

The Facts About Tooth Whitening

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Part 1 Need for Bleaching and In-office Bleaching

Introduction

- The “Practice of Dentistry” is changing.
- Patients want lighter teeth, in the past we have had to rely on mechanical dentistry.
- Chemical Dentistry (ie use of peroxide, fluoride, chlorhexidine gluconate, etchants, conditioners) is becoming a new major focus in dentistry.
- Bleaching works, but how do we optimize its effectiveness?
- European Commission’s Scientific Committee on Consumer Products (SCCP)
 1. Use of products up to 0.1 HP is safe.
 2. Use of products from 0.1-6% is safe with approval of dentist.
 3. There is an absence of studies on adverse effects in the mouth.
 4. Over-the-counter products should not be available.
- *http://europa.eu.int/comm/health/ph_risk/committees/04_sccp/docs/sccp_o_022.pdf
- “It seems that everybody in America wants whiter teeth to make them feel younger and provide beautiful smiles and accompanying increase in self-esteem.”
Christensen JADA 133:1277;2002
- To promote bleaching, use posters, offer staff bleaching and discuss color at restorative appointments. Ask “How do you like your smile?”
- Listen, Evaluate, Discus bleaching with patients. Beware of patients with unrealistic expectations.
- “Patients and consumers now demand not only a healthy mouth, but also a perfect smile.”
Joiner, J of Dent 32:3;2004

Goal is to remove stain

- Extrinsic—Stain, which is deposited on the outside surface.
- Intrinsic—Stain, which is incorporated into the tooth structure before or after eruption.
Tooth whiteners penetrate tooth surface to affect the color.

In-office Bleaching

- Advantages-Dentist controlled, no gel ingested.
- Disadvantages- Greater sensitivity, rapid reversal, possible “burning” of tissues.
- Respondents’ satisfaction with In-office bleaching:
Very satisfied 16%, Satisfied 32%, Unsatisfied 23%, Very unsatisfied 5%
CRA Newsletter 29:2;2005
- Overview of all In-office products. Basic details from manufacturers of 14 systems
Freedman, Dental Products Report 36:82;2002
- In vivo study of eight In-office bleaching systems: A pilot study (alphabetical order):

Accelerated In-Office by Life Like	ArchBrite by Biotrol
Illumine by Dentsply	BriteSmile by BriteSmile
Niveous by Shofu	PolaOffice by Southern Dental Industries
One Hour Smile by Den-Mat Corp	Zoom! by Discus Dental

Matis et.al. Op Dent 28:324;2007

-In-office tooth lightening: 1 year recall, shows bulb light causes no increase in lightness.
Opalescence Xtra Boose PolaOffice Rembrandt Lighten Plus
LumaArch Niveoous LaserSmile
Zoom!

CRA Newsletter 28:1-2;2004

- The effect of light enhanced bleaching on in vitro surfaces and intrapulpal temperature rise.
Zach & Cohen, O Surg, O Med, O Path 19:515;1965
- Effects of In-office tooth whiteners on hardness of tooth colored restoratives.
*Yap et. al., Op Dent 27:137;2002
- Effects of In-office tooth whiteners on surface finish of tooth colored restorations.
*Watanapayungul et al. Op Dent 28:15;2003.
- No effect on enamel micromorphology when 38% HP used in an *in vivo* study on teeth.
Cadenaro et..al., Op Dent Submitted for publication
- ADA accepted In-office product is not as effective as ADA accepted At-home product.
*Zekonis et. al., 28:114;2003.

Summary and Conclusions

- 1) Modern Restorative Dentistry minimizes tooth structure removal.
- 2) Chemical dentistry is as important as mechanical dentistry.
- 3) When patients come in, Listen, Evaluate and Discuss bleaching with patient to make sure you can meet their expectations.
- 4) EU's SCCP states 0.1-6.0% HP is safe with approval of dentist.
- 5) Main purpose of whitening agents is to remove intrinsic staining.
- 6) 16% of subjects are "very satisfied" with In-office tooth bleaching.
- 7) Light activation does not appear to increase lightening effect of bleaches.
- 8) Excessive exposure of light on teeth can cause injury to the pulp.
- 9) High concentrations of peroxide gel do not affect hardness or surface finish of dental materials.
- 10) At-home is more effective than In-office bleaching procedure with ADA accepted products.

Part 2 At-home Bleaching- The Science

At-home Bleaching

- Advantages-Less tooth sensitivity, patient monitored.
- Disadvantages-Not predictable, some sensitivity.
- Respondents' satisfaction with At-home bleaching:
Very satisfied 49%, Satisfied 45%, Unsatisfied 1%, Very unsatisfied 1%
CRA Newsletter 25:2;2001

Concentrations to use

- Effectiveness of different concentrations of carbamide peroxide: An *in vitro* study has shown it just takes longer with lower concentrations.
Leonard et. al., Quint Int 29:503;1998
- Maxillary anterior teeth lighten to the same value. Evidence of "Inherent Lightness Potential".

- American Dental Associations (ADA) first guidelines on safety and efficacy of bleaching agents were issued in 1994.
J Am Dent Assoc 125:1140;1994
- The following products are accepted as “safe” and “effective” by the ADA.
<http://www.ada.org/prof/prac/seal>, September 2002
Colgate Platinum Daytime Professional Whitening System **10% CP**
Nite White Classic Whitening Gel **10% CP**
Opalescence Whitening Gel **10% CP**
- Scandinavian Institute of Dental Materials has also recommended “to avoid using concentrations higher than 10% carbamide peroxide”.
- Outcome of bleaching depends on concentration, duration, times bleached and penetration of agent.
- Breakdown – 10% CP=3% HP+7% Urea; HP=Oxygen + Water; Urea=Ammonia + Carbon Dioxide
- Procedure for making tray:
 - Make stone model
 - Reduce to one inch high
 - Place resin using palm method
 - Vacuum form plastic (allow to droop 1 inch, cool model on platform)
 - Gross reduction then finer reduction on model
 - Lift tray off model and
 - Trim to cervical margin (indicated by transparent area)
 - Reverse directions on trimming interproximally to get better adaptation
- Instructions for use:
 - Thoroughly brush teeth
 - Express agent into reservoirs (facial areas)
 - Seat tray, express excess and brush it off
 - Rinse twice with water
 - Remove residual gel after bleaching

Studies to review effectiveness of whitening agents

- Efficacy of 10% CP for two weeks shows 20% large change, 50% moderate, 20% slight and 10% none.
Matis et. al., Quint Int 29:555;1998
- All had at least **24** subjects, bleached maxillary teeth for **14** days and used **reservoirs** in trays.
- All maxillary anterior teeth evaluated for color objectively and subjectively.
Subjectively by shade guide (Bioform Trubyte Color Ordered) and by photographs (slides).
Objectively by colorimeter (Minolta, Chroma Meter CR 321) with jig for positioning.
- 10% CP and Placebo, overnight.
Matis et. al., Quint Int 29:555;1998
- No difference between 10% and 15% four weeks post-bleaching.
10% CP and 15% CP, overnight.
Matis et. al., Quint Int 31:303;2000

- CP has same bleaching capacity as HP.
15% CP and 5.5% HP, ½ hour 2X daily.
Panich, Masters Thesis, IUSD, 1999
20% CP and 7.5% HP, 1 hour 2X daily.
Mokhlis et. al., J Am Dent Assoc 131:1269;2000
- 10% CP overnight produces same lightness as 20% CP or 7.5% used 1 hr twice daily.

Histological changes after bleaching

- Penetration of the pulp chamber by carbamide peroxide bleaching agents occurs very rapidly, within fifteen minutes.
Cooper et. al. J of Endo 18:315;1992
- Minor histological changes that were observed with 10% CP used overnight are considered to be reversible
Gonzalez-Ochoa J., Masters Thesis IUSD 2002

Sensitivity

- Tray alone causes tooth sensitivity in 15-20% of patients; add placebo agent and 20-30% report tooth sensitivity; add active agent and 55-75% report tooth sensitivity.
Haywood, JDR 79:519;2000
- To reduce tooth sensitivity:
 - Have patient use gel or paste with potassium nitrate before and/or after bleaching.
 - Have patient use bleaching agent less often.
 - Have patient wear the tray with bleaching agent for a shorter period of time.
 - Have patient use bleaching agent with lower amount of active agent.
- To reduce tissue sensitivity, have patient remove the excess bleaching agent better that comes out of the tray and/or trim tray more at cervical area.

Effects on teeth

- White spot lesions that occur sometimes during bleaching are not precarious lesions
*Al-Qunaian, Op Dent 30:265;2005
- Study *in vivo* completed recently showed no changes in microhardness and adhesion returns to baseline values in two weeks.
Metz et.al., accepted for publication in Op Dent

Degradation

- 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;1999
- Only about 13 percent of active bleaching agent is used in the bleaching process after 2 hours.
Matis, Compendium 21:S34;2000

-Causes of loss of recoverable agent are a combination of 1) physical loss of agent, 2) product degradation, 3) anti-oxidant degradation, 4) increased temperature and 5) absorbent tooth .

*Matis, Compendium 24:254;2003

-Degradation of hydrogen 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, Masters Thesis, IUSD, 2001

-With short term use no difference in clinical lightening of teeth with or without reservoirs

*Matis et. al. Operative Dentistry 27;5;2002

-How long should patients use it? Until cuspids are as light as central and lateral incisors.

-How long to rebleach? One day for every week that patient initially bleached.

-How soon to rebleach? In one to three years-Do not give both upper and lower tray to patients at the same time. Tell them to try upper first.

Reason: Potential for TMD and able to see relative color changes.

Over-the-counter products

-Whitening wraps caused greater shade guide change than strips containing the same concentration of tooth whitening agent.

*Matis et al. Op Dent 30:588;2005.

-Systems most to least effective: Overnight At-home, Daytime At-Home, In-office, OTC

-“All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy”.

Paracelsus (1493-1541)

-Daily ingestion of CP should not exceed 10 mg. Includes safety factor of 100.

Dahl and Becher, J Dent Res 74;710-14;1995.

-Does not cause oral cancer

Munro et.al., J Esthet Rest Dent 18:119;2006.

-Excellent article entitled “Biological Properties of Peroxide-containing Tooth Whiteners” is available.

Li, Food and Chemical Toxicity 34;887;1996

-Excellent book on bleaching: “Bleaching Techniques in Restorative Dentistry”

Linda Greenwell

Matis, Op Dent 27:103;2001 (Review of book)

Summary and Conclusions

- 1) 49% of patients are “very satisfied” with At-home tooth bleaching.
- 2) Lower concentrations just take longer to lighten teeth a comparable amount.
- 3) Only 10% carbamide peroxide bleaching agents are accepted as “safe” and “effective”.
- 4) Scandinavian Institute of Dental Materials recommend not using higher than 10% CP.
- 5) Carbamide peroxide and hydrogen peroxide lighten at the same rate in short periods of time. Carbamide peroxide is more effective in longer periods of time.
- 6) 10% CP has been shown histologically to cause very minor and reversible changes in the pulp.
- 7) Tooth sensitivity can be reduced by using potassium nitrate, reducing frequency of bleaching, bleaching during the daytime or bleaching with product with lower concentration of CP.
- 8) Tissue sensitivity can be reduced by trimming the tray length and/or removing the product from off the tissues.
- 9) There is no loss of microhardness when using up to 15% CP.
- 10) Resin restorations should not be placed for up to two weeks post-bleaching because of reduced bond strength and increased ability to long lasting color match.
- 11) After two hours about 50% of CP can be recovered when reservoirs are used.
- 12) A small amount of active agent is used during the bleaching process.
- 13) Caries susceptibility does not occur with bleaching.
- 14) After twenty minutes about 50% of HP can be recovered when reservoirs are used.
- 15) At-home system used overnight has been shown to be most effective way to bleach.

Part 3 Clinical Cases: The Proof is in the Taste

-Bleaching of primary teeth is possible with carbamide peroxide

- 1) 4 year old who fell sown, traumatizing deciduous central incisors, which were bleached for a total of 47 hours. Brantley et al. *Pediatr Dent* 23:514,2001
- 2) 19-year-old male, endodontically treated #8, placed glass ionomer plug, bleached internally and externally for 2 weeks each. Followed for 5 years post-bleaching.
- 3) 36-year-old female, trauma caused discoloration of tooth #8, no periapical pathology, bleached 6 weeks. Followed for 16 weeks postbleaching
- 4) 28-year-old male, semi-professional football player/student, canal in tooth #9 calcified and tooth discolored, bleached for 5 weeks and rebleached after 9 months for one week.
- 5) 62-year-old female, bleached mandibular teeth 6 weeks and followed for 6 weeks.
- 6) Hypocalcified area was bleached for 14 days, white spot lightened rapidly then returned to original color after cessation of bleaching.
- 7) 66-year old female with dark streak in tooth #9 was bleached and resin placed in area.
- 8) Unhappy person who was unsatisfied with 9 weeks of bleaching and decided on veneers.

Fluoride staining- a post eruptive stain

-Remove fluoride staining in enamel three ways: Microabrasion with HCl acid, beaching and/or use bur to remove stain

Croll, JADA 128:S45-S50;1997

Tetracycline staining- a pre-eruptive stain

-Not all tetracycline staining can be bleached

-Study in China on subjects with tetracycline staining, using different concentration of gel determined that 10% CP was effective in removing stain. Cervical area is the most difficult area for stain removal.

Matis et al. Quint Int 33:645;2002

Clinical cases of Bleaching Tetracycline Stained Teeth

1) Homogenous Staining	Right 15%- Left 20%
2) Incisal Staining	Right 10%-Left 20%
3) Cervical Staining	Right 20%-Left 10%
4) Bands of Staining	Right 10%-Left 15%

Summary and Conclusions

1. Subjects as young as four years old have been bleached successfully, when bleaching is indicated.
2. In discolored asymptomatic teeth without periapical pathology, bleach without root canal treatment.
3. In nonvital bleaching, seal orifice to canal with glass ionomer and leave lingual orifice to tooth open during bleaching. Seal with glass ionomer.
4. Anytime dentin is discolored, bleaching will work, but it takes longer.
5. Hypocalcified spots in some teeth turn lighter in color very rapidly but reverse to original lightness when bleaching stops.
6. Use bleach as long as teeth continue to lighten.
7. Most teeth with fluorosis bleach fairly rapidly and retain lightening.
8. Some teeth with tetracycline staining may take longer than six months to lighten, especially in the cervical areas.
9. More than 50% of the tooth lightning in teeth stained by tetracycline occurred in the first month.
10. Ten percent CP lightened almost as rapidly as the 15% and 20%.
11. Bleaching is time and concentration dependent.
12. Never promise results.

My prescription for successful and safe tooth whitening:

Place 10% CP agent into tray with reservoirs and use it overnight

Thank you for your attendance. Feel free to pose questions to me on my web site on bleaching at: www.bamatis.com

*Article is available on Dr Matis' web site

Questions patients often ask and their answers

How long do I use the product?

Usually from 10-14 days. (On some teeth that are yellow due to aging, patients may need to use bleaching agent for 2 months. Use it as long as teeth continue to lighten. Dr. Haywood has used it 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.

How long does the lightness from the bleaching last?

It usually lasts from one to three years. In some patients there is no reversal. (They very seldom return to the original discoloration, except for smokers. Smokers have a greater chance to return to baseline values.)

Can I rebleach?

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

How fast does rebleaching work?

You will need to bleach one day for each week you originally bleached.

I am expecting, can I use At-home whitening agents?

You should not bleach 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.)

Do I bleach both arches at the same time?

No, first bleach the maxillary arch. (Patients do not sense teeth are lightening if both arches are bleached at the same time.) You will have less chance of TMD discomfort if you bleach one arch at a time.

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.)

How young can you begin bleaching?

Dr. Haywood has bleached patients as young as four when there has been a need for it.

Will it damage my teeth or overall health?

There are five agents, which have been accepted as “safe” and “effective”. If you use any of those products as recommended, they have been shown not to harm the teeth or your overall health.

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.