Part 1 Introduction and In-Office Bleaching

Introduction

- Restorative Dentistry is changing. “The more we cut tooth, the more we weaken tooth.”
- We have been trained mostly in “mechanical dentistry” however now we must also become trained in “chemical 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 mouth.
  4. Over-the-counter products should not be available.
- Needs to be dental supervised.
- “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 have posters, offer staff bleach and discuss color at restorative appointment.
- Listen, evaluate, discuss bleaching with patients. Beware of patients with unrealistic expectations.
- To determine if patients have bleached, check out color of cuspids. If same as incisors, patient has probably bleached.
- “Tooth shade is indeed the most important variable of the attractiveness of a smile.”
  Dunn et al., J Prosthod 5:166-171;1996
- “Patients and consumers now demand not only a healthy mouth but also a perfect smile.”
  Joiner, J Dent 32(Sup 1):3-12;2004

Goal is to remove stain
- Extrinsic—Stain, which is deposited on the outside surface.
- Whiteners will lighten calculus and the subsurface structure.
- Calculus needs to be removed before bleaching so stain will not be deposited onto it.
  Collins et al., J Dent Res 79(SI):583(#3517);2000
- Intrinsic—Stain, which is incorporated into the tooth structure before or after eruption.
- Tooth whiteners penetrate tooth surface to affect the color.
- As we age our teeth become darker, more yellow and slightly more red.

In-Office Bleaching

- Respondents’ satisfaction with In-office bleaching:
  Very satisfied-16%, Satisfied 32%, Unsatisfied 23%, Very unsatisfied 5%
  CRA Newsletter 29:2;2005
- Advantages—Rapid tooth whitening, -no gel ingested.
- Disadvantages- Greater sensitivity, rapid reversal of tooth whitening, possible “burning” of tissues.
- Overview of In-office bleaching products. Basic details from manufacturers on 14 systems.
  Freedman, Dental Products Report 36:82;2002
- *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
Illumine by Dentsply
Niveous by Shofu
One Hour Smile by Den-Mat Corp
Initial bleaching was good, but large reversal occurred within one week with most of the products.

Franco and Al-Ammar, Masters Theses, Indiana University 2003

- Effectiveness of In-office products evaluated with and without use of light.

Opalescence Xtra Boost
LumaArch
Zoom!

One-year recall shows that light use does not increase whitening over non-light use.

CRA Newsletter 28:1-2;2004

The effect of intrapulpal temperature rise on vitality of pulp in Rhesus monkies.


Effects of In-office tooth whiteners on hardness and surface finish of tooth colored restoratives. Both are material dependent and minimally affected by bleaching agents.


ADA accepted In-office product is not as effective as ADA accepted At-home product.


How effective is piggybacking both In-office and At-home products? Most effective is In-office followed by At-home.

Matis, unpublished

- In-office agents should be used when patients want rapid tooth whitening or when they cannot wear a tray. When possible have patient use tray whiteners to “boost” In-office whiteners.

Matis, J Esthet Restor Dent 16:87-88;2004

**Summary and Conclusions**

1) Tooth shade is the most important element of patients’ perception of dental attractiveness.
2) Whiter teeth give us a more youthful image and an increase in self-esteem.
3) Must make dental decisions on evidence based facts, not opinion based theories.
4) When patients come in, Listen, Evaluate and Discuss bleaching with patient to make sure you can meet their expectations.
5) Dental cleaning is necessary to remove calculus, but not for bleaching efficacy.
6) Main purpose of whitening agents is to remove intrinsic staining.
7) Older patients are as satisfied as younger patients with the color of their teeth.
8) Isolation of soft tissues is a must with In-office bleaching.
9) Tooth lightness and color reversal are person dependent.
10) Light activation does not appear to increase tooth lightening effect of bleaching.
11) Excessive length of light on one tooth can cause injury to the pulp.
12) High concentrations of peroxide do not affect hardness or surface finish of dental materials, hardness and surface finish are material specific.
13) At-home is more effective than In-office bleaching using ADA accepted products.
14) Follow In-office bleaching with use of At-home tray whitening gel.
At-Home Bleaching

- Respondents’ satisfaction with At-home bleaching:
  Very satisfied-49%, Satisfied 45%, Unsatisfied 1%, Very unsatisfied 1%
  CRA Newsletter 29:2;2005
- Advantages-Less tooth sensitivity, more effective.
- Disadvantages-Not predictable, takes longer.

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 29:503-07;1998
- There appears to be an “inherent lightness potential” of teeth. Six anterior teeth attain the same color.
- 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
- The following products are accepted as safe and effective by the ADA.
  Colgate Platinum Daytime Professional Whitening System 10%
  Nite White Classic Whitening Gel 10%
  Opalescence Whitening Gel 10%
- Breakdown – 10% CP=3% HP+7% Urea; HP=Oxygen + Water; Urea=Ammonia + Carbon Dioxide
- Products do not always contain what is indicated on the container.
  *Matis, Compendium 24(4A);354-362;2003

Studies to review effectiveness of whitening agents
- First study showed clinical safety and effectiveness of 10% CP. 20% of patients experience large change, 50% moderate, 20% slight and 10% very little or none
  Matis et al., Quint Int 29:555-563;1998
- All had at least 24 subjects, bleached for 14 days and used reservoirs in trays.
- All maxillary anterior teeth evaluated for color objectively and subjectively.
- Compare three studies
  10% CP and 15% CP, overnight. No difference between 10% and 15% four weeks post-bleaching.
  Matis et al., Quint Int 31:303-310;2000
  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. 20% CP or 7.5% used 1 hr twice daily produces same lightness as 10% CP overnight.
  Mokhlis et al., J Am Dent Assoc 131:1269-1277;2000
- CP has same bleaching capacity as HP at comparable concentrations.
- Color reversal plateaus between 1 and 4 weeks post-bleaching.
-Procedure for making tray:
  Make stone model
  Reduce to approximately one inch high
  Place resin using palm method
  Vacuum form plastic (allow to droop 1 inch, cool model on platform)
  Gross reduction on model
  Finer reduction on model
  Lift tray off model
  Trim to cervical margin (indicated by transparent area)
  Reverse directions on trimming

-Instructions for use:
  Thoroughly brush teeth
  Express agent into reservoirs
  Seat tray and express excess
  Brush off excess
  Rinse twice with water
  Remove residual gel after removing tray in morning

Histological changes after bleaching
-Minor 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
-Penetration of the pulp chamber by carbamide peroxide bleaching agents occurs very rapidly, within fifteen minutes.
  Cooper et al., J Endo18:315-17;1992

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
-About 50% of the patients will have some tooth sensitivity
-To reduce tooth sensitivity:
  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
-Sodium Lauryl Sulfate, a foaming agent in toothpaste, may cause gingival irritation or aphthous ulcers.
-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.

Effects on teeth
-Caries susceptibility does not increase with bleaching. Use of PF reduces caries susceptibility.
  Al-Qunaian, Op Dent 30:265;2005
-10% CP has shown to cause minimal microhardness (Knoop) changes with \textit{in situ} studies in enamel.
  Araujo et al., J Esthet Restor Dent 15:166-173;2003
-Adhesion of resin composite to bleached enamel is lower for up to two weeks after bleaching.
  Titley et al., J Endo 19:112-15;1993
Degradation
-Rapid initial degradation of carbamide peroxide agent and then it slows down.
  87% of agent recoverable after 15 seconds \textit{in vivo}
  66% of agent recoverable after 1 hour \textit{in vivo}
  53% of agent recoverable after 2 hours \textit{in vivo}
  31% of agent recoverable after 4 hours \textit{in vivo}
  18% of agent recoverable after 6 hours \textit{in vivo}
  6% of agent recoverable after 10 hours \textit{in vivo}
  Matis et al., J Am Dent Assoc 130:227-235;1999
-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
-No clinical difference in degradation of various concentrations of CP or with or without reservoirs however trays without reservoirs have greater physical loss of product, which is probably ingested.
  *Matis et al., Op Dent 27:12-18;2002
-With short term use no difference in clinical lightening of teeth with or without reservoirs
  *Matis et al., Op Dent 27:5-11;2002
-More rapid degradation of hydrogen peroxide
  61% of agent recoverable after 5 minutes \textit{in vivo}
  56% of agent recoverable after 10 minutes \textit{in vivo}
  49% of agent recoverable after 20 minutes \textit{in vivo}
  44% of agent recoverable after 30 minutes \textit{in vivo}
  38% of agent recoverable after 45 minutes \textit{in vivo}
  32% of agent recoverable after 60 minutes \textit{in vivo}
  Al-Qunaian et al., Op Dent 28:236-241;2003
-How long to use agent. Usually two weeks (but I have bleached yellow teeth for two months).
-Rebleaching should be done when needed, about every 1-3 years
-How fast? One day of rebleaching for every 5-7 days of initial bleaching.
-How long does tooth whitening last?
  Leonard et al., J Esthet Rest Dent 15:142-152;2003
-Is overbleaching to be avoided? Yes, it may cause teeth to turn gray.
-“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 10mg. Includes safety factor of 100.

-Excellent article entitled “Biological Properties of Peroxide-containing Tooth Whiteners” is available.
  Li, Food and Chemical Toxicity 34;887-904;1996
  Matis, Op Dent 27;103;2002 Book reviewed

Over the counter whitening toothpaste
-Lighten teeth, but very slowly.
-Whitening toothpaste decreased reversal of color that happens after vital tooth bleaching.
Over the counter whitening gels
- They can be divided into Stock Trays, Strips, Paint-on, Wraps and Tray-in-tray products.
- Many whitening products are appearing on the shelves with various concentrations of HP and CP
  Matis, Compendium 24(4A):354-362;2003
- Most research on Over-the-counter products have been accomplished by manufacturers.
  Hanning et al., Am J of Dent 18:13;2004
- How much peroxide is found in saliva? Depends on how it is used.
  Hanning et al., Am J of Dent 18:13;2004
- What is their effectiveness in bleaching? For six Vita tab changes; Strips (30 min)=31 cycles,
  At-home (8 hours)=7 cycles, In-office (15 min)=3 cycles.
  Aushill et al., Op Dent 30:156;2005
- Whitening wraps were more effective than Whitestrips Premium.
  *Matis et al., Op Dent 30:588;2005
- When patients ask about over-the-counter bleaching I tell them:
  Gel is usually higher percentage than recommended.
  It is entry level bleaching
  Works, but not as well as tray bleaching
  ADA accepts only 3 products. All have 10% CP.
  Comparison of studies is very difficult. Different criteria, instruments and personnel are used.
  At IUSD we have completed 12 studies, most of which are published or will soon be published.
  The At-home gels are used for two weeks in all studies reported.

Summary and Conclusions

1) 98% of patients are “very satisfied” or “somewhat 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) 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.
5) Daytime bleaching for one hour a day takes twice the concentration to obtain the same
   bleaching effect as overnight bleaching.
6) Trays need to be made carefully so they fit well.
7) Show patients how to use product so they do not waste or ingest bleaching agent.
8) 10% CP has been shown histologically to cause minor but reversible changes in the pulp.
9) Tooth sensitivity can be reduced by using potassium nitrate, reducing frequency of bleaching or
   bleaching for shorter periods during the daytime.
10) Tissue sensitivity can be reduced by trimming the tray length and/or removing the product from
    off the tissues.
11) Caries susceptibility does not increase with bleaching.
12) Most studies show microhardness stays the same after bleaching.
13) Resin restorations should not be placed for up to two weeks post-bleaching.
14) Restorative materials do not degrade during bleaching.
15) After two hours about 50% of the initial concentrations of carbamide peroxide is remaining
    when reservoirs are used. Less amount of active agent is remaining if reservoirs are not used.
16) Patients will ingest 50% more peroxide when trays are used without reservoirs.
17) Not a lot of active agent is used during the bleaching process.
18) Reservoirs are needed for overnight bleaching.
19) After 20 minutes about 50% of the initial active hydrogen peroxide is remaining in trays.
20) Whitening toothpastes have the ability to slow reversal of tooth whitening.
21) Whitening Stock Trays, Strips, Paint-ons, Wraps and Tray-in-tray products not as effective as
    tray bleaching.
Part 3 Clinical Cases: The Test is in the Taste

1) 4 year old who fell down, traumatizing deciduous central incisors, which were bleached for a total of 47 hours.
2) 19-year-old male, endodontically treated #8, placed glass ionomer plug, bleached internally and externally for 2 weeks each. Followed for 2 months post-bleaching.
3) 36-year-old female, trauma caused discoloration of tooth #8, no periapical pathology, bleached 6 weeks. Followed for 4 months post-bleaching.
4) 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.
5) 62-year-old female bleached mandibular teeth 6 weeks. Followed for 2 months post-bleaching.
6) Lightened stained craze line on left central incisor on 66-year-old female. Followed for 4 months post-bleaching.
7) Hypocalcified area was bleached for 14 days, white spot lightened rapidly then returned to original color after cessation of bleaching.
8) Unhappy person who was dissatisfied with vital bleaching and decided on veneers.

Stubborn stains
- Remove fluoride staining, a post eruptive stain in enamel, three ways:
  - Beaching, micro abrasion with HCl acid, and/or use bur to remove stain
    Croll, J Am Dent Assoc 128:S45-S50;1997
  - Remove tetracycline staining, a pre-eruptive stain in dentin, usually with bleaching
  - Traditional tetracycline staining classification
    Jordan and Boksman, Comp Cont Ed 5(10):803-808;1984

- New classification for tetracycline stained teeth and total percentage of teeth in each class:
  1) Homogenous staining (50%)
  2) Incisal staining (14%)
  3) Cervical staining (19%)
  4) Bands of staining (17%)

- Professionally rated esthetical results of six months treatment of tetracycline staining:

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<th>Homogenous</th>
<th>Incisal</th>
<th>Cervical</th>
<th>Bands</th>
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<td>Excellent</td>
<td>58%</td>
<td>86%</td>
<td>10%</td>
<td>56%</td>
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<tr>
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<td>38%</td>
<td>0</td>
<td>70%</td>
<td>33%</td>
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<tr>
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<td>4%</td>
<td>14%</td>
<td>20%</td>
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Matis et al. Quint Int 33:645-655;2002

Clinical Cases
1) Right 15%--Left 20%
2) Right 10%--Left 20%
3) Right 20%--Left 15%
4) Right 20%--Left 15%
Summary and Conclusions

1) Teeth can be lightened to match a crown that has been placed previously, many years ago.
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 open during bleaching.
   Seal orifice with glass ionomer as resin will not adhere well to cavosurface area.
4) Anytime dentin is dark bleaching will work, but it takes longer.
5) Light spots in some teeth turn lighter very rapidly but reverse to original lightness.
6) Other teeth develop white spots during bleaching which indicate less dense enamel areas.
   These white spots disappear after bleaching is discontinued.
7) Use bleach as long as teeth continue to lighten.
8) Teeth will rebleach 5 times faster than they initially bleach.
9) Staining depends on stain quotient of patients. Usually lasts 6 months to 3 years.
10) Bleaching usually removes fluorosis and it does not return.
11) Some teeth with tetracycline staining may take longer than six months to lighten, especially in the cervical area.
12) More than 50% of the tooth lightening in fluorosis cases occurred did so in the first month.
13) Few of the subjects had sensitivity. Most of the sensitivity was on the sides using 15% and 20%.
14) Ten percent CP lightened teeth almost as rapidly as the 15% and 20%.

End of Course   Thank you for your attention

* Means articles are available on Dr Matis’ web site- www.bamatis.com
**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.

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.)

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 rebleach one day for each 5-7 days you originally bleached.

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.)

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 three 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.

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.