

# State of the Art of Bleaching in Resorative Dentistry\*

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## 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”.

### Goal is to remove stain

- Extrinsic—Stain, which is deposited 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.  
Tooth whiteners also 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).  
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 Southern Dental Industries  
One Hour Smile by Den-Mat Corp      Zoom! by Discus Dental  
\*Matis et al., Op Dent 28:324;2007
- Effectiveness of In-office products evaluated with and without use of light.  
Opalescence Xtra Boost                      PolaOffice                      Rembrandt Lighten Plus  
LumaArch                                      Niveous                          LaserSmile  
Zoom!  
One-year recall shows that light use does not increase whitening over non-light use.  
CRA Newsletter 28(6):1-2;2004
- No effect on enamel micromorphology when 38% HP used in an *in vivo* study on teeth.  
Cadenaro et al., Op Dent 33(2):127-134;2008
- Recommend any In-office treatment be followed up with At-home treatment

### Summary and Conclusions

- 1) 48% of patients are “very satisfied” or “somewhat satisfied” with In-office tooth bleaching.
- 2) The more we cut tooth, the more we weaken tooth.
- 3) Main purpose of whitening agents is to remove intrinsic staining.
- 4) Considerable tooth lightening occurs but there is also a reversal of color 1-2 weeks post-bleaching.
- 5) Light activation does not appear to increase tooth lightening effect of bleaching.
- 6) Micro morphology and surface smoothness is not affected with bleaching.
- 7) Follow In-office bleaching with use of At-home tray whitening gel.

## 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 29:2;2005

### Concentrations to use

- 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.  
Opalescence Whitening Gel **10% CP**  
Platinum Daytime Professional Whitening System **10% CP**  
[http://www.ada.org/ada/seal/adaseal\\_consumer\\_shopping.pdf](http://www.ada.org/ada/seal/adaseal_consumer_shopping.pdf), October 2007

### Studies to review effectiveness of whitening agents

- 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.

### 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

### 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?  
Cannot bond properly because of oxygen inhibition internally.  
Cannot color match because color reversal will occur.

## 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 130:227-235;1999

-More rapid 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 et al., Op Dent 28:236-241;2003

## Over the counter tooth whitening agents

-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 2 products. Both have 10% CP.

-Review of bleaching-compared 9 studies from IUSD printed in peer reviewed literature

Matis et al. Op Dent (submitted)

## Summary and Conclusions

- 1) 98% of patients are “very satisfied” or “somewhat satisfied” with At-home tooth bleaching.
- 2) Only 10% carbamide peroxide bleaching agents are accepted as “safe” and “effective”.
- 3) 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.
- 4) Trays need to be made carefully so they fit well.
- 5) 10% CP has been shown histologically to cause some minor but reversible changes in the pulp.
- 6) Microhardness stays the same after bleaching.
- 7) Shear bond strength is reduced with bleaching, but returns to baseline in 2 weeks postbleaching.
- 8) Resin restorations should not be placed for up to two weeks post-bleaching.
- 9) 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.

- 10) After 20 minutes about 50% of the initial active hydrogen peroxide is remaining in trays.
- 11) Systems from most to least effective: At-home nighttime, At-home daytime, In-office, Over-the-counter.

### **Clinical Cases: The End Result**

- 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) 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.
- 4) Lightened stained craze line on left central incisor on 66-year-old female. Followed for 4 months post-bleaching
- 5) Hypocalcified area was bleached for 14 days, white spot lightened rapidly then returned to original color after cessation of bleaching.
- 6) Unhappy person who was dissatisfied with vital bleaching and decided on veneers.

### **Summary and Conclusions**

- 1) In discolored asymptomatic teeth without periapical pathology bleach without root canal treatment.
- 2) 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.
- 3) Light spots in some teeth turn lighter very rapidly but reverse to original lightness.
- 4) Other teeth may develop whiter areas during bleaching which indicate less dense enamel areas. These areas disappear after bleaching is discontinued.
- 5) Use bleach until cuspids become as light as the incisors.

\* Articles are available on Dr Matis' web site- [www.bamatis.com](http://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 remains at full strength 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.**

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

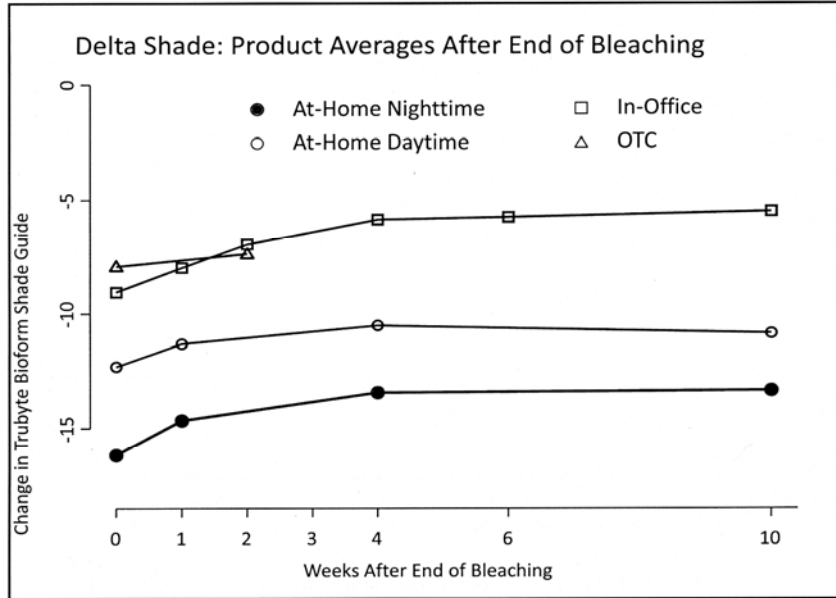
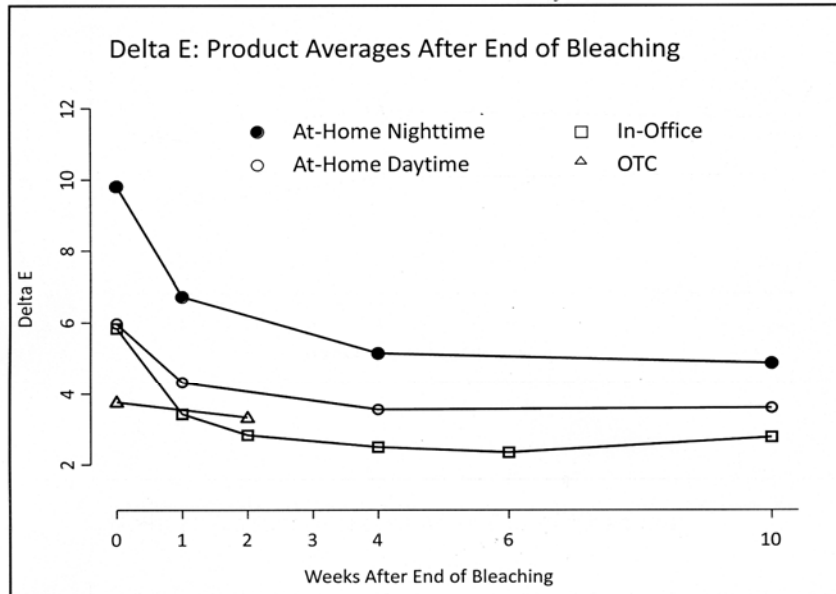


Figure 2: Mean Delta E of Products Evaluated at Clinical Research Section at IU School of Dentistry



**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/Nighttime 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. 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.
6. 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**

7. 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.
8. Matis BA, Cochran MA, Franco M, Al-Amman 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**

9. 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.

<u>Study #</u>	<u>Products</u>	<u>Concentration</u>	<u>N</u>	<u>Bleaching</u>	<u>Time of Bleach</u>	<u>Post Bleaching</u>	<u>Length of Study</u>
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	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
6	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
7	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
8	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
9	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