New Tooth Bleaching Research*

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Part 1 Need for Bleaching and In-office Bleaching

Introduction

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

-Respondents' satisfaction with In-office bleaching:
Very satisfied 16%, Satisfied 32%, Unsatisfied 23%, Very unsatisfied 5%
CRA Newsletter 29(10):2;2005

-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	PolaOfice 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 Boost	PolaOffice	Rembrandt Lighten Plus
LumaArch	Niveoous	LaserSmile
Zoom!		

CRA Newsletter 28:1;2004

-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.
*Yap et al. Op Dent 27:137-141;2002
*Wattanapayungkul 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 (accepted for publication)

Part 2 At-home Bleaching- The Science

At-home Bleaching

-Respondents' satisfaction with At-home bleaching:
Very satisfied 49%, Satisfied 45%, Unsatisfied 1%, Very unsatisfied 1%
CRA Newsletter 29(10):2;2005

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

-There appears to be an "inherent lightness potential" of teeth.

-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.
Opalescence Whitening Gel **10% CP**
Colgate Platinum Daytime Professional Whitening System **10% CP**
http://www.ada.org/ada/seal/adaseal_consumer_shopping.pdf, October 2007
-Scandinavian Institute of Dental Materials has also recommended "to avoid using concentrations higher than 10% carbamide peroxide".
Dahl & Pallesen Crit Rev Oral Biol Med 14:229;2003

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.
-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.

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
-Causes of loss of recoverable agent are a combination of 1) absorbent tooth (13%), 2) physical loss of agent, 3) anti-oxidant degradation, 4) Increased temperature 5) product degradation
*Matis, Compendium 24(SI4A):354-362;2003

Histological changes after bleaching
-Minor histological changes that were observed with 10% CP used overnight are considered to be reversible.
Gonzalez-Ochoa., Masters Thesis IUSD 2002

Effects on teeth
-Study *in vivo* completed recently showed no changes in microhardness and shear bond strength returned to baseline values in two weeks.
*Metz et al., Op Dent 32(5) 427:2007

-Why not place resin immediately after bleaching?

a) Cannot bond properly because of oxygen inhibition.

b) Cannot color match because color reversal will occur.

PF and ACP

-Both potassium nitrate (PF) and amorphous calcium phosphate (ACP) are effective in bleaching agents.

*Matis et al., Op Dent 32:549;2007

-PF and CPP-ACP are equally effective desensitizing agents.

Duan et al. Op Dent (submitted for publication)

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

*Al-Qunaian, Op Dent 30:265;2005

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.

Effectiveness of systems

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

*Figures 1, 2; *Attachment 1, 2

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 down, 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) 66-year old female with dark streak in tooth #9 was bleached and resin placed in area.

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 get 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

-Bleaching is time and concentration dependent.

-Never promise results but help patients understand the possibilities.

* Information available on Dr Matis' web site.

My prescription for successful and safe tooth whitening:
Place 10% CP agent into tray with reservoirs and use it overnight!

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 use life is 18 months if kept 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 two 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.

Figure 1: Mean Delta Shade of Products Evalutated at Clinical Research Section at IU School of Dentistry

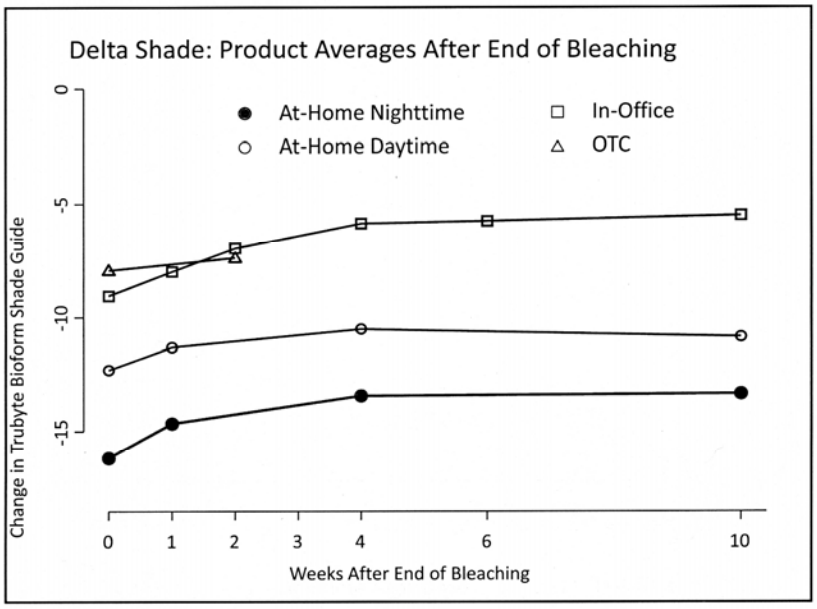
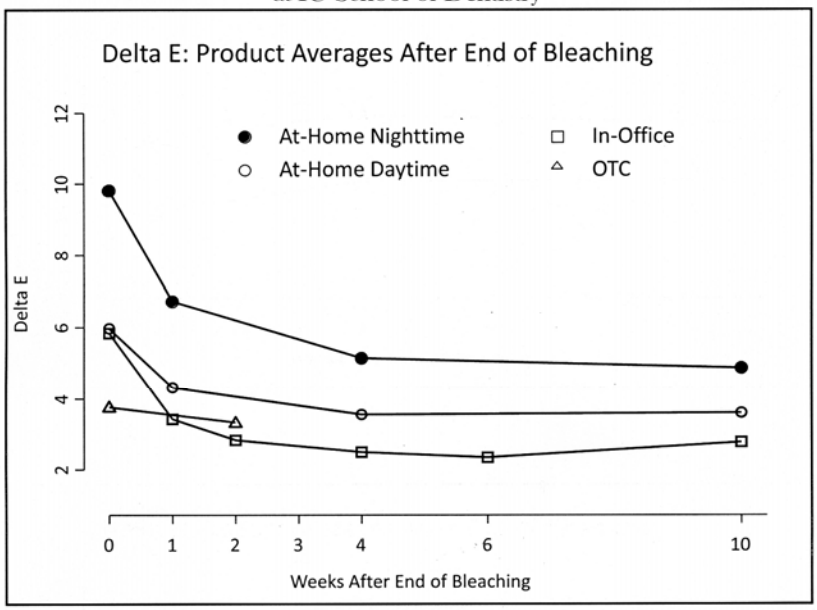


Figure 2: Mean Delta E of Products Evalutated at Clinical Research Section at IU School of Dentistry



Attachment 1. References to Studies Conducted at Clinical Research Section, Indiana University School of Dentistry

At-Home Bleaching/Professionally Prescribed/Overnight

1. Matis BA, Cochran MA, Eckert G, Carlson TJ (1998) The efficacy and safety of a 10% carbamide peroxide bleaching gel *Quintessence International* **29(9)** 555-563.

2. Matis BA, Mousa HN, Cochran MA, Eckert GJ (2000) Clinical evaluation of bleaching agents of different concentrations *Quintessence International* **31(5)** 303-310.

3. Matis BA, Cochran MA, Eckert GJ (2007) *In vivo* study of Carbamide peroxide with two different desensitizing agents *Operative Dentistry* **32(6)** 549-556.

At-Home Bleaching/Professionally Prescribed/Nightime and In-Office Bleaching

4. Zekonis R, Matis BA, Cochran MA, Al Shetri SE, Eckert GJ, Carlson TJ (2003) Clinical evaluation of in-office and at-home bleaching treatments *Operative Dentistry* **28(2)** 114-121.

At-Home Bleaching/Professionally Prescribed/Daytime

5. Panich M (1999) *In vivo* evaluation of 15-percent carbamide peroxide and 5.5-percent hydrogen peroxide whitening agent during daytime use [Thesis] Indianapolis, IN: Indiana University, School of Dentistry.

6. Matis BA, Hamdan YS, Cochran MA, Eckert GJ (2002) A clinical evaluation of a bleaching agent used with and without reservoirs *Operative Dentistry* **27(1)** 5-11.

7. Mokhalis GR, Matis BA, Cochran MA, Eckert GJ (2000) A clinical evaluation of carbamide peroxide and hydrogen peroxide whitening agents during daytime use *Journal of the American Dental Association* **131(Sep)** 1269-1277.

In-Office Bleaching

8. Shethri SA, Matis BA, Cochran MA, Zekonis R, Stropes M. (2003) A clinical evaluation of two in-office bleaching products *Operative Dentistry* **28(5)** 488-495.

9. Matis BA, Cochran MA, Franco M, Al-Ammar W, Eckert GJ, Stropes M (2007) Eight in-office bleaching systems evaluated *in vivo*: A pilot study *Operative Dentistry* **32(4)** 324-329.

At-Home Bleaching/Over-the-counter

10. Matis BA, Cochran MA, Wang G, Franco M, Eckert GJ, Carlotti RJ, Bryan C (2005) A clinical evaluation of bleaching using whitening wraps and strips *Operative Dentistry* **30(5)** 588-592.

Attachment 2. Products, concentration, subject number, bleaching, time of bleaching, post bleaching and length of studies.

Study #	Products	Concentration	N	Bleaching	Time of Bleach	Post Bleaching	Length of Study
1	Opalescence	10% CP	30	2 Weeks	Overnight	22 Weeks	24 Weeks
	Placebo	0% CP	30	2 Weeks	Overnight	22 Weeks	24 Weeks
2	Opalescence	10% CP	25	2 Weeks	Overnight	4 Weeks	6 Weeks
	Opalescence	15% CP	25	2 Weeks	Overnight	4 Weeks	6 Weeks
3	Opalescence	15% CP + PF	32	2 Weeks	Overnight	10 Weeks	12 Weeks
	Nite White	16% CP +ACP	32	2 Weeks	Overnight	10 Weeks	12 Weeks
4	Opalescence	10% CP	20	2 Weeks	Overnight	10 Weeks	12 Weeks
	StarBrite	35% HP	20	2 Weeks	2-3X10 Min	10 Weeks	12 Weeks
5	Opalescence	15% CP	25	2 Weeks	2X30 Min	4 Weeks	6 Weeks
	Day White	5.5% HP	25	2 Weeks	2X30 Min	4 Weeks	6 Weeks
6	Rembrandt Xtra	15% CP	27	2 Weeks	2 Hours	10 Weeks	12 Weeks
	Rembrandt Xtra	15% CP	27	2 Weeks	2 Hours	10 Weeks	12 Weeks
7	Opalescence	20% CP	24	2 Weeks	2X60 Min	10 Weeks	12 Weeks
	Day White	7.5% HP	24	2 Weeks	2X60 Min	10 Weeks	12 Weeks
8	Opalescence Xtra B	35% HP	20	1 Hour	In chair	11 Weeks	11 Weeks
	Opalescence Xtra B	38% HP	20	1 Hour	In chair	11 Weeks	11 Weeks
9	Accelerated	40% HP	4	15 Min	In chair	6 Weeks	6 Weeks
	ArcBrite	30% HP	4	1 Hour	In chair	6 Weeks	6 Weeks
	BriteSmile	15% HP	4	1 Hour	In chair	6 Weeks	6 Weeks
	Illumine	15% HP	4	1 Hour	In chair	6 Weeks	6 Weeks
	Niveous	27% HP	4	45 Min	In chair	6 Weeks	6 Weeks
	One-Hour Smile	35% HP	4	45 Min	In chair	6 Weeks	6 Weeks
	PolaOffice	35% HP	4	36 Min	In chair	6 Weeks	6 Weeks
	Zoom!	25% HP	4	1 Hour	In chair	6 Weeks	6 Weeks
10	Whitestrip Supreme	10% HP	25	1 Week	2X30 Min	2 Weeks	3 Weeks
	Ranir Wrap	8% HP	26	1 Week	2X30 Min	2 Weeks	3 Weeks
	Ranir Wrap	8% HP	25	1 Week	30 Min	2 Weeks	3 Weeks