Abstract
Utilization of tooth whitening products and services in the U.S. and globally is very strong and shows no signs of diminishing. The three primary methods of tooth whitening include in-office, take-home and over the counter whitening agents. The two major types of tooth discoloration are intrinsic and extrinsic. Extrinsic stains are easily removed during a prophylaxis. Extrinsic discoloration can become intrinsic by migrating to the interior of the tooth through pits, fissures and surface irregularities. Peroxide containing whitening agents enhance the appearance of teeth by addressing intrinsic stains. The most common side effect of whitening procedures is transient hypersensitivity. This course provides a review of tooth whitening services and agents.

Educational Objectives
At the conclusion of this educational activity participants will be able to:
1. Discuss the primary responsibilities of dental professionals.
2. Describe the available tooth whitening agents and their mechanism of action.
3. Discuss the potential benefits and side effects of tooth whitening agents.
4. Describe the different types of tooth staining.

Author Profile
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Utilization of tooth whitening products and services in the U.S. and globally is very strong and shows no signs of diminishing. The three primary methods of tooth whitening include in-office, take-home and over the counter whitening agents. The two major types of tooth discoloration are intrinsic and extrinsic. Extrinsic stains are easily removed during a prophylaxis. Extrinsic discoloration can become intrinsic by migrating to the interior of the tooth through pits, fissures and surface irregularities. Peroxide containing whitening agents enhance the appearance of teeth by addressing intrinsic stains. The most common side effect of whitening procedures is transient hypersensitivity. This course provides a review of tooth whitening services and agents.

Introduction
Esthetic dental services have developed over a relatively short period of time and the demand for these services is very high. Recent estimates indicate that Americans are spending over 2 billion dollars annually on the various types of tooth whitening products and services available. The terms whitening and bleaching are used interchangeably by both the dental profession and the lay public. It may be worthwhile to emphasize to patients that bleaching does not refer to the type of bleach used in the laundry. Whitening agents are not drugs and as such, are not regulated by the Food and Drug Administration. It should be appreciated that not all patients who desire whiter teeth are good candidates. Oral and systemic contraindications preclude some patients from these services. Patient expectations should also be addressed along with the potential side effects, most notably hypersensitivity. Esthetic procedures including tooth whitening must be considered within the context of the patient’s oral and general health, which are the primary responsibilities of dentists, dental hygienists and other dental professionals. Diagnosis and management of disease is the first and most important priority of dental clinicians. It would be inappropriate to provide tooth whitening services or any other cosmetic dental procedure to a patient with periodontal disease, caries or mucosal lesions, among many others.

The ADA Position Statement on Tooth Whitening
In April 2012 the ADA Council on Scientific Affairs adopted its; “Statement on the Safety and Effectiveness of Tooth Whitening Products”. The summary of the statement is as follows:

“The ADA recommends that if you choose to use a bleaching product, you should only do so after consultation with a dentist. This is especially important for patients with many fillings, crowns, and extremely dark stains. A thorough oral examination, performed by a licensed dentist, is essential to determine if bleaching is an appropriate course of treatment. The dentist and patient together can determine the most appropriate treatment. The dentist may then advise the patient and supervise the use of bleaching agents within the context of a comprehensive, appropriately sequenced treatment plan.”

Thorough Oral Exam and an Appropriately Sequenced Treatment Plan
The ADA recommends the provision of other esthetic dental services as well. Regarding porcelain veneers, the organization states; “There’s no reason to put up with gaps in your teeth, or with teeth that are stained, badly shaped or crooked. Today a veneer placed on top of your teeth can correct nature’s mistake or the results of an injury and help you have a beautiful smile.”

The most impactful aspect of the ADA’s whitening position statement is that use of bleaching agents are to be undertaken within the context of an appropriately sequenced treatment plan. Appropriate sequence clearly means prioritizing patient needs, with disease and function first, and esthetic procedures provided during or after disease management and restoration of proper function. The ADA also notes the need for a thorough oral examination by a licensed dentist to determine if tooth whitening treatment is appropriate for the patient. Providing veneers, porcelain crowns, tooth whitening etc. to a patient with uncontrolled periodontitis would be similar to a physician providing Botox® injections to a patient with uncontrolled hypertension, diabetes or atherosclerosis, among others. This is obviously the reason why the ADA cautions against the use of whitening services without consideration of the patient’s oral and overall health. Failure to examine, treatment plan and address the highest priority dental needs prior to providing cosmetic procedures would be ethically questionable. In certain circumstances necessary and elective procedures can be provided simultaneously, depending on the specific dental needs. If a patient has a limited number of small to moderate carious lesions and healthy gingiva, providing in-office whitening or impressions for take-home whitening can be provided when the carious lesions are treated. If a patient has xerostomia, the etiology should be determined and the condition should be addressed with an antioxidant gel or an enzymatic oral rinse, among others.

Periodontal disease is a category unto itself. Gum disease is a bacterial infection, with inflammation-driven damage to the hard and soft tissue which must be controlled prior to undertaking a cosmetic treatment plan of any kind. This may take an extended period of time. The overarching reason for addressing and controlling periodontal disease, high caries rate, xerostomia or any other oral pathology or condition prior to providing esthetic dental services is because the same problems will continue or recur after the desired cosmetic result is achieved.
It is completely ethical to provide tooth whitening or other cosmetic procedures when undertaken in a properly sequenced treatment plan. Contributory medical conditions such as diabetes, chronic infections, autoimmune disorders and chronic inflammatory conditions are addressed first. Referral to a dental specialist or physician may be necessary. The patient’s biofilm control regimen should also be thoroughly evaluated since the most common oral diseases and conditions are directly linked to the oral bacterial load. Recommendations for the appropriate biofilm control devices such as power toothbrushes, antimicrobial rinses and interdental cleaning devices should be provided not only to facilitate optimal oral and general health, but to protect the patient’s financial investment in their appearance.

Extrinsic Stains
The superficial or extrinsic coloration of an individual’s teeth is associated with stain that accumulates on the surface of the teeth from food and beverages, which can seep into the cracks, pits and flaws in the enamel. Seepage can also occur between the enamel rods in some cases. Some individuals seem to be more susceptible to extrinsic staining due to enamel surface morphology, salivary proteins, diet, tobacco usage and the efficacy of the home care. High levels of extrinsic staining are caused by polyphenolic compounds found in food and beverages such as red wine, darkly brewed tea, chocolate, coffee, grapes, pomegranate, spinach and plums, among others. Superficial stain accumulation occurs as a result of the attraction between the negatively charged salivary pellicle and the positively charged food/beverage molecules. (Figures 1, 2) Extrinsic stain is substantially removed by abrasives in toothpaste and prophylactic paste.

Figure 1. Staining from chlorhexidine rinse

Figure 2. Extrinsic stain

Intrinsic Stains
When extrinsic stains migrate below the surface they become intrinsic stains and can no longer be removed by mechanical means. Intrinsic molecules that cause discoloration are organic pigments incorporated into enamel during tooth formation. The visual effects of intrinsic tooth color are associated with the absorption and reflection of light by the enamel and dentin with the dentin playing the primary role in determining overall tooth color. The natural off-white hue of enamel is modified by the yellow/brown shades of dentin, together determining the normal color of an individual’s teeth. Discoloration can also be caused by trauma, tetracycline and a number of metabolic diseases and other systemic factors. Postnatal infections such as chicken pox, streptococcal infections and scarlet fever can result in tooth discoloration as well. With advancing age, an individual’s teeth commonly take on a generalized yellow or brown color. This occurs as a result of thinning of the enamel, thus revealing more of the darker underlying dentin. Additionally, over time, the dentin becomes darker from the formation of secondary dentin in response to restorations and normal physiologic processes.

Figure 3. Discoloration of central incisor from trauma

Figure 4. Discoloration from trauma
Enamel is semitranslucent and the underlying dentin color and other colored substances beneath the enamel affects the overall color of the teeth. Tooth color is caused by a variety of factors including the influence of genetics, drugs and medication taken by the mother while pregnant or the child during tooth development such as tetracycline. Environmental factors such as excess fluoride intake and maternal infections also influence tooth color. An individual’s genetic makeup is the primary determinant of tooth color. Some people’s teeth have a blue-gray base color, others more yellow-brown. When it comes to tooth whitening, yellow and brown base colored teeth whiten faster than blue-gray teeth.

The color molecules are comprised of groups of atoms that are held together by bonding forces. Some of these bonding forces themselves absorb and reflect light. The absorption of light makes the object, in this case the teeth, appear darker and light reflection gives the appearance of color. These absorbing and reflecting bonds are called chromophores and they are all around us. Everything we see, and the colors we observe are due to chromophores. Peroxide based whitening agents work by breaking the chromophore bonds, bringing out the natural whiteness of the teeth.

Mechanism of Action of Peroxide Tooth Whitening Agents
Intrinsic staining is removed by chemical means, primarily different forms of peroxide. Typically used whitening agents are hydrogen peroxide or carbamide peroxide-containing whitening gels, liquids, strips etc. Carbamide peroxide is broken down into hydrogen peroxide and urea upon dissolution in water or saliva. Peroxide based bleaching products diffuse into the tooth and react with the color molecules. The mechanism by which peroxide compounds lightens the color of the teeth involves the chemical composition of the intrinsic stain. Upon application of the bleaching gel, hydrogen peroxide ($H_2O_2$) breaks down into $H_2O$ and a free reactive oxygen species. These hydrogen peroxide breakdown products attach to the stained portions of the teeth which have the chromophore bonds. The free reactive oxygen species break the double chromophore bonds into single bonds. The single bonded carbon atoms produce colorless molecules bringing out the natural whiteness of the teeth. (Figure 10)
Tooth Whitening Treatments
Chemical tooth whitening can be performed in-office or at home, using products dispensed in the office or over the counter (OTC). Professionally provided and consumer take-home bleaching agents are supplied as pastes or gels that are used in trays, strips, rinses or paint-on liquids. The whitening agents typically used with take-home products are carbamide peroxide or hydrogen peroxide. The concentration of the whitening agent ranges between 10-35% depending on the manufacturer. The same agents are used for in-office whitening and the concentrations can range up to 40% hydrogen peroxide. The oral tissue must be carefully isolated to prevent soft tissue irritation and ingestion. The most common method of isolation is by using paint-on or rubber dams. Protective eyewear must also be used by patients undergoing in-office bleaching, as is the case anytime a curing light is used and aerosols are created. An example of the steps involved in in-office whitening are shown in figures 11-17.
In-office whitening treatments provide immediate results while take-home products can take days or weeks to provide the same result. In-office whitening procedures commonly employ the use of chemically activated whitening systems, while other systems are light activated. Tooth whitening due to dehydration can occur in some cases of light activated in-office whitening. In such cases rebound can occur making the teeth look darker than they looked immediately following the whitening procedure, potentially leading to patient dissatisfaction. The peroxide concentration of take home bleaching agents are generally lower than in-office whitening agents. This is due to the lack of professional application and supervision with agents applied by the patient.

There are advantages and disadvantages to in-office and take-home whitening treatments, just as there are for virtually any situation with multiple options. The primary advantage of in-office whitening is the same day results. For some patients this may be the best option due to a personal or social event such as a wedding or reunion, receiving an award or starting a new job in the near future. Another consideration for many patients is cost. In-office treatment is commonly more expensive than take-home whitening. Compliance is another consideration. Patients may opt for in-office whitening, or the clinician may recommend in-office treatment if they know from past experience that compliance is an issue in general. Patients who have difficulty taking all doses of prescription medication or those who have had past compliance issues with take-home whitening may be good candidates for in-office treatment.

The advantages of in-office whitening are the same day results and the lack of compliance issues. The cost may be perceived to be a disadvantage by some patients. The primary advantage of take-home preparations is the lower cost. Disadvantages of take-home treatments include the longer time frame to achieve the end results and the potential for non-compliance.

**Tooth Whitening Contraindications**

Patient selection is critical when tooth whitening is being considered by the patient or recommended by the clinician. Women who are pregnant or nursing should avoid all whitening procedures and products. There is no research demonstrating safety during pregnancy or while nursing. Children should be carefully screened. Tooth whitening for patients below the
age of 15 should only be provided with careful consideration. Patients in this age category should only be treated under dental professional supervision. Patients with gum disease, especially periodontitis, should defer restorative procedures of all types, including tooth bleaching, until the disease is controlled. There is some evidence that peroxide compounds kill bacteria and may thereby be beneficial to the gingiva, but tooth whitening should never be considered or cited as a viable primary or adjunctive treatment option for periodontal disease. Patients with significant restorative needs should have these addressed prior to whitening the teeth. Other contraindications may include exposed root surfaces, xerostomia or a history of hypersensitivity. Individually with dental restorations involving the facial surfaces of teeth in the esthetic zone must be advised that the restorations will not respond to the whitening agents. This includes composite restorations, hybrid restorations, crowns, veneers, bridgework or any other dental restorative material. Patients should be advised that whitening procedures will only have an effect on natural tooth surfaces and that restorations may need to be replaced after whitening the teeth.

Issues Associated with Tooth Whitening

Potential side effects of tooth whitening are changes to the properties of dental restorations. There is significant variability of whitening agents including concentration, duration of contact and pH, among others. Some studies have shown no effects on dental restorations. Other studies have shown an increase in surface roughness and decrease in hardness of porcelain restorations. Other studies have shown deleterious effects to glass ionomer cements. Numerous studies have demonstrated a potential for changes to composite restorations. Still other studies have shown changes to color, surface hardness and roughness, staining susceptibility, microleakage and elution, in which the composite material washes out of the restorations. The large number of variables and inconsistent study results prevents definitive conclusions regarding the effect of whitening agents on restorations at this time. However, caution should be advised with all tooth whitening systems due to the potential negative effects on dental restorations and materials from improper use.

Survey research has indicated that the most frequently reported issue with whitening treatment is sensitivity, followed by soft tissue irritation. Gingival, lingual, palatal or mucosal irritation is caused by exposure of the tissue to the bleaching agent. Ill-fitting or overfilled take-home trays can result in tissue exposure and irritation. Improperly applied paint-on dam can expose the tissue to damage during in-office whitening.

Tooth sensitivity has been an issue since whitening materials were first introduced. The most widely accepted theory explaining the mechanism of tooth sensitivity is Brannstrom’s hydrodynamic theory, first described in 1966. Brannstrom’s theory indicates that stimuli are transmitted to the pulp from fluid movement in the dentinal tubules. The inward and outward flow of fluid acts as the medium conveying stimuli including cold, heat, acids, pressure and chemicals, among others, to the nerve endings in the pulp. The basis of this theory is that the fluid filled dentinal tubules are open to the oral cavity at the dentinal surface as well as within the pulp.

Sensitivity is subjective and transient with symptoms usually disappearing in a matter of hours or a few days. Some whitening agents will dehydrate the teeth, particularly if they are anhydrous, and this can also contribute to sensitivity. The dehydration can make the teeth appear whiter and as the tooth rehydrates in a short period of time the whiter color dissipates. This phenomenon can easily be mistaken for a transient, short duration whitening result, when in reality it was due to dehydration of the tooth. Rebound of whitening effect can also occur in which the pre-treatment discoloration of the teeth reappears. Hydrogen peroxide changes the color of the stain molecules, rather than actually removing them. Over time, the stained appearance can reappear.

Prior to whitening treatment, a thorough conversation with the patient especially those who experience sensitivity to temperature variation. Discussing the potential for sensitivity to patients prior to undertaking treatment will help the patient make an informed decision. Thorough documentation of pre-op conversations is important as well. The manufacturers of whitening materials have addressed sensitivity by adding different compounds to the bleaching agent. These include amorphous calcium phosphate, potassium nitrate and fluoride, among others. Some in-office light activated whitening equipment have variable intensity lights to help manage sensitivity.

Addressing Patient Expectations

It is critically important to discuss each patient’s expectations prior to undertaking whitening treatment. A thorough clinical and radiographic examination must precede esthetic treatment. Patients who are pregnant, have xerostomia, exposed root

Figure 21. Brannstrom's hydrodynamic theory.
surfaces or those with generalized thermal sensitivity need to be informed that they are not candidates for tooth whitening. Patients who are allergic to peroxides must be excluded as well. Systemic contraindications include patients with asthma or other respiratory conditions, uncontrolled diabetes or cancer. Patients with restorations in the esthetic zone need to be informed that they may need to be redone to match the shade of the teeth after whitening. Patient’s expectations should also be discussed if the teeth have bands of discoloration or very dark teeth prior to whitening. Once it has been determined that a patient is a good candidate for whitening and all other dental needs have been addressed, a discussion of the potential side effects should occur. Among the topics that must be discussed is the possibility for hypersensitivity, soft tissue inflammation or other side effects. The final shade that will be achieved cannot be guaranteed without risking patient dissatisfaction. The potential for rebound of the discoloration must also be mentioned, as well as the possibility of non-uniform results. Some patient’s teeth have a streaky or blotchy appearance after whitening. This usually self corrects in a short period of time. In some instances, the non-uniform results are due to dehydration which correct in a few hours or days. The need for thorough documentation cannot be overstated. The patient notes should include the essential nature of the dialogue, potential contraindications, expectations, etiology of the discoloration and the patient’s level of understanding of the potential side effects. Documentation should also indicate that the patient had the opportunity to ask all of their questions and they understood the answers provided. The records should be similar to an informed consent document.

Ideally at this point the patient selects in-office or take-home whitening. Prior to undertaking whitening treatment a pre-op shade must be selected, having the patient participate in the initial shade selection. For patients who select take-home whitening, they should be instructed to whiten until the desired shade is achieved, rather than for a pre-determined number of days. Appearance in general is subjective and the patient’s opinion of what constitutes an ideal result should be discussed in advance. Choosing and endpoint for treatment can provide a goal for the patient.

Conclusion
When undertaken with careful consideration and proper sequencing of treatment, whitening can have a very positive outcome for the patient. Patients who are reluctant to smile in general, in photographs, in social or business situations due to the appearance of their teeth can experience a life changing outcome from tooth whitening. There are many reasons why people whiten their teeth but the underlying motivation is the desire for a better looking smile. There are many reasons why people want to enhance their appearance including career advancement. The obvious examples include models, television and movie actors. Others include corporate executives and public speakers. Among the reasons cited by individuals who whiten their teeth are self-esteem and confidence in social and business situations. Tooth whitening is the number one cosmetic procedure because it’s the most affordable way to significantly improve one’s appearance.

Further developments in whitening procedures and materials will continue in the future. Improvements in the predictability of the results, outcomes and reductions is side effects will benefit our patients and our practices.

Bibliography
Ibid.
Ibid.


Spaid, M, Giniger, M. Effect of adjunctive universal whitening enhancer on enamel and dentin. IADR 2006; Abstract 1665.


Kukowska M. Analysis of surface stains treated with whitening formulations. 81st General Session of the International Association for Dental Research. 2003.


Questions

1. The color of an individual’s teeth results from:
   a. Intrinsic and extrinsic color molecules
   b. Intrinsic and interior color molecules
   c. Extrinsic and exterior color molecules
   d. Superficial stains only

2. Which of the following can increase the discoloration of teeth?
   a. Trauma
   b. Surface irregularities
   c. Enamel pits and fissures
   d. All of the above

3. The American Dental Association’s position on tooth whitening states:
   a. Tooth whitening is appropriate for everyone with dark teeth
   b. Tooth whitening can be undertaken after a thorough exam
   c. Tooth whitening can be undertaken as part of a properly sequenced treatment plan
   d. Both b and c

4. The most common side effects of tooth whitening are:
   a. Sensitivity and periodontitis
   b. Sensitivity and gingivitis
   c. Sensitivity and soft tissue irritation
   d. Sensitivity and caries

5. Causes of intrinsic staining include:
   a. Frequent consumption of darkly brewed tea
   b. Trauma
   c. Medications
   d. Both b and c

6. Tooth sensitivity association whitening is:
   a. Permanent
   b. Always severe
   c. Transient
   d. None of the above

7. Contraindications to tooth whitening include all of the following except:
   a. Active periodontal disease
   b. 18 years of age
   c. Pregnancy

8. Which of the following is true regarding tooth coloration?
   a. Intrinsic stains can become extrinsic stains
   b. Extrinsic stains can become intrinsic stains
   c. Extrinsic stains are the result of organic pigments incorporation during tooth formation
   d. None of the above

9. Which of the following is true regarding the FDA’s position on tooth whitening procedures?
   a. FDA approves whitening procedures
   b. FDA regulates whitening procedures
   c. FDA has not taken a position on whitening procedures
   d. None of the above

10. Which of the following is generated by H₂O₂?
    a. Free radicals
    b. H₂O
    c. Both a and b
    d. None of the above

11. Which of the H₂O₂ breakdown products breaks carbon to carbon double bonds?
    a. H₂O
    b. The unpaired oxygen free radical
    c. Both a and b
    d. None of the above

12. Carbamide peroxide breaks down into:
    a. Hydrogen peroxide and urea
    b. Hydrogen peroxide and H₂O
    c. Hydrogen peroxide and oxygen
    d. Free radicals

13. Which of the following is true regarding managing tooth patient expectations with tooth whitening procedures?
    a. Discussions should be undertaken during the treatment
    b. Potential side effects should be addressed when they occur
    c. The final shade of the teeth can be guaranteed prior to whitening
    d. None of the above

14. Brannstrom’s hydrodynamic theory indicates:
    a. Static fluid in the dentinal tubules increases sensitivity
    b. Movement of particles in the dentinal tubules increases sensitivity
    c. Movement of fluid in the enamel increases sensitivity
    d. None of the above

15. Which of the following conditions may be contraindications for tooth whitening?
    a. Xerostomia
    b. Previous thermal sensitivity
    c. Compliance issues
    d. All of the above

16. Which of the following is true regarding advantages and disadvantages of in-office and take-home tooth whitening?
    a. The primary advantage of take-home whitening is the same day results
    b. The primary advantage of in-office whitening is the same day results
    c. The primary disadvantage of take-home whitening is the cost
    d. The primary disadvantage of in-office whitening is compliance

17. Materials used to reduce sensitivity include all of the following except:
    a. Amorphous calcium phosphate
    b. Potassium nitrate
    c. Amorphous calcium nitrate
    d. Variable light intensity

18. Gingival, lingual, palatal or mucosal irritation is caused by:
    a. Exposure of the tissue to the bleaching agent
    b. Ill-fitting or overfilled take-home trays
    c. Improperly applied paint-on dam
    d. All of the above

19. Studies have shown changes in composite restorations after tooth whitening including:
    a. Elution
    b. Improved surface hardness
    c. Reduced surface roughness
    d. Increased longevity of the restoration

20. Patient documentation should include:
    a. The essential nature of the dialogue between clinician and patient
    b. Potential contraindications
    c. Patient expectations
    d. All of the above

21. Consumption of foods rich in which of the following increases extrinsic staining?
    a. Alkaline compounds
    b. Polyphenols
    c. Acidic compounds
    d. All of the above

22. It is ethical to provide tooth whitening services:
    a. When undertaken as part of a properly sequenced treatment plan
    b. Without a radiographic examination
    c. Without a clinical examination
    d. All of the above

23. Which of the following is correct regarding tooth whitening for adolescent patients?
    a. Careful screening is required
    b. Patients under 15 should only be treated after careful consideration
    c. Professionally supervision is critical
    d. All of the above

24. In-office whitening procedures typically use H₂O₂ concentrations of:
    a. 20-30%
    b. 40-50%
    c. 25-35%
    d. 35-45%

25. Breaking down the carbon to carbon double bonds in stain molecules:
    a. Removes the stain
    b. Lightens the stain
    c. Has no effect on the stain
    d. Darkens the stain

26. Setting patient expectations prior to tooth whitening includes:
    a. Side effect development
    b. Non-uniform initial results
    c. Improved periodontal condition
    d. Replacement of restorations

27. Soft tissue irritation from tooth whitening may be caused by:
    a. Ill-fitting trays
    b. Improperly applied barriers
    c. Peroxide whitening agents
    d. All of the above

28. Peroxide whitening agents work by:
    a. Making single bonds into double bonds
    b. Breaking double bonds into single bonds
    c. Making double bonds into triple bonds
    d. Breaking triple bonds into single bonds

29. Which of the following affects color perception?
    a. Absorption of light
    b. Light reflection
    c. Dentin
    d. All of the above

30. Isolation during in-office whitening includes:
    a. Vinyl dam
    b. Paint-on dam
    c. Tofflemire band
    d. Lip and cheek retractors
A Review of Tooth Whitening Services

Educational Objectives

1. Discuss the primary responsibilities of dental professionals.
2. Describe the available tooth whitening agents and their mechanism of action.
3. Discuss the potential benefits and side effects of tooth whitening agents.
4. Describe the different types of tooth staining.

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