Evidence Based Tooth Whitening

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The objective of this presentation is to increase your understanding of tooth whitening. We will do this by reviewing the **clinical studies** in the scientific literature that has been published. The presentation has been divided into six sections. They are:

Introduction	Pulpal concerns
Material concerns	Effectiveness of systems
Tooth concerns	Clinical Cases

Introduction

-Why learn about tooth whitening?

--Restorative Dentistry is changing. "The more we cut tooth, the more we weaken tooth."

-How do we present it to our patients without insulting them?

--To promote bleaching have posters, offer staff bleach or discuss color at restorative appointment. Ask "How do you like your smile?" or "Are you pleased with the color of your teeth".

--Listen, evaluate, discus bleaching with patients. Beware of patients with unrealistic expectations.

-What are the two kinds of stains that develop?

--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.

-There are six major systems, three are At-Home and three are In-office system. (Discuss only 3)

--At-home bleaching (overnight and daytime) in a custom made tray

---Advantages-Lower tooth sensitivity, more long term effectiveness, less peroxide ingestion.

---Disadvantages-Takes longer to lighten teeth, takes time to fabricate tray.

--At-home with over-the-counter bleaching kits

---Examples of such products Whitestrips, Whitening Wraps, Tray-in-tray, Paint-On)

---Advantages-Less expensive, no doctor visits

---Disadvantages-Not as effective, higher ingestion of peroxide, higher concentration than recommended

--In-office bleaching "power bleaching"

---Some use halogen, LED or proprietary lights

---Advantages-Rapid initial tooth whitening; no gel ingested.

---Disadvantages- Greater sensitivity; rapid reversal of tooth whitening; "burning" of soft tissues if agent reaches gingiva.

--In office bleaching of discolored spots "microabrasion"

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

---Disadvantages- Must use rubber dam as agent is caustic (removes from 8-22 microns per application), works only on superficial stains

--In office bleaching single dark tooth "walking bleach"

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

---Disadvantages-Need to see patients several times, difficult to seal lingual, requires entry into the pulp chamber plus 2mm into canal space

- American Dental Association has an acceptance program for materials.
    --First guideline on safety and efficacy of bleaching agents was issued in 1994.
        J Am Dent Assoc 125:1140-42;1994
    --Efficacy standard was revised in 2006.
    --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 April 2011

Material Concerns

-Hydrogen peroxide is active agent. Breakdown: 10% CP=3.3% HP+6.7% Urea;
HP=Oxygen + Water; Urea=Ammonia + Carbon Dioxide
-How long is the carbamide peroxide bleaching gel active after placement?
    --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

Tooth Concerns

-Is there loss of adhesion 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.
-Is there a loss of microhardness?
    --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 used in an *in vivo* study on teeth.
        Cadenaro et al., Op Dent 33(2):127-134;2008
-Is there an increase in caries susceptibility?
    --Use of PF will make tooth more resistant to caries.
        Al-Qunaian, Op Dent 30:265;2005

Pulpal Concerns

-Does peroxide placed on the tooth during cause histological changes to the pulp?

--Mild 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. Op Dent 29(4):363-368;2004

-Will discomfort occur during tooth whitening?

--Patient may have one of two different kinds of discomfort: Tooth or Gingival sensitivity.

---Tray alone causes tooth sensitivity in 20% of patients, add placebo agent and 36%% report tooth sensitivity, use 10% CP active agent and 69% report tooth sensitivity, use 16% CP and 92% report tooth sensitivity.

Leonard, Whitening Symposium 2010

-What can be done to reduce tooth and tissue sensitivity?

--Tooth sensitivity

---To reduce tooth sensitivity

----Have patient begin using toothpaste for "sensitive teeth" two weeks before initiation of bleaching.

----Have patient use agent with potassium nitrate 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

--Tissue sensitivity

---To reduce tissue sensitivity, have patient more effectively remove excess bleaching agent that comes out of the tray during placement and insure tray trimmed shy of cervical collar of gingiva.

Effectiveness of various concentrations and systems

-How effective are the In-office systems?

--*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

--Does light use improve the effectiveness of the In-office systems?

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

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

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

CRA Newsletter 27(3):3;2003

-Use of 10% CP for shorter time periods can decrease tooth sensitivity.

Cardoso et al. J Am Dent Assoc 141:1213-1220;2010

-Summary of effectiveness

--Nine studies with 26 products with both subjective and objective evaluations

---At-home nighttime in tray with reservoirs is most effective system

---At-home daytime in tray is next most effective system

---Over-the-counter is next most effective system

---In-office bleaching the least effective system unless followed by at-home

Matis et al. Op Dent 34:230-235;2009

Odds and Ends

-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?
--Depends on the person

Clinical Cases

19-year-old male, endodontically treated tooth #8, placed glass ionomer plug, bleached internally and externally for 2 weeks each. Followed for 2 months post-bleaching.

36-year-old female, trauma caused discoloration of tooth #8, no periapical pathology, bleached 6 weeks. Followed for 4 months post-bleaching

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.

62-year-old female bleached mandibular teeth 6 weeks. Followed for 2 months post-bleaching.

Lightened stained craze line on tooth #9 on 66-year-old female. 4 months post-bleaching

Hypocalcified area was bleached for 14 days, white spot lightened rapidly then returned to original color after cessation of bleaching.

Unhappy person who was dissatisfied with vital bleaching and decided on veneers.

Fluoride stain removal using bleaching on a 28 year old.

Tetracycline stain removal in a study accomplished in the China
--Not all tetracycline staining can be bleached
--Cervical area stain removal most challenging to remove
Matis et al., Quint Int 33:645;2002
--Clinical case of bleaching tetracycline stained teeth

Never promise results but help patients understand the possibilities!