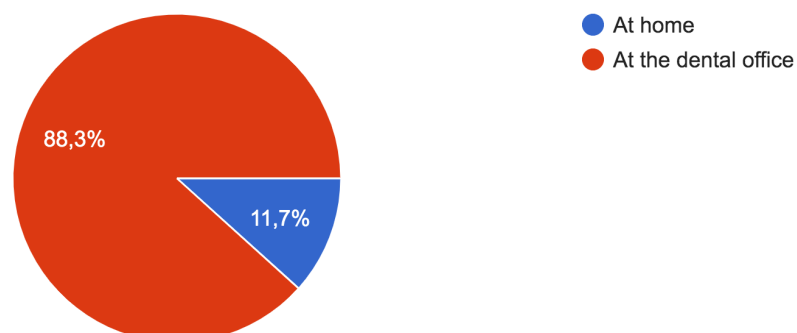


Figure 23. Comparison of sensibilities between at home and at the dental office.

In the question 16, 82,9 % recommend tooth whitening at dental office whereas 17,1% at home.

If you have tried a bleaching treatment both in a dental office and at home, which one will you recommend?

76 réponses

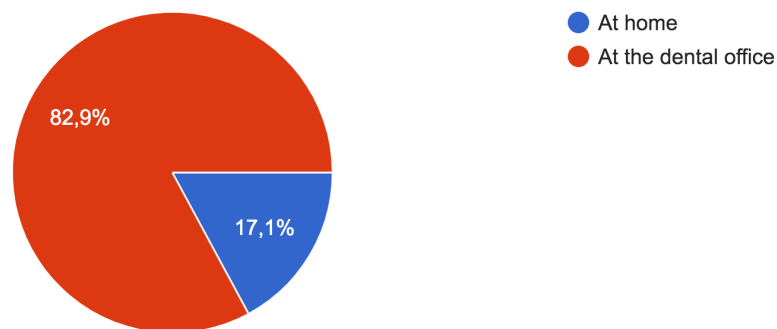


Figure 24. Recommendation between at home and at the dental office.

In the question 17, 46,8 % have not used treatment to reduce side effect whereas 53,2 % have used.

If you noticed side effects, did you used any treatment to reduce them?

94 réponses

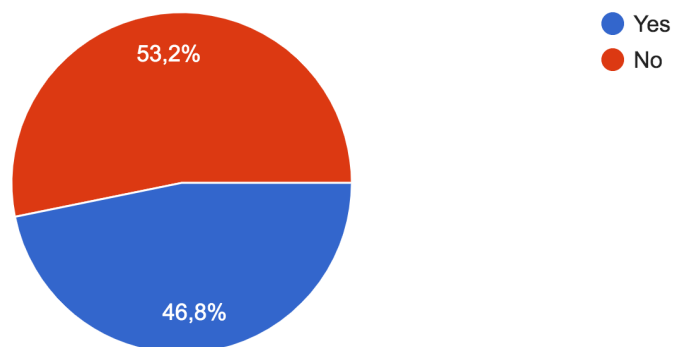


Figure 25. Use of treatments.

In the question 18, 33,3 % have noticed not effective at all the treatment whereas 33,3 % have noticed it effective and 1,3 % very effective.

If you took any medication, how effective where those treatments?
78 réponses

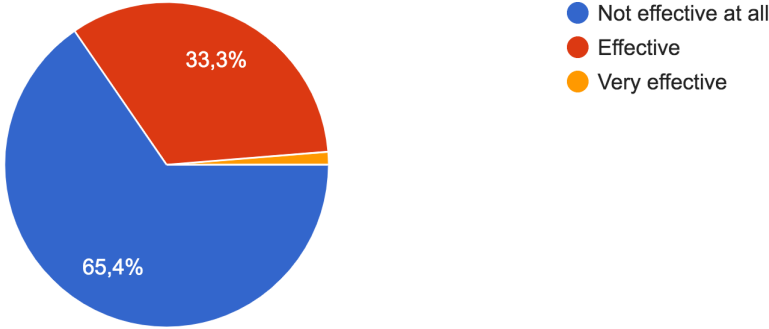


Figure 26. Effectiveness of treatments.

V/ Discussion:

Tooth whitening is performed by as many men as by women. The desire to achieve a whitening or the reflection of their image is as important for men as for women as shown in Figure 8. The majority of the test participants are between 22 and 25 years old and with French nationalities, Figure 9 and 10. This can be explained by the means of distribution of the survey. It was distributed on my social networks reaching a population of the same nationality and age as me as well as by chat groups of French people. A large majority of patients go to the dentist once a year and have a good oral hygiene respecting the advice of health professionals, Figure 11 and 12. But not most of them perform a dental cleaning every 6 months so the awareness by doctors in this way would be important, Figure 13.

Regarding the use of external substances such as alcohol, coffee and cigarettes that can lead to pathological tooth discoloration. We observe that although only a minority of the sample abuse these substances (Figure 14, 15 and 16), the number of people who have used tooth whitening at least once, represents more than 75% of the sample, Figure 17. Thus, we assume that the need felt by the patients to begin this treatment is not necessarily advised by their dentists but by the desire to have a white smile, which links us to the results of question 12. Indeed, the research reveals that the first motivation of patients to undertake this treatment is to have a white smile before their dentist even advises them or even be influenced by social networks, Figure 19.

In addition, the vast multitude of patients had used tooth whitening at least once and a less that 10 % more than once, Figure 17. The most used whitening method is the one done in the dental office by professionals followed by the home whitening method and finally a small part using whitening products like toothpaste or chewing gum, Figure

18. This becomes interesting when we see that a large majority answered positively to question 13 concerning post-treatment sensitivities, Figure 20. Thus, as we have just mentioned, the majority of the sample performed bleaching in the office and the majority observed post-treatment sensitivity. Therefore, a link between question 11 and 13 can be established; In the majority of cases, in-office bleaching leads to post-treatment sensitivity in patients.

Moreover, patients who have undergone both home and in-office bleaching, observe more sensitivity with the in-office technique, Figure 23. This is because the product used for teeth whitening in dental office is more concentrated than the one used at home and diffuses more quickly to the pulp. Which leads us to the result of the question 16; In patients who have undergone both home and in-office bleaching, 88% had more sensitivities with the in-office technique. Hence, it helps up us to confirm our hypothesis of the beginning: Teeth whitening performed in clinic produces more sensitivities than that done at home. To reduce post- treatment sensitivity practitioners can use of potassium nitrate or sodium fluoride before and during the treatment.

But it is appealing to see that even if the dental office whitening creates more sensitivities, the patients who have done both still advise the dental office whitening than the one at home, Figure 24. It can be explained by two reasons. First the immediate result after the dentist's bleaching, the patient is satisfied right away, while the tray bleaching needs more weeks. Secondly, bleaching in dental clinic appear to last more time than home bleaching.

Furthermore, this dental sensitivity affects the patients in a moderate and important way in 58% of the cases in their daily life, Figure 21. Even if almost 90% of the sample were aware that undertaking this treatment leads to dental sensitivities (Figure 22), still more than the majority of the participant realized it.

Finally, to combat and reduce this side effect, one half of the sample takes treatments to reduce sensitivities and the other half does not, Figure 25. They have proved to be not effective in reducing the pain associated with the treatment in the majority of the case and effective in 33%, Figure 26. In this way, as post- treatment advice, dentists can prescribe paracetamol and ibuprofen to patients.

VI/ Conclusion:

The smile is a key element of our psycho-social well-being and is the most dynamic expression of the beauty of a face. "White" teeth convey an image of youth, good health, self-confidence and therefore well-being.

Tooth whitening is a reliable medical treatment with recognized effectiveness that requires scientific and technical knowledge concerning treatment methods, control of undesirable effects and special precautions. The risks associated with external lightening techniques exist but are minimal when supervised by a dental surgeon. The risks are most frequently limited to transient gum irritation and dentinal sensitivity.

The technique relies on a chemical process that breaks down color-causing molecules, resulting in teeth lightening without invasive or harmful effects. Proper diagnosis of the discoloration is crucial to achieve optimal outcomes as the treatment has a wide range of applications.

Finally, taking into account the limitations of this systematised research, the conclusion was as follow:

Home bleaching with customized mouthgards and carbamide peroxide has been shown to be with less post-treatment sensitivities and less aggressive in patients than the one realized by dentists in the dental office.

The use of anti-inflammatory drugs such as Ibruprofen or painkillers such as Paracetamol has not proven to be effective in reducing postoperative dentinal sensitivities in this research.

In addition, the surface of the enamel may be altered, but the application of remineralizing products can restore the enamel structure.

However, a more directed research on substances such as propolis extract or special products such as potassium nitrate and sodium fluoride allowing to reduce post treatment dentinal sensitivities would be interesting to conduct.

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