

# Evidence Based Facts About Tooth Whitening

Prof Bruce A. Matis

[www.bamatis.com](http://www.bamatis.com)

5-2019

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

Introduction

Tooth Concerns

Material Concerns

Effectiveness of Products

Clinical Cases

## Introduction

- Three kinds of dental research studies
  - In Vitro=Lab bench studies, In Situ=in mouth, sometimes, In Vivo=in mouth, all the time
  - Can count on finding same results in clinic as with In Vivo studies
- Why learn about tooth whitening?
  - The practice of dentistry is changing. Patients want to look good when they leave your office.
- “Patients and consumers now demand not only a healthy mouth but also a perfect smile.”  
Joiner, J Dent 32:3-12;2004
- It works!
- What are the two kinds of stains that develop?
  - Extrinsic—Stain, which is found 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.
- What agent/s lighten teeth?
  - Peroxide is active agent. Found in Carbamide Peroxide. Breakdown:  
10% CP=3% HP+7% Urea; HP=Oxygen + Water; Urea=Ammonia + Carbon Dioxide
  - Carbamide peroxide dissociates and creates a higher pH, decreasing potential for caries
- How is color evaluated in the scientific literature?
  - Tooth color should be evaluated both subjectively and objectively.
    - Subjectively, shade guides are used.
    - Objectively, colorimeter or spectrophotometer is used to measure L\*, a\*, b\* and Delta E.
- Delta E value correlates well with our ability to visually judge color differences.

## Material Concerns

- What concentration to use for At-home tooth bleaching
  - The higher the concentration, the more rapid the tooth whitening.  
Harris et al., JRD 80:172(Abst1096);2001.
- The 10% CP product had lower risk and intensity of tooth sensitivity when compared to higher CP concentration without jeopardizing color change.  
de Geus et al., Op Dent 43:E210;2018
- European Union’s recommendation to dentists regarding tooth whitening agents?
  - European Commission’s Scientific Committee on Safety (SCCS)
    - Use of products up to 0.1 HP is safe.
    - Use of products from 0.1-6% HP is safe with approval of dentist.
    - Over-the-counter products should not be available.
    - Clinical examination and first prescription by dentist.
    - Label must have concentration of enclosed whitening agent.
    - Not to be used for those under 18 years of age.  
Official J Euro Union, published 29.10.2011

- How long is the carbamide peroxide bleaching material active?
  - Rapid initial degradation of carbamide peroxide agent and then it slows down.
    - 87% of agent recoverable after 15 seconds
    - 66% of agent recoverable after 1 hour
    - 53% of agent recoverable after 2 hours
    - 31% of agent recoverable after 4 hours
    - 18% of agent recoverable after 6 hours
    - 6% of agent recoverable after 10 hours
- Matis et al., J Am Dent Assoc 130:227-235;1999
- 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
    - 56% of agent recoverable after 10 minutes
    - 49% of agent recoverable after 20 minutes
    - 44% of agent recoverable after 30 minutes
    - 38% of agent recoverable after 45 minutes
    - 32% of agent recoverable after 60 minutes
- Al-Qunaian et al., Op Dent 28:236-241;2003
- Bleaching is polydirectional
  - Area under brackets is lightened
- Jadad, Am J Orthod Dentofacial Orthop 140:e43;2011

### **Tooth Concerns**

- In all dental procedures there are “Risks” and “Benefits”
- Is there a loss of enamel microhardness?
  - Review of 55 scientifically valid studies on microhardness published. When more simulated intraoral conditions were present the loss of microhardness was decreased.
    - Attin et al., Den Mat 25:143-157;2009
  - In vivo study shows no change in microhardness after bleaching for two weeks.
    - \*Metz et al., Op Dent 32(5):427;2007
  - Recent publication states that there is no loss of microhardness when using 10% Carbamide Peroxide.
    - Zanolla et al., Australian Dent J 62:276;2017
- Is there loss of adhesion in enamel when placing a resin composites after bleaching?
  - In vivo study 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.
  - Why not place resin immediately after bleaching?
    - Cannot bond properly because of oxygen inhibition internally.
    - Cannot color match because color reversal will occur.

## Effectiveness

### -In-office products effectiveness (Power Bleaching)

--In vivo study of eight In-office bleaching systems: A pilot study (alphabetical order). Manufacturers 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

--Product effectiveness evaluated in half arch design study with and without use of light. Light use did not improve the effectiveness of the In-office systems

|                        |            |                        |
|------------------------|------------|------------------------|
| Opalescence Xtra Boost | PolaOffice | Rembrandt Lighten Plus |
| LumaArch               | Niveous    | LaserSmile             |
| Zoom!                  |            |                        |

CRA Newsletter 27(3):3;2003

--In-office system bleaching can be boosted by At-home systems

\*Matis et al. Op Dent 34;142-149;2009

--Very good isolation is important, if system leaks discomfort usually occurs.

### -At-home systems effectiveness 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**.

---First study was for safety and efficacy. 10% CP and Placebo (product without CP)  
Efficacy of 10% CP used for two weeks shows 17% large change, 48% moderate, 21% slight and 14% none after six months.

Matis et al., Quint Int 29:555;1998

---There are three 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 concentration produced similar results.

Panich, Masters Thesis, IUSD, 1999

----20% CP and 7.5% HP, 1 hour 2X daily showed 20% twice a day was similar to 10% overnight.

Mokhlis et al., J Am Dent Assoc 131:1269-1277;2000

--10% was twice as effective both subjectively and objectively than In-office products.

### -Is there one comparison of all the systems effectiveness?

--Nine studies with 26 products with both subjective and objective evaluations

At-home nighttime in tray with reservoir is most effective system

At-home daytime in tray is next most effective system

In-office system is the third most effective system

\*Matis et al., Op Dent 34:230-235;2009

## **Odds and Ends**

- Is a “White Diet” necessary during tooth bleaching?
  - No, sometimes dentists do it to justify their bleaching was not effective.  
Matis BA. Wang G. Matis JI et al. Op Dent 40(3):235-240;2015
- 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?
  - 42% were satisfied after 10 years post bleaching  
Leonard et al., J Esthet Rest Dent 15:142-152;2003
- How old should patients be before bleaching?
  - Should not lighten teeth while patient is in mixed dentition.
  - Tooth whitening for individual teeth has a different policy.  
Pediatr Dent 2016;38(6):81-83
- Are there any contraindications for tooth whitening?
  - Patients with resin allergies, peroxide allergies and pregnant or lactating patients.
- Publication--Safety Controversies in Tooth Whitening  
Li et al. Brit Dent J 2013;215:29-34

## **Clinical Cases**

- 4-year-old who fell down, traumatizing deciduous central incisors, which were bleached for a total of 47 hours.  
Brantly et al. Ped Dent 23:514;2001
- 83-year-old male who bleached for 6 weeks with one-month post-bleaching
- Inside/Outside bleaching: 19-year-old male, endodontically treated N 11, placed glass ionomer plug, bleached internally and externally for 2 weeks each. Followed for 2 months post-bleaching. Returned at 5 years.  
Bizhang Op Dent 28:334;2003
- 36-year-old female, trauma caused discoloration of tooth N 11, no periapical pathology, bleached 6 weeks. Followed for 4 months post-bleaching.
- 28-year-old male, semi-professional football player/student, canal in tooth N 21 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 N 21 on 66-year-old female. Followed for 4 months post-bleaching. Cervical dentin does not usually lighten much with 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 B, Wang Y et al., Op Dent 31(6):643-651;2006

My prescription for tooth whitening: Use 10% CP, in a tray, overnight.

Never promise results but help patients understand the possibilities!

\* Articles are available on Prof 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 bleach while you are pregnant or use bleaching agent until you have completed nursing. (There is no evidence it would harm the newborn, but no studies have been 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.