

International Symposium on Tooth Whitening: Evidence & Clinical Based

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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 seven sections. They are:

Introduction	Single Tooth Bleaching
Systems Used	Tetracycline Bleaching
Agent/Tooth Concerns	Clinical Cases
Guidelines on Safety and Efficacy	

Introduction

- Three kinds of dental research studies
 - In Vitro-Lab=bench studies, In Situ=in mouth sometimes, In Vivo=in mouth during treatment
 - Can count on finding same results in clinic with In Vivo studies
- Why learn about tooth whitening?
 - Restorative Dentistry is changing. "The more we cut tooth, the more we weaken the tooth."
- "Patients and consumers now demand not only a healthy mouth but also a perfect smile."
 - Joiner, J Dent 32:3-12;2004
- How does tooth whitening work?
 - Peroxide alters compound double bonds usually to single bonds and a shorter molecule. The action alters the light properties of the stain, making the tooth appear lighter.
 - Joiner, J of Dent 34:412-419;2006.
 - Example of a conjugated double bond molecule, Crocetin having a dark red color changing to white upon degradation, using peroxide.
 - Thompson et al., J Chem Soc, Faraday Transactions 89:4035-4043;1993.
- What agent/s change tooth surfaces to reflect wavelengths and therefore lighten teeth?
 - Peroxide is active agent. Found in Carbamide Peroxide. Breakdown:
10% CP=3% HP+7% Urea; HP=Oxygen + Water; Urea=Ammonia + Carbon Dioxide
- How is color evaluated in the scientific literature?
 - Tooth color should be evaluated both subjectively and objectively.
 - Subjectively shade guides are used. Lightest is usually #1.
 - Objectively a colorimeter or spectrophotometer is used to measure L*, a*, b* and Delta E.
- Bleaching is polydirectional
 - Area under brackets is lightened
 - Jadad, Am J Orthod Dentofacial Orthop 140:e43;2011
- How important is tooth whitening to our patients?
 - Teeth are rated as the most important facial feature.
 - Jornung et al., JADA 138:1544;2007.

Summary of Section

- In vivo studies are most reliable
- Color is determined by reflection and absorption of light waves
- One-third of Carbamide Peroxide is Hydrogen Peroxide
- There are two ways to measure color
 - Objective—Instruments
 - Subjective—Human visual
- Our patients want to lighten the color of their teeth

Systems Used in Vital Tooth Whitening

- How many systems are there for whitening teeth?
 - There are At-home systems and In-office system.
- What are the advantages and disadvantages of each system?
 - At-home custom tray bleaching
 - Advantages-Lower tooth sensitivity, more effective, less peroxide ingested (with reservoirs)
 - 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
 - There are four major types of over the counter products; Strips, Wraps, Tray-in-Tray and Paint-On
 - In-office bleaching-outside surface (Sometimes called “Power Bleaching”)
 - Advantages-Rapid tooth whitening; no gel ingested.
 - Disadvantages- Greater sensitivity; more rapid reversal of tooth whitening; possible “burning” of tissues.
- How effective are the In-office systems?
 - In-office bleaching outside tooth surface, Conventional (Power Bleaching)
 - 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
 - Light use did not improve the effectiveness of the In-office conventional system
Effectiveness evaluated with and without use of light.

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

CRA Newsletter 27(3):3;2003
 - In-office systems can be boosted by At-home systems
Matis et al. Op Dent 34;142-149;2009
- 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**.
 - There are two half-mouth design studies which taught us some important concepts.
 - 10% CP and 15% CP, overnight. 15% was no different than 10% at 1 month
Matis et al., Quint Int 31:303-310;2000
 - 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
 - 10% CP was twice as effective both subjectively and objectively than In-office products.

Summary of Section

- There are two major systems of tooth whitening
- Each has advantages and disadvantages
- If At-home make good fitting trays
- If In-office isolate gingiva from gel

Agent/Tooth Concerns

-In dental procedures there are “Benefits” and “Risks”

-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 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

-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

-Is there an increase in caries susceptibility?

--Use of PF will make tooth more resistant to caries.

Al-Qunaian, Op Dent 30:265;2005

-Is there loss of adhesion in enamel with resin composites 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.

--Why not place resin immediately after bleaching?

Cannot bond properly because of oxygen inhibition internally.

Cannot color match because color reversal will occur.

-Is there a loss of enamel microhardness?

--Review of 55 scientifically valid studies on microhardness recently published.

Attin et al., Den Mat 25:143-157;2009

--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 or 35% CP were used in an *in vivo* study on teeth.

Cadenaro et al., Op Dent 33(2):127-134;2008

Summary of Section

- CP retains ~50% initial concentration after 2 hours
- HP retains ~50% initial concentration after 20 minutes
- CP extends the bleaching process
- No loss of bonding strength if bonding delayed for two weeks
- No loss of microhardness with in vivo research
- No change in micro-morphology

Guidelines on Safety and Efficacy

- 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 Abst 1096; 2001.
- What do major organizations recommend to dentists regarding tooth whitening agents?
American Dental Association's Seal that a materials is "Safe" and "Effective"?
 - 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 4/11/11
 - 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.
 - International Organization for Standardization
 - Concentration: must be on label
 - Peroxide concentration during use life (+10% to -30% variance from label)
 - Surface microhardness (not more than -10% loss)
 - Surface erosion (no more loss than 10 micrometers)
ISO/DIS 28399 published 11.12.2011
Official J Euro Union, published 29.10.2011
- Accuracy of concentration on label
 - Product label concerns may be in manufacturing process, or could occur during shipment and storage in the US and other countries. Products tested using method advocated in US Pharmacopia for carbamide peroxide
 - In United States 35 products within 30% of concentration indicated on label
 - In China 13 products tested within 30% of concentration indicated on label
 - In Saudi Arabia 1 of 8 products had greater than 30% difference in concentration than indicated on label
 - In Brazil 3 of 15 products had greater than 30% difference in concentration than indicated on label
- Matis B, Matis J, Wang Y, et al., Op Dent 38(3):334-343;2013
- Efficacy of 10% CP used for two weeks shows 20% large change, 50% moderate, 20% slight and 10% none.
Matis et al., Quint Int 29:555;1998

Summary of Section

- No higher than 16% CP is recommended by any reputable organization
- Lack of effectiveness may be due to loss of agent concentration
- Not everyone will be happy with bleaching outcome

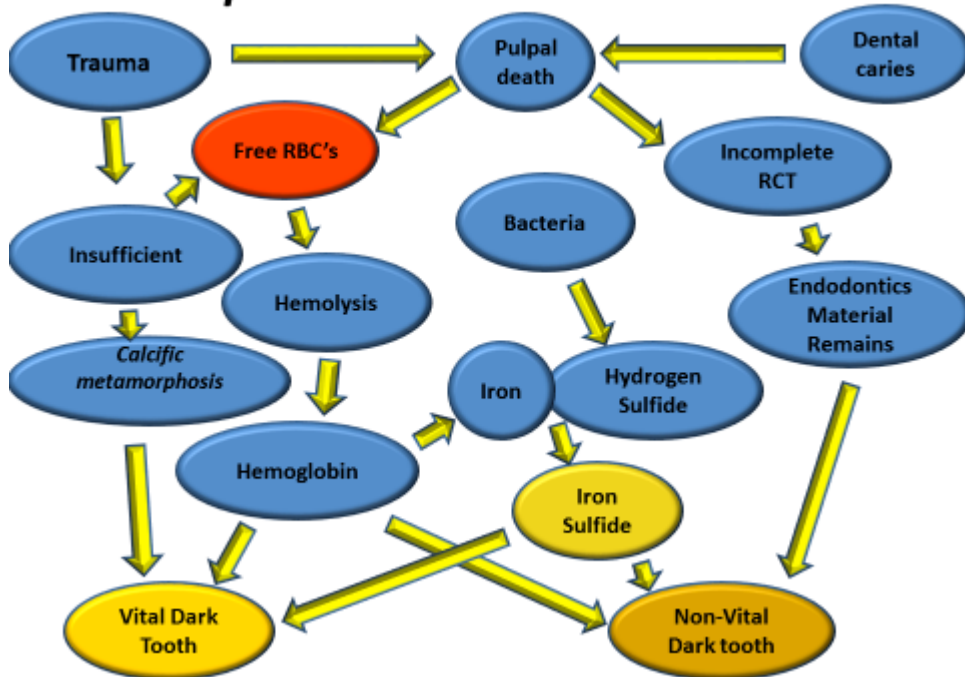
Single Dark Tooth Bleaching

-Tooth may be vital or non-vital.

--Treat teeth as vital unless periapical radiolucency

Haywood V, Diangelis A. Inside Dent 6(8):42-52;2010

Post-eruptive dark tooth: Dr Senan Ahmed



-Single tooth bleaching

--Vital Dark Tooth

---Custom tray-full arch tray

----Advantages-More conservative, Less dental office time

----Disadvantages-Takes longer, May not become as light as desired

---Custom tray-single tooth tray

--Non-vital Dark Tooth

---In-office bleaching-inside the pulp chamber “Walking Bleach”

----Advantages-No gel ingested, No tooth sensitivity

----Disadvantages- Need to see patient multiple times, Difficult to seal lingual, Requires entry into pulp chamber and a barrier placed.

Procedure on Bamatis.com

---Important to place barrier to avoid idiopathic root resorption

--In office bleaching inside tooth chamber (Walking Bleach)

---Sodium perborate can be mixed with water as well as peroxide with equal effectiveness.

de Souza-Zaroni et al., Oral Surg, Oral Med, Oral Path, Radiol, Endod 107:e43-e47;2009

--At home- Custom tray (“Inside/Outside Bleaching”)

Clinical Cases

-Difficult to remove Stain

--Tetracycline stain removal in a research study in Wuhan, China

---Not all tetracycline staining can be bleached, cervical area stain removal most challenging to remove,

Matis et al., Op Dent 31(6):643-651;2006

- Fluoride stain removal using custom tray bleaching on a 28 year old.
- Stained craze line removed on N 21 on 66-year-old female. Followed for 4 months post-bleaching. Cervical dentin does not usually lighten much with bleaching.
- Hypocalcified area was bleached for 14 days, white spot lightened rapidly then returned to original color after cessation of bleaching.
- Mandibular teeth bleached for 6 weeks on 62-year-old female. Followed for 2 months post-bleaching.
- Veneers cases due to dark teeth will always be bleached first.

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
- Is the use of hydrogen peroxide or carbamide peroxide safe?
 - “All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy.”
Paracelsus (1493-1541)
 - Body produces about 6.5 g of peroxide daily in the liver. Oral cavity can decompose 29 mg peroxide in one minute. Approximately 3.5 mg peroxide used per session with 10% CP
Li Y, Greenwall L. “Safety Issues of Tooth Whitening Using Peroxide-based Materials”
Br Dent J 215:29-34;2013.
- Are there any contraindications for tooth whitening?
 - Patients with resin allergies (if In-office bleaching), peroxide allergies and pregnant or lactating patients.
- Are there other excellent sources of information on tooth whitening?
 - Excellent article entitled “Biological Properties of Peroxide-containing Tooth Whiteners”.
Li, Food and Chemical Toxicity 34;887-904;1996
 - Excellent book on bleaching entitled “Tooth Whitening Techniques” by
Linda Greenwell, published by CRC Press
 - Book entitled “Tooth Whitening: Indications and Outcomes of Nightguard Vital Bleaching”
Van Haywood, Published by Quintessence International
- My prescription for tooth whitening: Use 10% CP with PF in tray with reservoirs, overnight.
- Never promise results but help patients understand the possibilities!

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.

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.