

# Evidence Based Tooth Whitening

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The objective of this presentation is to increase your understanding of tooth whitening. We will do this by reviewing the **clinical studies** in the scientific literature that has been published. The presentation has been divided into eight sections. They are:

Introduction	Tooth concerns
Evaluation of color	Pulpal concerns
Tooth whitening systems	Effectiveness of systems
Material concerns	Clinical Cases

## Introduction

- Why learn about tooth whitening?
  - Restorative Dentistry is changing. “The more we cut tooth, the more we weaken tooth.”
- How do we present it to our patients without insulting them?
  - To promote bleaching have posters, offer staff bleach or discuss color at restorative appointment. Ask “How do you like your teeth?” or “Are you pleased with the color of your teeth”.
- Teeth are rated as the most important facial feature.
  - Jornung et al., JADA 138:1544;2007.
- A smile has been said to be among man’s most important interactive communication skills.
  - Hattab et al., J Esthet Dent 11;291;1999.
- What are the two kinds of stains that develop?
  - Extrinsic—Stain, which is deposited on the outside surface. Whiteners will lighten calculus and the subsurface structure.
  - Intrinsic—Stain, which is incorporated into the tooth structure before or after eruption.

## Evaluation of Color

- How is color evaluated in the scientific literature?
  - Tooth color should be evaluated both subjectively and objectively. Subjectively shade guides are used. Objectively a colorimeter or spectrophotometer is used calculating L\*, a\*, b\* and E.

## Tooth Whitening Systems

- How many systems are there for whitening teeth?
  - There are four major systems, three are At-Home systems and one an In-office system.
- What are the advantages and disadvantages of each system?
  - At-home in a custom tray bleaching
    - What is important in fabricating and delivering a custom tray?
      - Take alginates and pour models carefully
      - Use vacuum to mix stone
      - Place reservoirs on models
      - Trim shy of the soft tissue margin
    - Why is it important to show patient how to use the tray?
      - Patient is anxious to get out of the chair
      - May not understand how to use it
      - Not sure how to use it when they get home, so do not use it
    - Advantages-Less tooth sensitivity, more effective.
    - Disadvantages-Not predictable, takes longer.

- At-home over-the-counter bleaching
  - Advantages-Less expensive, no doctor visits
  - Disadvantages-Not as effective, higher concentration than recommended
- In-office bleaching (Sometimes called “power bleaching”)
  - Some use halogen, LED or proprietary lights
  - Advantages-Rapid tooth whitening; no gel ingested.
  - Disadvantages- Greater sensitivity; rapid reversal of tooth whitening; possible “burning” of tissues.
- What criteria are required for American Dental Association’s Seal that a materials is “Safe” and “Effective”?
  - American Dental Associations (ADA) first guidelines on safety and efficacy of bleaching agents were issued in 1994.  
J Am Dent Assoc 125:1140-42;1994
  - Efficacy standard was revised in 2006.
  - The following product is accepted as safe and effective by the ADA.  
Opalescence Whitening Gel **10% CP**  
[http://www.ada.org/ada/seal/adaseal\\_consumer\\_shopping.pdf](http://www.ada.org/ada/seal/adaseal_consumer_shopping.pdf) May 2008

### **Material Concerns**

- Peroxide is active agent. Found in Carbamide Peroxide. Breakdown: 10% CP=3% HP+7% Urea; HP=Oxygen + Water; Urea=Ammonia + Carbon Dioxide
- How long is the carbamide peroxide bleaching gel active after placement?
  - Determined by ability to recover gel after it is placed.
    - Rapid initial degradation of carbamide peroxide agent and then it slows down.
      - 87% of agent recoverable after 15 seconds *in vivo*
      - 66% of agent recoverable after 1 hour *in vivo*
      - 53% of agent recoverable after 2 hours *in vivo*
      - 31% of agent recoverable after 4 hours *in vivo*
      - 18% of agent recoverable after 6 hours *in vivo*
      - 6% of agent recoverable after 10 hours *in vivo*
- Matis et al., J Am Dent Assoc 130:227-235;1999
- Causes of loss of peroxide: absorbent tooth (13%); physical loss of agent (14%), anti-oxidant degradation/increased temperature/product degradation (42%)
  - \*Matis, Compendium 24(SI4A):354-362;2003
- Does hydrogen peroxide degrade at the same rate as carbamide peroxide?
  - HP degrades more rapidly than carbamide peroxide
    - 61% of agent recoverable after 5 minutes *in vivo*
    - 56% of agent recoverable after 10 minutes *in vivo*
    - 49% of agent recoverable after 20 minutes *in vivo*
    - 44% of agent recoverable after 30 minutes *in vivo*
    - 38% of agent recoverable after 45 minutes *in vivo*
    - 32% of agent recoverable after 60 minutes *in vivo*
- Al-Qunaian et al., Op Dent 28:236-241;2003
- Why are different countries finding different rates of activity? Perhaps it is because degradation of product during shipment and before use. Each country should test materials and publish results of actual concentrations. Test method at [www.bamatis.com](http://www.bamatis.com)
  - Matis, Compendium 24(SI4A):354-362;2003
- “All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy.” Paracelsus (1493-1541)

## Tooth Concerns

- Is there loss of adhesion after bleaching?
  - Study *in vivo* completed recently showed changes in shear bond strength returned to baseline values two weeks after bleaching.
    - \*Metz et al., Op Dent 32(5):427;2007
  - The reason is “oxygen inhibition” that occurs with Bis-GMA resins.
- Is there a loss of microhardness?
  - Studies differ in loss of microhardness. Some good studies show loss of microhardness and changes in micromorphology, some show none, WHY?
  - Study *in vivo* shows no changes in microhardness after bleaching for two weeks.
    - \*Metz et al., Op Dent 32(5):427;2007
- Are there morphological changes on tooth surface?
  - Effect on enamel micromorphology when 38% HP used in an *in vivo* study on teeth.
    - Cadenaro et al., Op Dent 33(2):127-134;2008
- Is there an increase in caries susceptibility?
  - Use of PF will make tooth more resistant to caries.
    - \*Al-Qunaian, Op Dent 30:265;2005

## Pulpal Concerns

- Does peroxide placed on the tooth during cause histological changes to the pulp?
  - Mild histological changes that were observed with 10% CP used overnight are considered to be reversible. No moderate or severe histological changes observed.
    - Gonzalez-Ochoa, J. Masters Thesis IUSD 2002
- Will discomfort occur during tooth whitening?
  - Patient may have one of two different kinds of discomfort: Tooth or Gingival sensitivity.
    - Tray alone causes tooth sensitivity in 15-20% of patients, add placebo agent and 20-30% report tooth sensitivity, add active agent instead of placebo and 55-75% report tooth sensitivity.
      - Haywood, J Dent Res 79:519(#3001);2000
- What can be done to reduce tooth and tissue sensitivity?
  - Tooth sensitivity
    - To reduce tooth sensitivity
      - Have patient begin using toothpaste for sensitive teeth two weeks before initiation of bleaching.
      - Have patient use agent with potassium nitrate after bleaching for 10-30 minutes.
      - Have patient use agent less often.
      - Have patient wear the tray for a shorter period of time.
        - Haywood, Quint Int 32:105-09;2001
  - Tissue sensitivity
    - To reduce tissue sensitivity, have patient more effectively remove excess bleaching agent that comes out of the tray and have tray trimmed shy of cervical collar of gingiva.

## Effectiveness of various systems

- How do we determine effectiveness of systems? Internet not always science based information.
- How effective are the In-office systems?
  - In vivo* study of eight In-office bleaching systems: A pilot study (alphabetical order).
    - Manufacturer's were invited to come observe use of their product.

Accelerated In-Office by Life Like	ArcBrite by Biotrol
Illumine by Dentsply	BriteSmile by BriteSmile
Niveous by Shofu	PolaOffice by SDI Industries
One Hour Smile by Den-Mat	Zoom! by Discus Dental
    - \*Matis et al., Op Dent 28:324;2007
  - Does light use improve the effectiveness of the In-office systems? One-week recall shows that light use does not increase whitening over non-light use.
    - Effectiveness of In-office products evaluated with and without use of light.

Opalescence Xtra Boost	PolaOffice	Rembrandt Lighten Plus
LumaArch	Niveous	LaserSmile
Zoom!		
    - CRA Newsletter 27(3):3;2003
- How effective are the Over-the-counter systems?
  - Whitening wraps were more effective than Whitestrips Premium.
    - \*Matis et al., Op Dent 30:588;2005
- How effective are the At-home systems used with a custom tray?
  - All studies had at least **24 subjects**, bleached for **14 days** and **used reservoirs** in trays. Maxillary anterior teeth evaluated for color **objectively** and **subjectively**.
  - Here are three other half-mouth design studies which taught us some important concepts.
    - 10% CP and 15% CP, overnight. 15% was no different than 10% at the end of one month
      - Matis et al., Quint Int 31:303-310;2000
    - 15% CP and 5.5% HP, ½ hour 2X daily showed equal concentrations produced equal results.
      - Panich, Masters Thesis, IUSD, 1999
    - 20% CP and 7.5% HP, 1 hour 2X daily showed 20% twice a day was no better than 10% overnight.
      - Mokhlis et al., J Am Dent Assoc 131:1269-1277;2000
  - Efficacy of 10% CP used for two weeks shows 17% large change, 48% moderate, 21% slight and 14% none.
    - Matis et al., Quint Int 29:555;1998
- Summary of effectiveness
  - Nine studies with 26 products with both subjective and objective evaluations
    - At-home nighttime in tray with reservoirs is most effective system
    - At-home daytime in tray is next most effective system
    - Over-the-counter is next most effective system
    - In-office bleaching the least effective system
    - \*Matis et al. Op Dent 34:230-235;2009

## Odds and Ends

- How long do patients use agent?
  - When cuspids become as light as central and lateral incisors.
- Do I deliver both trays at the same time?
  - Deliver maxillary tray first so patients can see the amount of bleaching that has occurred.
- Rebleaching, how often should it be done?
  - When needed, probably every one to three years.
- Does rebleaching take as long as initial bleaching?
  - No it is much faster, one day of rebleaching is usually required for every 5-7 days of initial bleaching.
- Can we guarantee lightness with bleaching?
  - No, but I tell patients I will apply the money it costs to bleach on a discount for veneers or crowns within three months if they are not pleased with the results.
- How long does tooth whitening last?
  - Depends on the person

## Clinical Cases

19-year-old male, endodontically treated tooth #8, placed glass ionomer plug, bleached internally and externally for 2 weeks each. Followed for 2 months post-bleaching.

36-year-old female, trauma caused discoloration of tooth #8, no periapical pathology, bleached 6 weeks. Followed for 4 months post-bleaching

28-year-old male, semi-professional football player/student, canal in tooth #9 calcified and tooth discolored, bleached for 5 weeks, rebleached after 9 months.

62-year-old female bleached mandibular teeth 6 weeks. Followed for 2 months post-bleaching.

Lightened stained craze line on tooth #9 on 66-year-old female. Followed for 4 months post-bleaching

Hypocalcified area was bleached for 14 days, white spot lightened rapidly then returned to original color after cessation of bleaching.

Unhappy person who was dissatisfied with vital bleaching and decided on veneers.

Fluoride stain removal using bleaching on a 28 year old.

Tetracycline stain removal in a study accomplished in the Peoples Republic of China

- Not all tetracycline staining can be bleached
- Cervical area stain removal most challenging to remove  
Matis et al., Quint Int 33:645;2002
- Clinical cases of Bleaching Tetracycline Stained Teeth  
Homogenous Staining      Right 15%-Left 20%

Never promise results but help patients understand the possibilities!

**End of Course**    **Thank you for your attention**

\* Articles are available on Dr Matis' web site- [www.bamatis.com](http://www.bamatis.com)

### **Other questions patients often ask and their answers**

How long do I use the product?

Usually from 2-4 weeks. (On some teeth that are yellow due to aging, I have used the agents for 2 months. Use it as long as teeth continue to lighten. Dr. Haywood has used agents for 12 months on tetracycline stained teeth.)

When will I notice some effect?

In about three days.

What if I cannot wear the tray all night?

Wearing the tray is usually not a problem. The tray is like a contact lens; it stays in place with the gel. Some people will salivate more the first couple of nights. If you find you cannot sleep with it through the night we will have you wear it in the morning or evening for a couple of hours. That way will just take a little longer .

What happens if I miss a day?

No problem, just wear it the following evening.

Can I rebleach?

Yes, use the same tray. The product is good for 18 months in the refrigerator.

I am pregnant, can I use At-Home whitening agents?

We recommend you not use it until you have completed nursing. (There is no evidence it would harm the newborn, but no studies have conducted to determine if it would harm the offspring. This is an elective procedure so it is better to wait.)

Is it true that laser bleaching is more effective than at-home bleaching?

No. (The American Dental Association has stated that laser bleaching is not more effective than at-home bleaching.)

Will it damage my crowns or fillings?

No, it will not damage fillings or crowns. It will not lighten them either. It will discolor some temporary filling materials.

**There is an excellent article on my web site by Dr Haywood entitled “Frequently Asked Questions about Bleaching”, which was published in Compendium 24(4A):324-338;2004.**