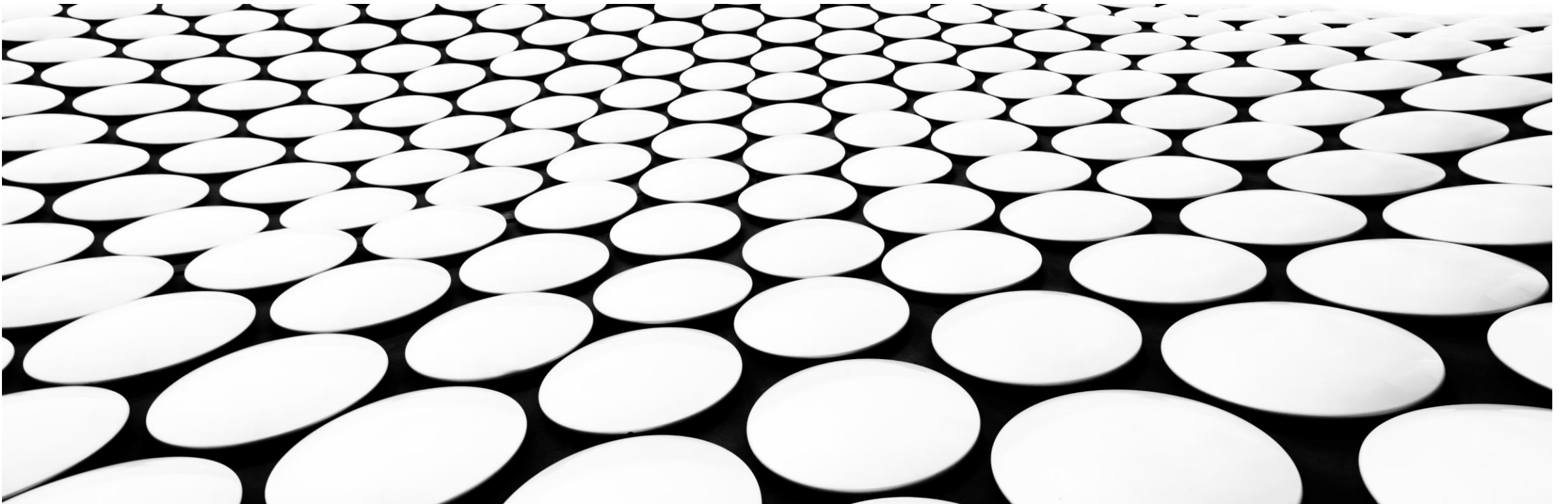


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# **NEW YORK CITY COLLEGE OF TECHNOLOGY**

## **TEETH WHITENING-DENTAL MATERIALS**

DR. ANDREW MOSHMAN & MAUREEN ARCHER-FESTA & PROF. JOANNA CAMPBELL



## WHITENING LEARNING OBJECTIVES

1. Explain the difference between intrinsic and extrinsic stain.
2. List the factors that affect the whitening process.
3. Explain how the whitening process occurs.
4. Differentiate between the three types of whitening systems.
5. Identify indications and contraindications for whitening.
6. Discuss ways in which dental clinicians can prevent or alleviate the side effects that can occur during whitening.
7. Understand how to record shade of the teeth before and after the whitening process
8. Whitening Informed Consent and Documentation

Reading Assignment prior to class:

Wilkins-Vital bleaching

& Chapter 17 Clinical Aspects of Dental Materials

**ARE DENTAL PATIENTS  
INTERESTED IN  
WHITENING THEIR  
TEETH?**



Interesting Business Marketing Research:

- 88% of people who use a whitening toothpaste are desiring whiter teeth
- The majority of Adults believe a smile is one of the most important features when you meet people (99.7%)
- Searches for teeth whitening on the internet per month  $\longrightarrow$  673,000 people/month

## WHAT CAUSES DISCOLORATION OF NON-VITAL TEETH?



Images obtained from google

- Dental trauma leading to Injury to the Pulpal tissue & potential of blood products in between the dentinal tubules
  - Necrotic pulp
  - Internal resorption (pink tooth)
  - History of RCT



Tooth with RCT



Internal resorption

# NON VITAL BLEACHING TECHNIQUES

- Technique: **Internal Bleaching**

(Internal Bleaching is performed on teeth that have a history of Root Canal Treatment)

- Advantages:

- Return tooth to a brighter color after it has turned darker following root canal treatment.

- Disadvantages:

- Takes two appointments

- Have to drill into the tooth.

- Possible to over-bleach

## TOOTH ANATOMY REVIEW

### A Tooth is like a Pencil:

- The Eraser is the Crown
- The Wooden Handle is like the root of the tooth
- The lead filling is the Nerve



# WHAT IS A ROOT CANAL?

A Tooth is like a Pencil:

- The Eraser is the Crown
- The Wooden Handle is like the root of the tooth
- The lead filling is the Nerve

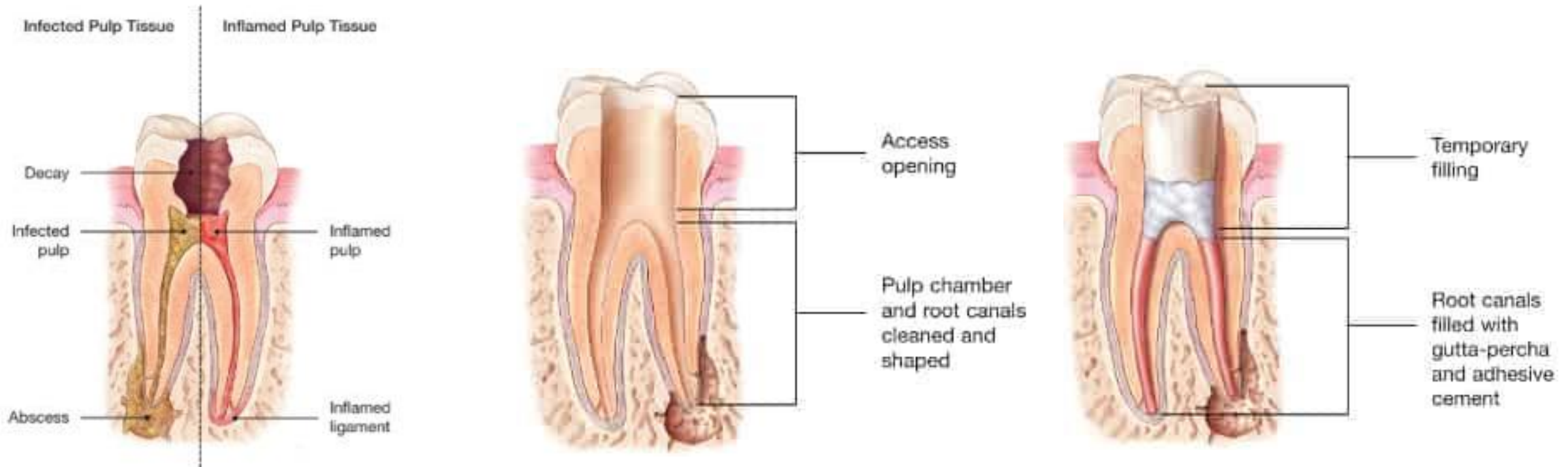
What Happens during a Root Canal?

- During a root canal the inflamed or infected nerve is removed, the inside of the tooth is carefully cleaned and disinfected, then filled and sealed.
- Nerve Removed; Filler Material placed
- The Filler material is called Gutta Percha



# WHAT IS A ROOT CANAL?

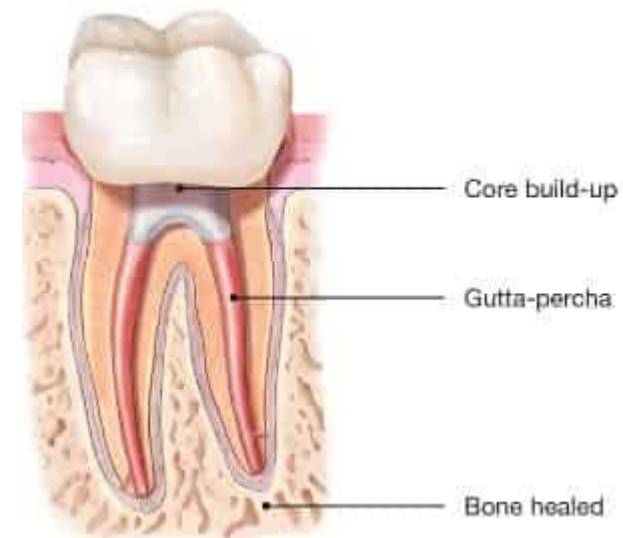
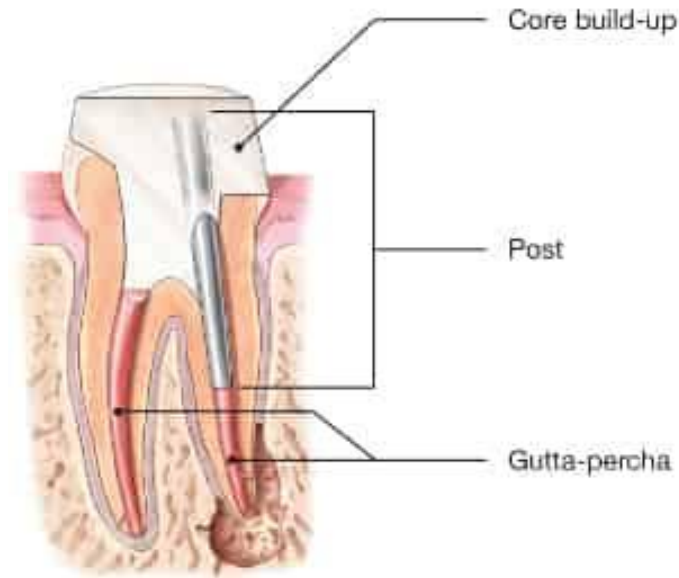
- During a root canal the inflamed or infected nerve is removed, the inside of the tooth is carefully cleaned and disinfected, then filled and sealed.
- Nerve Removed; Filler Material placed
- The Filler material is called Gutta Percha





## WHAT HAPPENS AFTER A ROOT CANAL?

- Posterior teeth require a full coverage crown following root canal treatment due to the increased biting forces.
- First a Core Buildup is placed, then a Permanent crown is fabricated.
- In cases where substantial amount of tooth is missing, instead of just a Core Buildup, a Post and Core Buildup is placed prior to the crown
- Anterior teeth have less biting force and often a simple filling is enough following root canal therapy



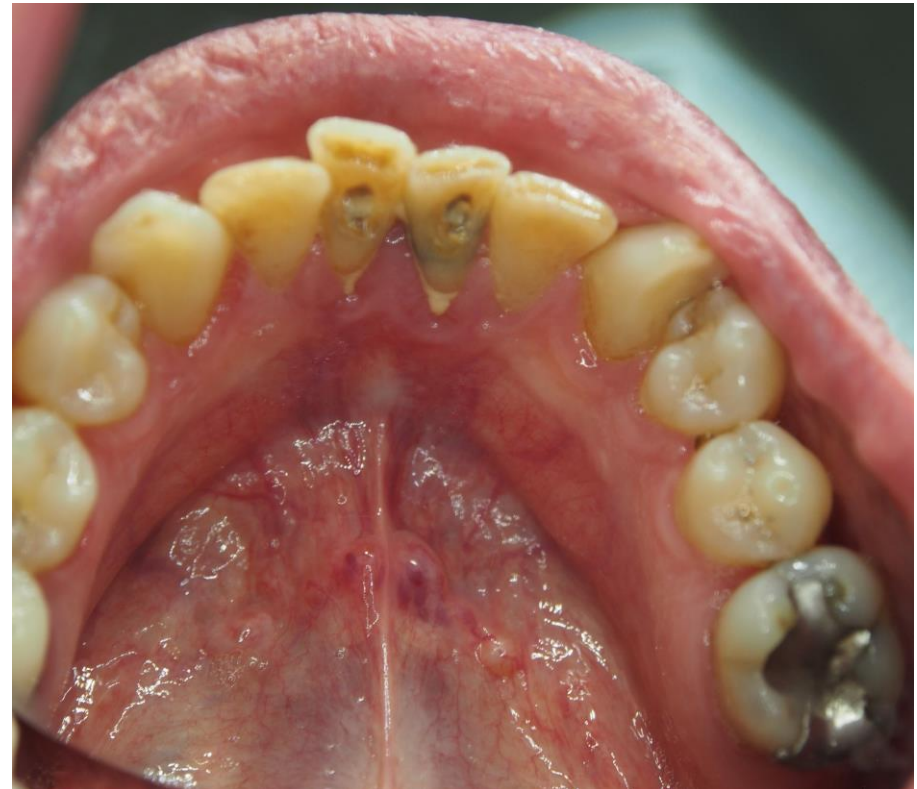
## STAINING AFTER A ROOT CANAL

- On any tooth that has had a root canal treatment, the coronal tooth structure can become darker over time. This will be due to breakdown of the heme products in the pulp chamber
- This will show more on anterior teeth that have not received a full coverage crown
- They will become grey.



# INTERNAL BLEACHING TECHNIQUE

- 1) Access tooth via previous filling until top of gutta percha is reached.
- 2) Place a cotton pellet soaked with Superoxol (35% hydrogen peroxide) and apply heat directly to cotton pellet. Repeat several times
- 3) Place zinc peroxide in pulp chamber. Place cavit temporary filling and wait 1 week.
- Remove temporary filling and zinc peroxide. Place permanent composite.



## INTERNAL BLEACHING #25: BEFORE AND AFTER



## **WHAT CAUSES DISCOLORATION OF VITAL TEETH?**



- Many factors contribute to the discoloration of Vital teeth:
  - Genetic Color of teeth
  - Aging
  - Developmental disturbances :
    - Fluorosis
  - Hereditary conditions:
    - Amelogenesis imperfecta; Dentinogenesis Imperfecta
  - External factors like dietary choices & habits like smoking/drinking red wine/ Betel nut use



## TYPES OF STAINS ON TEETH

- Extrinsic: bound to the surface of the tooth
  - Common Colors:
    - Yellow
    - Green
    - Black line stain (frequently associated with dietary iron intake)
    - Brown (coffee & tea drinkers)
    - Tobacco
    - Antimicrobial rinses (chlorhexidine)
    - Swimmers stain ( orange/brown)
    - Betel/Areca
    - Metallic stains (industrial workers/amalgam leaching )

- Intrinsic: are stains within the tooth structure & cannot be removed by dental hygiene scaling /polishing

Tooth color may be affected **by a combination** of extrinsic and intrinsic stain

## CLINICAL EXAMPLES

Of extrinsic stain



Betel Nut/Areca

Images provided by Dr. Archer

# CLINICAL EXAMPLES

Of extrinsic stain



Black line stain



Brown stain



Swimmers stain



## MANAGEMENT OF EXTRINSIC STAINS

Images obtained from google

- Can be prevented by improved Oral hygiene care
- Can be removed by:
  - Toothpastes with whitening agents
  - Professional prophylaxis (air polishing/engine polishing)



## TOOTH COLOR

**Extrinsic stains** influence tooth color.

- Extrinsic stains appear as colored molecules absorb onto the pellicle or enamel.
- Extrinsic stains are discolorations of the tooth surface which are caused by:
  - tobacco
  - foods/drinks
  - poor oral hygiene

Extrinsic stains can be removed by a professional dental cleaning, and some whitening agents in toothpaste and mouthwash.

# TOOTH COLOR

**INTRINSIC STAINS** RESULT WHEN COLOR PENETRATES BELOW THE SURFACE OF THE ENAMEL & INTO THE DENTIN.

INTRINSIC STAINS ARE DISCOLORATION WITHIN THE TOOTH THAT CAN BE CAUSED BY :

- TETRACYCLINE,
- FLUOROSIS,
- AMALGAM (SILVER FILLINGS)
- TOOTH TRAUMA AND PULPAL NECROSIS
- LIFESTYLE HABITS WHICH CAUSE EXTRINSIC STAIN AND OVER TIME INTRINSIC STAIN ( RED WINE DRINKING/COFFEE/TEA CONSUMPTION/SMOKING)- **CHROMOPHORES**

WITH PROFESSIONALS WHITENING PROCEDURES, WE WILL NEED TO CONSIDER THE DEGREE AND TYPE OF STAINING, AND HOW MUCH TOOTH STRUCTURE REMAINS.

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# KEY TERMS TO KNOW

- **Hue-** The color of the tooth and may include mixtures of colors, such as yellow-brown.
- **Chroma-** The amount or intensity of color present. This is what creates the hue.
- **Value-** The amount of lightness or darkness of the tooth (sometimes described as the grayness of the tooth).
- **Translucency-** The ability of the material to allow light to pass through.

# How Do We See Tooth Color?

## ATOMS & CHROMOPHORES INSIDE OUR ENAMEL

In enamel, large, long-chain natural pigment & stain molecules get trapped within the enamel crystal

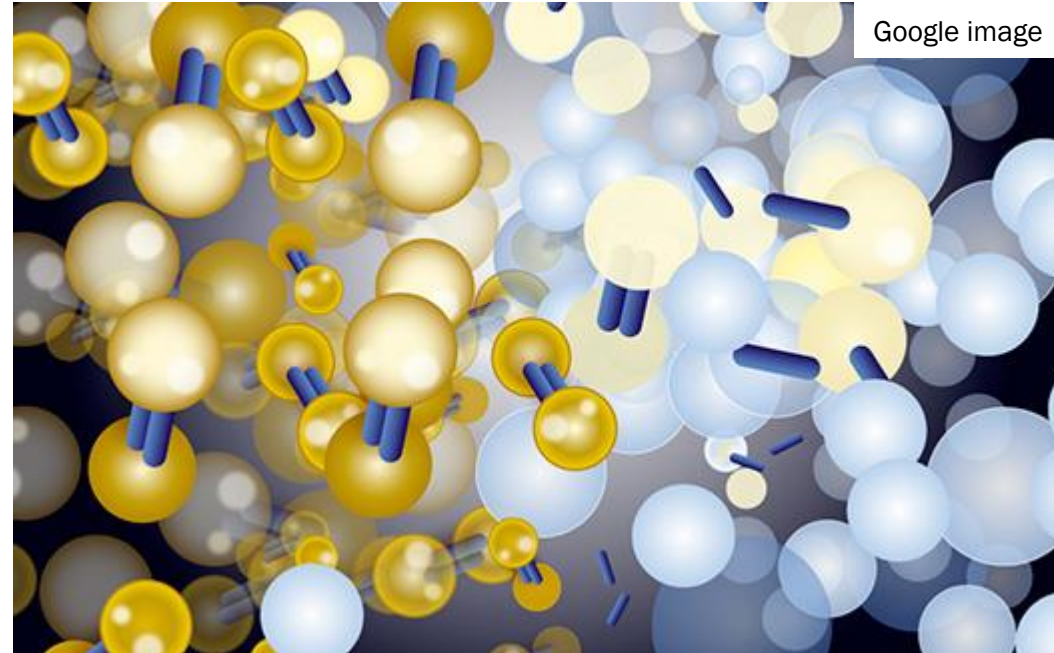
These color molecules consist of an atom are held together by double bonds. The double bonds are called

### Chromophores

Chromophores are responsible for absorbing various wavelengths of light (violet & blue) making the teeth appear to your eye as yellow/brown

When the **double bonds (chromophores)** are broken to **single bonds** the bonds absorb less light and reflect to ur eye as white

Source; Joiner A. Tooth colour: a review of the literature. Journal of Dentistry.2004;32(Suppl.1):3



Double bonds → Single bonds



## **TOOTH COLOR IS AFFECTED BY HOW CHROMOPHORES ABSORB LIGHT WITHIN THE TOOTH**

Chromophores absorb  
Violet & Blue wavelengths  
Making the teeth reflect  
back to our eyes as  
yellow/brownish



Image courtesy of Colgate

**Yellow, Orange & Light Brown Stains Respond Best to the Whitening Process**

**Gray responds the least to the Whitening Process**

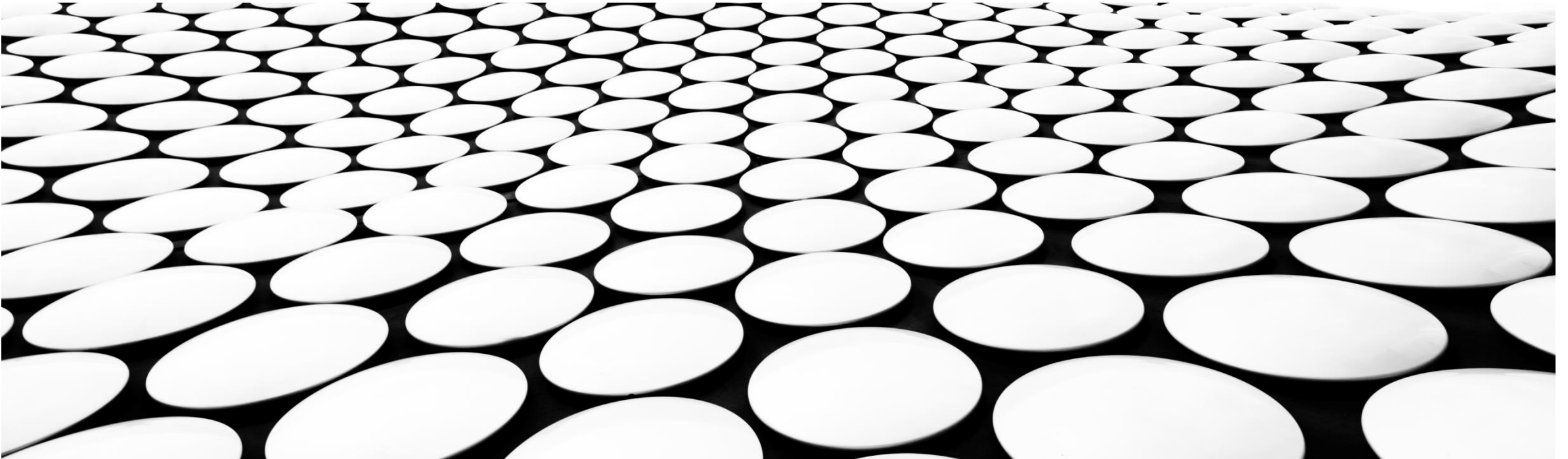


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# TOOTH COLOR

The color of teeth is influenced by a combination of intrinsic color & the presence of extrinsic stain on the tooth surface

However the natural color of a tooth is primarily determined by the underlying dentin

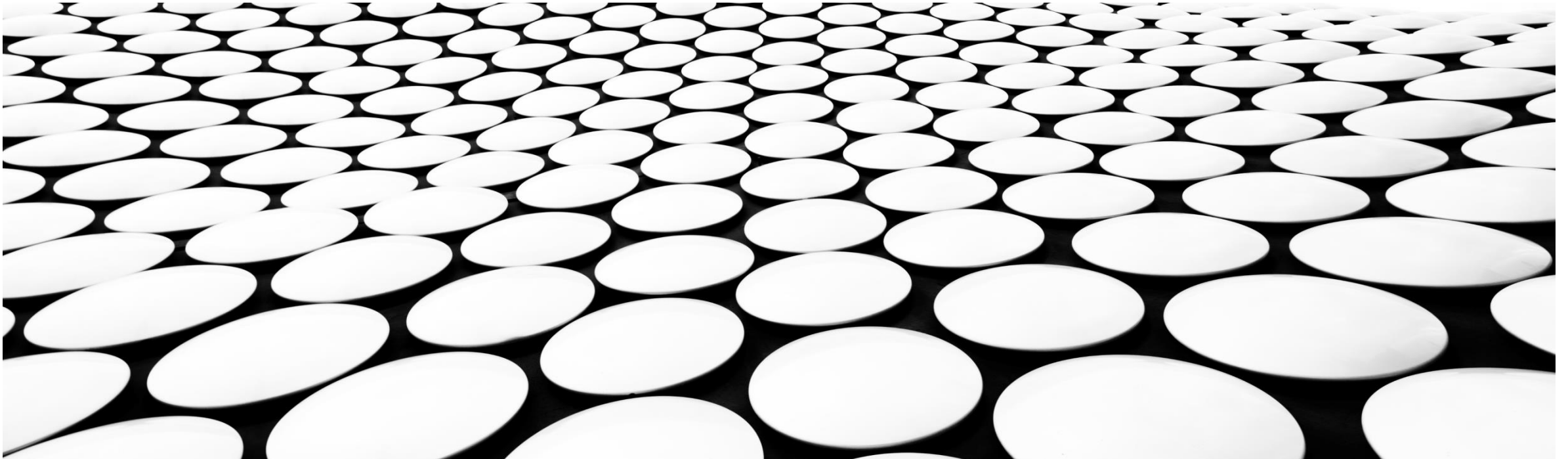


# TOOTH COLOR

The natural color of a tooth is primarily determined by the underlying dentin:

Enamel is a translucent crystal, so the color of the dentin is seen through enamel

The color of teeth is also influenced by the thickness of the enamel and how much dentin color (yellow/gray) reflects through





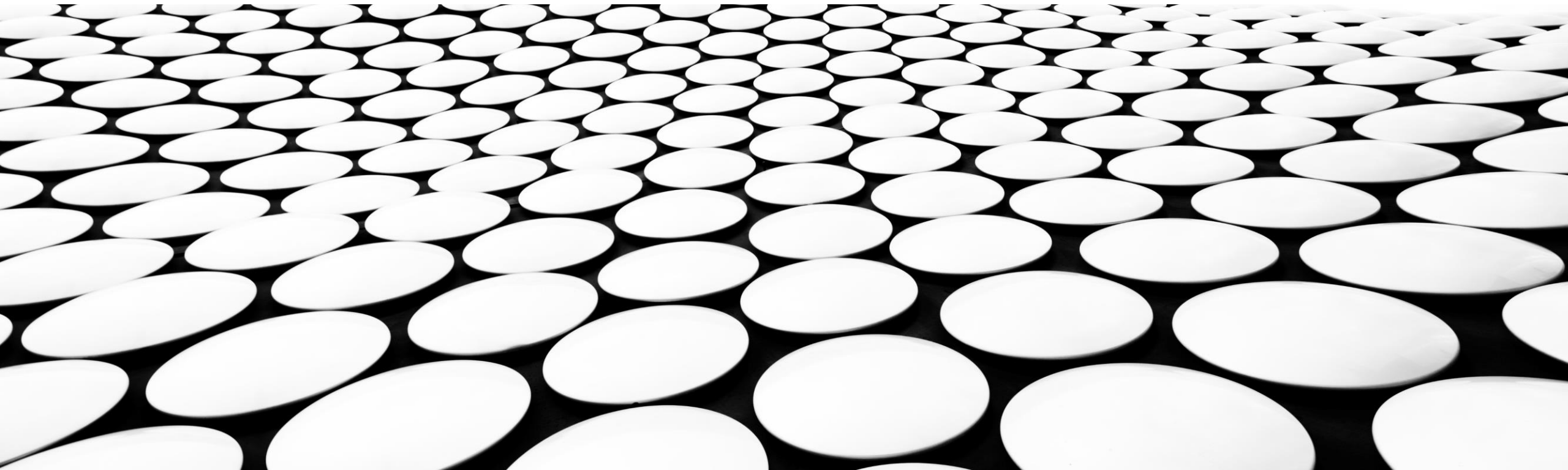
**RECAP SLIDE**



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# TEETH WHITENING

IS A PROCESS THAT LIGHTENS THE INTRINSIC COLOR OF TEETH.  
THE DEGREE OF WHITENESS WILL VARY FROM PATIENT TO PATIENT,  
*THIS PORTION OF THE LECTURE WILL FOCUS ON VITAL TOOTH WHITENING*



## VITAL TOOTH WHITENING

May not be able to solve all teeth that have esthetic issues, some teeth will need a restorative treatment because the discoloration or stain is severe (tetracycline stain).

Restoration of the tooth may be the treatment of choice which can include:

- Full crown

- Facial veneers





## CONTRA- INDICATIONS FOR VITAL TOOTH WHITENING

Patients should not bleach if:

1. Patients with esthetic anterior restorations are not willing to pay for replacement of anterior composite restorations. Must be informed that whitening will not change the appearance (shade) of those restorations.
2. Enamel is cracked or hypoplastic.
3. Mouth is unhealthy (Carious lesions/Periodontal disease)
4. Cervical abrasions, sensitive recession areas, or tooth sensitivity is found.  
Root surface is not bleached
5. No light activated Vital Bleaching systems for the following for any patient who:
  - Undergoing radiation or chemotherapy.
  - Diagnosed with melanoma
  - Using photosensitive drugs or photosensitive herbal remedies.
6. Amalgam stains in dentinal tubules.
7. Discoloration will not respond to Vital tooth bleaching products

# SOMETHING TO CONSIDER...

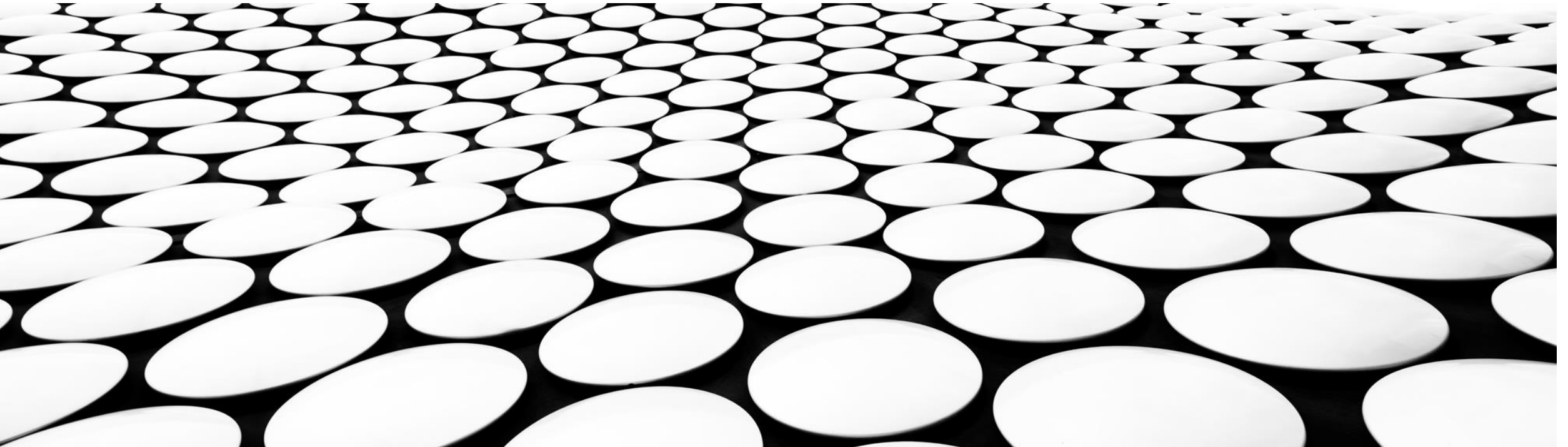


- A patient should wait at least 2 weeks after his or her teeth have been whitened, to have crowns or composites placed, to match the new tooth color. It takes 2 weeks for the color of the teeth to stabilize after whitening.



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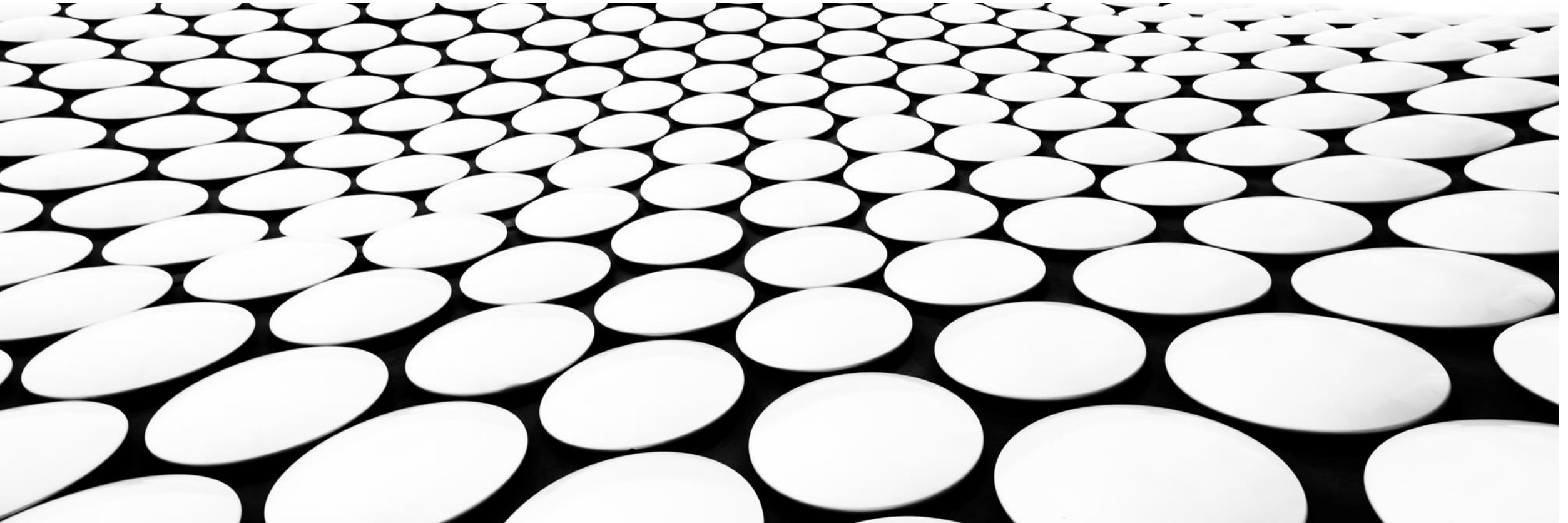
Commercialized Whitening began in 1989  
and today  
there are several different methods of  
teeth whitening on the market.



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# The Science Behind Vital Tooth Whitening

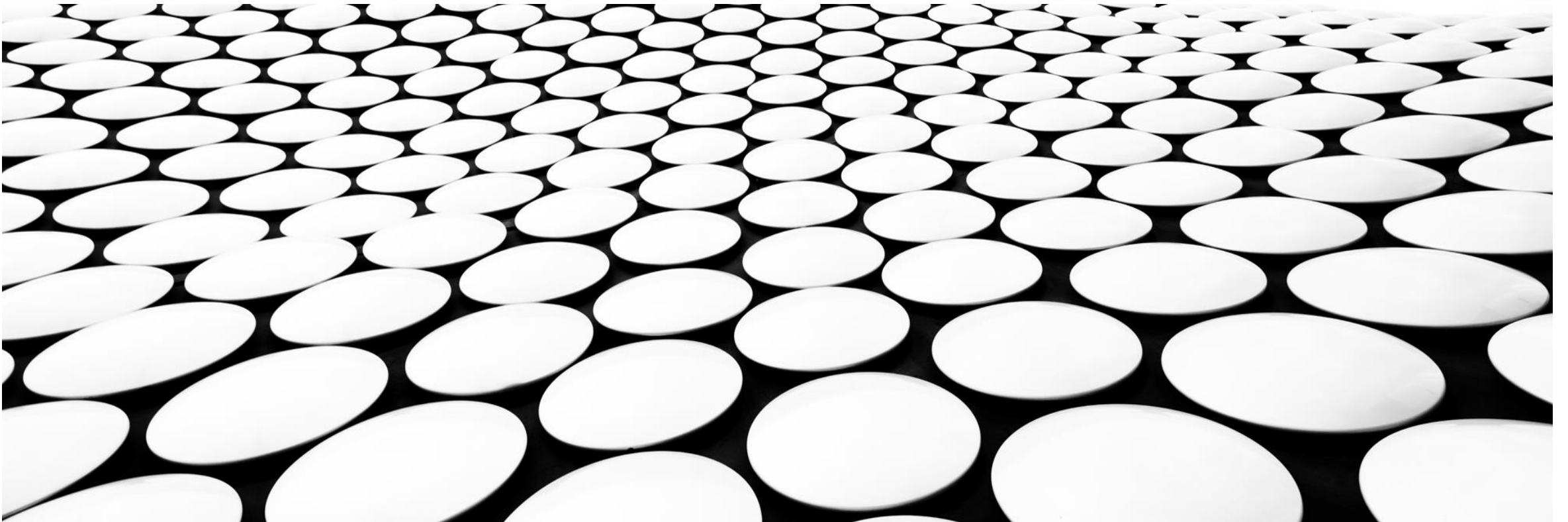
## How does it Work?



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# How does it Work?

by breaking the bonds, transforming double bond chromophores into single bonds



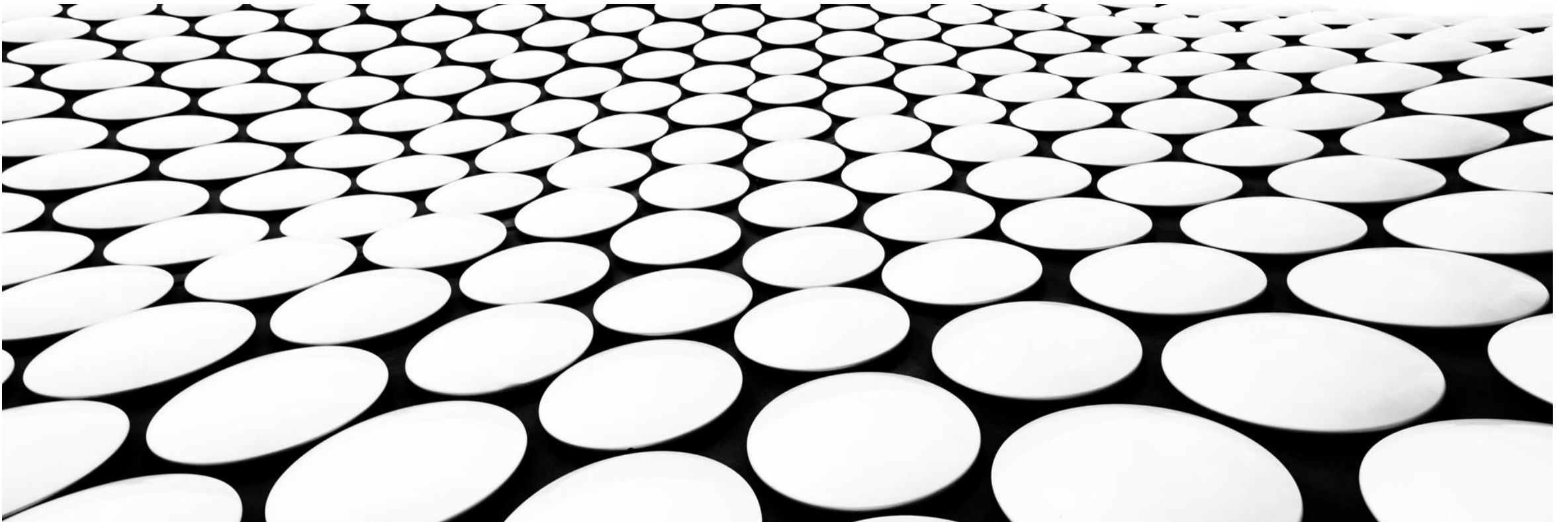


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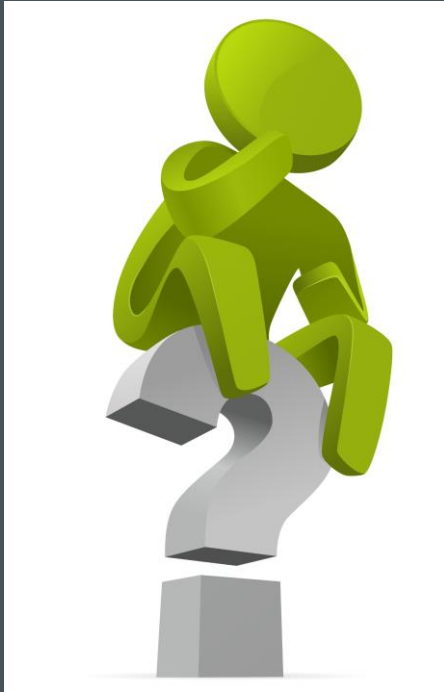
# Products used for Tooth Whitening

## Carbamide Peroxide

## Hydrogen Peroxide



**WHAT IS THE  
CHEMICAL REACTION  
OF THESE WHITENING  
PRODUCTS?**



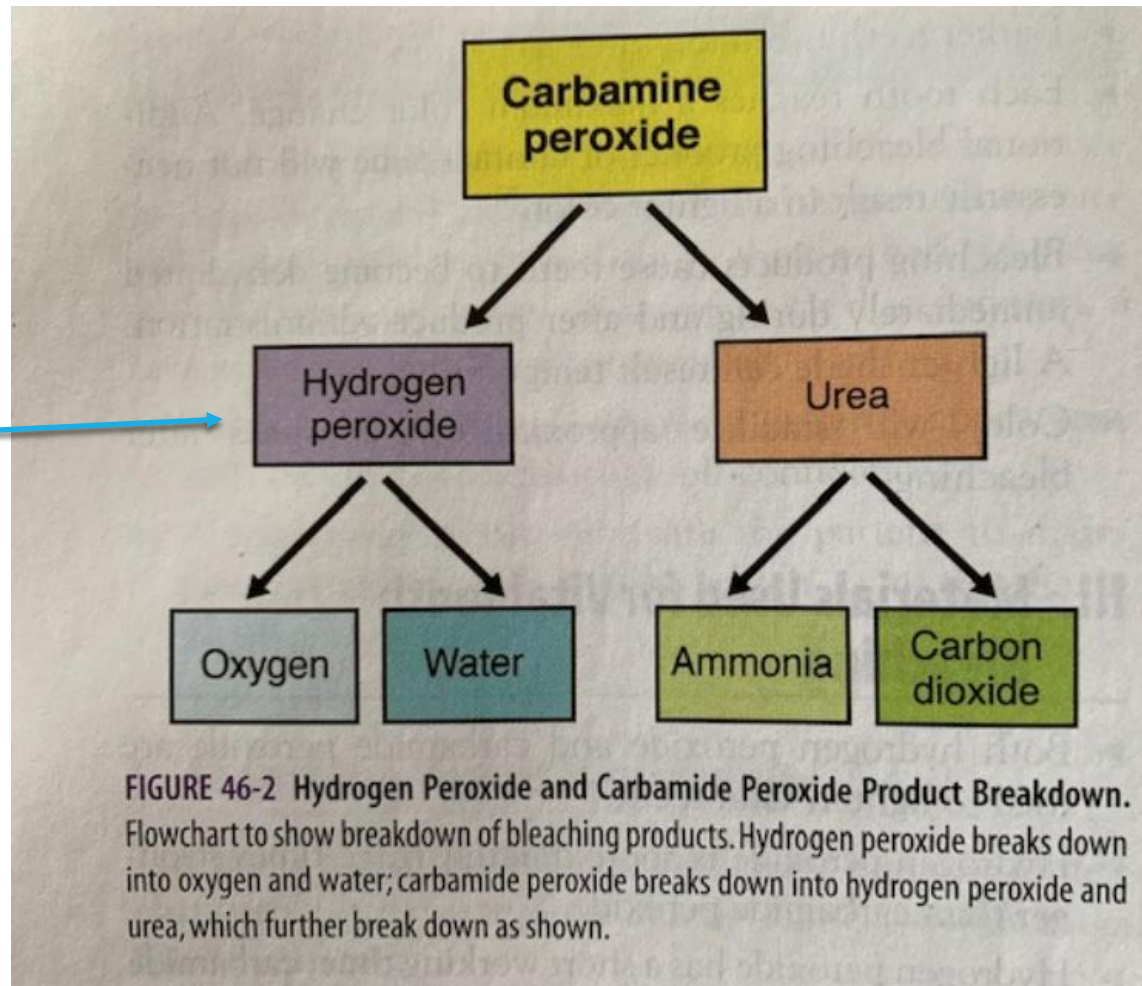
## Regardless of the Formulation

Hydrogen peroxide is the active ingredient that whitens teeth



**HYDROGEN PEROXIDE (H<sub>2</sub>O<sub>2</sub>) IS A STRONG OXIDIZING AGENT THAT READILY DECOMPOSES INTO WATER AND OXYGEN. THE DECOMPOSITION OF HYDROGEN PEROXIDE RELEASES FREE RADICALS OF OXYGEN THAT REACT WITH PIGMENTS IN BOTH EXTRINSIC AND INTRINSIC STAINS, PRODUCING THE WHITENING EFFECT.**

# CARBAMIDE PEROXIDE REACTION



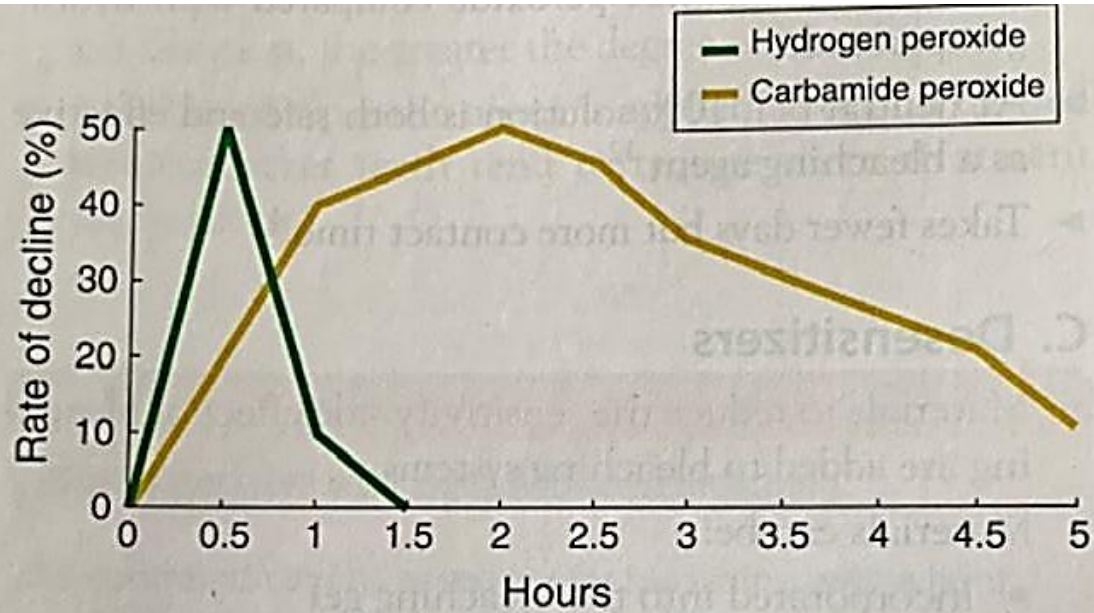
Active ingredient  
In all whitening products

FIGURE 46-2 Hydrogen Peroxide and Carbamide Peroxide Product Breakdown. Flowchart to show breakdown of bleaching products. Hydrogen peroxide breaks down into oxygen and water; carbamide peroxide breaks down into hydrogen peroxide and urea, which further break down as shown.

Source: Wilkens

## HYDROGEN PEROXIDE VS CARBAMIDE PEROXIDE REACTION RATE

Hydrogen peroxide breaks down more quickly into oxygen and water and is therefore able to bleach faster than carbamide peroxide which needs more contact time with the tooth to change tooth color



**FIGURE 46-1 Release Time of Carbamide Peroxide Compared to Hydrogen Peroxide.** Hydrogen peroxide has a much shorter working time than carbamide peroxide and causes more sensitivity. Hydrogen peroxide releases all of the peroxide within 1.5 hours. Carbamide peroxide releases the peroxide over a much longer time. Hydrogen peroxide is approximately three times stronger than carbamide peroxide. (Figures courtesy of Dr. Van Haywood. Reprinted from Haywood VB. Treating sensitivity during tooth whitening. *Compend Contin Educ Dent.* 2005;28(9, Suppl 3):11–20. © 2005, AEGIS Publications, LLC. Used with permission.)

Source: Wilkens textbook

# Carbamide Peroxide Breaks Down Into Hydrogen Peroxide

HOW MUCH HYDROGEN PEROXIDE AS AN ACTIVE INGREDIENT IS IN A CARBAMIDE PEROXIDE PRODUCT?

Roughly a 3:1 ratio conversion

## Carbamide Peroxide

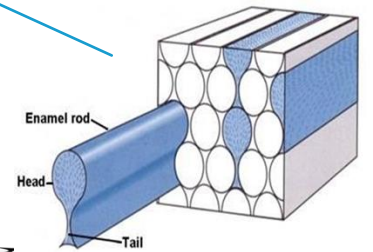
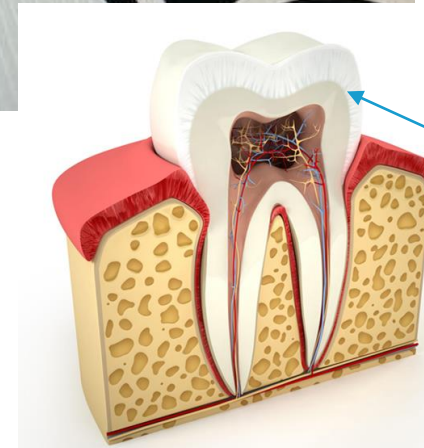
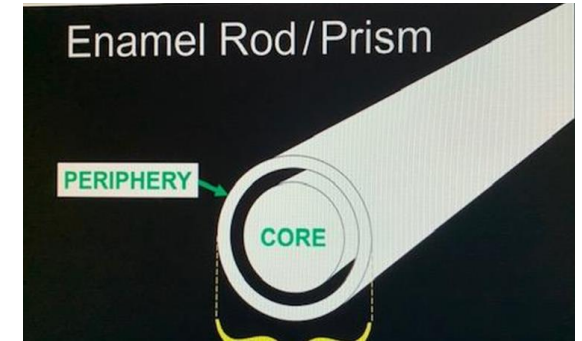
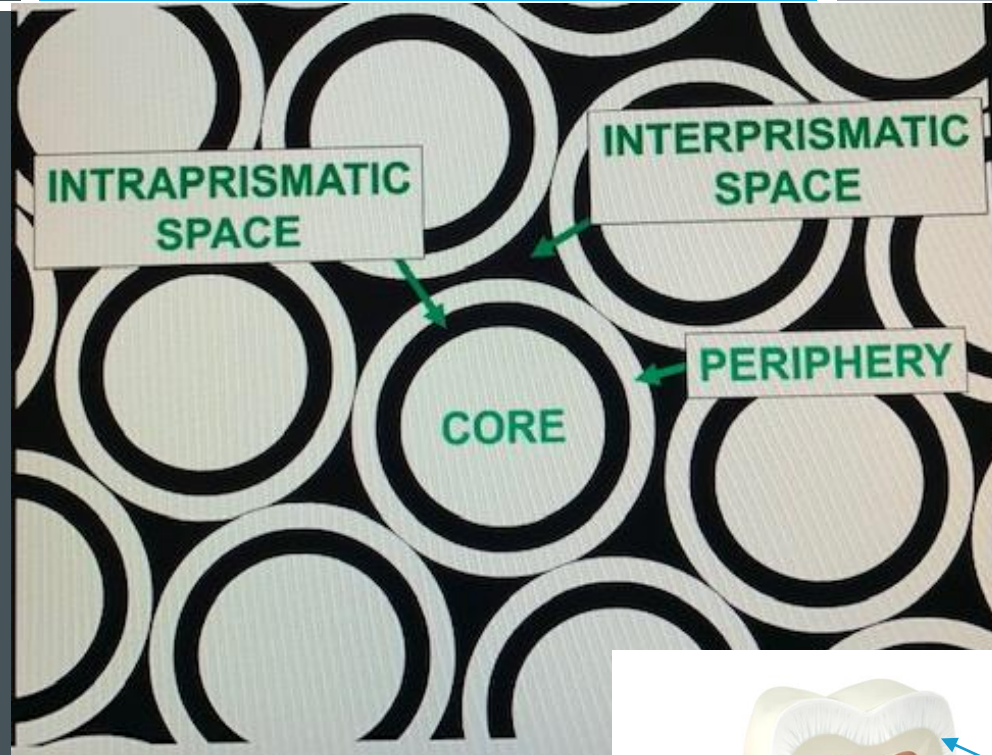
Carbamide peroxide 20% = 7% hydrogen peroxide

Carbamide peroxide 26% = 9% hydrogen peroxide



# Structure of Enamel Crystal

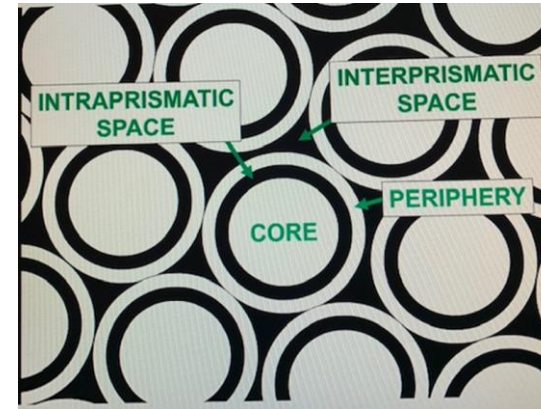
HOW DOES THE HYDROGEN PEROXIDE GET INTO THE ENAMEL CRYSTAL?



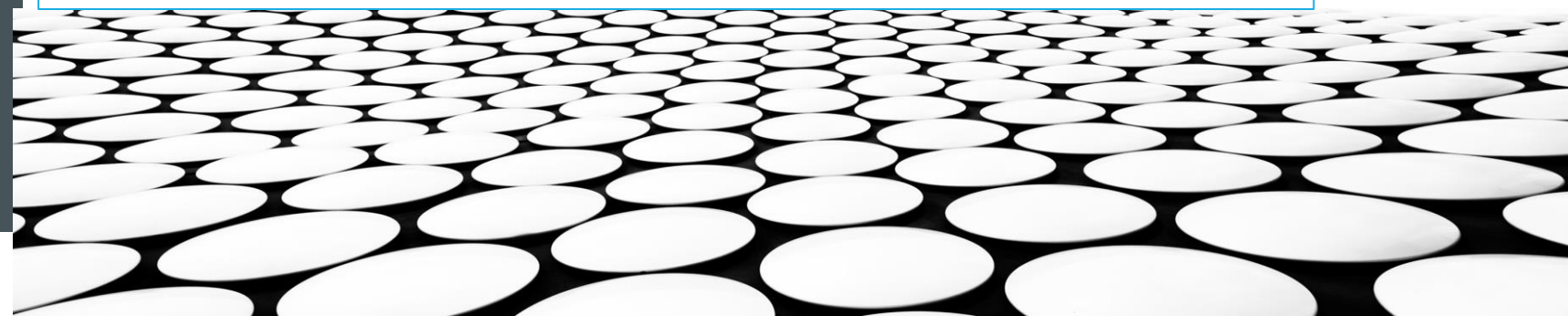
## HOW DOES THE HYDROGEN PEROXIDE GET INTO THE ENAMEL CRYSTAL?



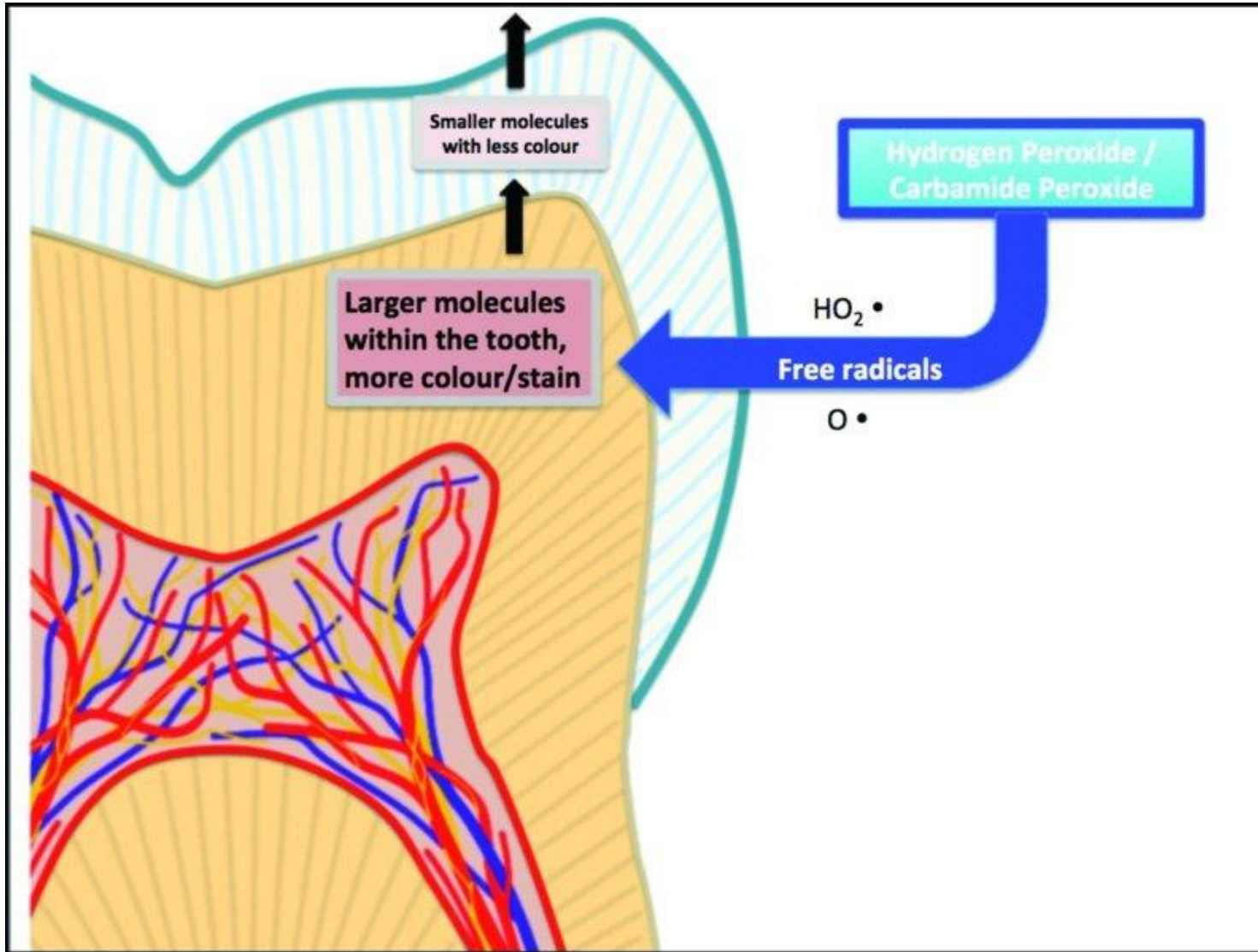
The staining occurs in the interprismatic region internally on the enamel, which causes the tooth to appear darker or more yellow overall.



- Oxygen radicals from the peroxide in the whitening agents contact the stains in the interprismatic spaces within the enamel layer. When this occurs, stain molecules will have their bonds broken and the teeth now appear lighter in color. Teeth not only appear whiter but also reflect light in increased amounts, which makes the teeth appear brighter as well.



# SUMMARY OF VITAL TOOTH WHITENING WORKS?







An Analogy for Enamel  
Rods could be paving  
stones

Stains of the tooth tend  
to accumulate in the  
space between the rods



**RECAP SLIDE**





# MODES OF WHITENING FOR VITAL TEETH

DIRECT SALES TO CONSUMERS: (AT-HOME PRODUCTS)

PROFESSIONALLY DISPENSED/PROFESSIONALLY MONITORED

PROFESSIONALLY APPLIED


Hygienists must educate their patients about the procedure and obtain consent for  
Professionally dispensed & professionally applied



# MODES OF WHITENING FOR VITAL TEETH

DIRECT SALES TO CONSUMERS: (AT-HOME PRODUCTS)

VARIOUS COMBINATIONS OF HYDROGEN  
PEROXIDE AND CARBAMIDE PEROXIDE  
STRIPS, PREFABRICATED TRAYS, PAINT-ON,  
DENTIFRICES, MOUTHRINSES









# MODES OF WHITENING FOR VITAL TEETH

PROFESSIONALLY DISPENSED/PROFESSIONALLY MONITORED

CUSTOM TRAY WITH CARBAMIDE ( % RANGE 10 TO 45%)

OR

HYDROGEN PEROXIDE (10 -15%)

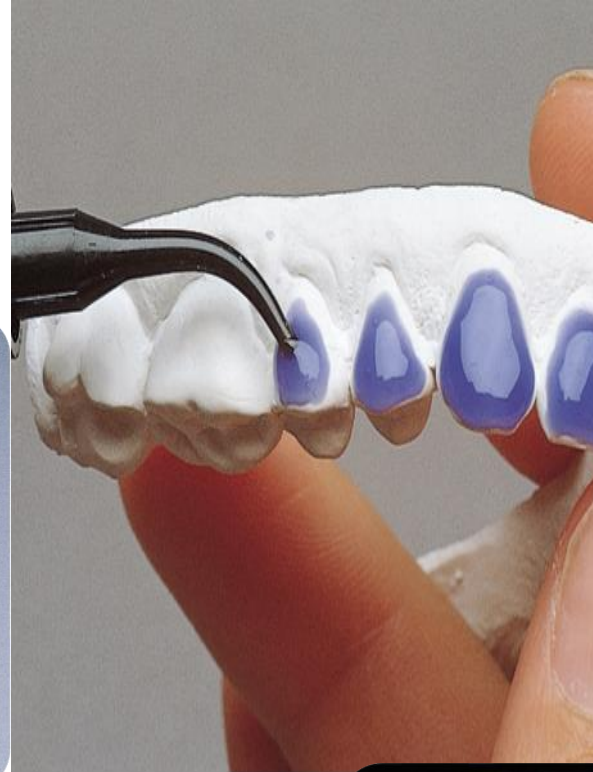
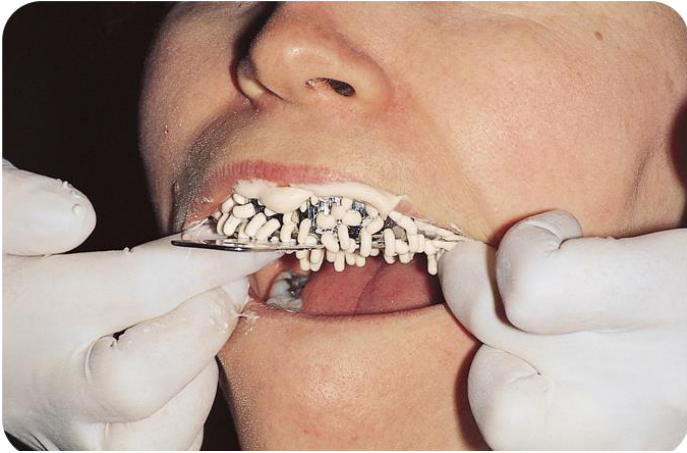
WORN ONCE OR TWICE DAILY FOR UP TO

TWO WEEKS

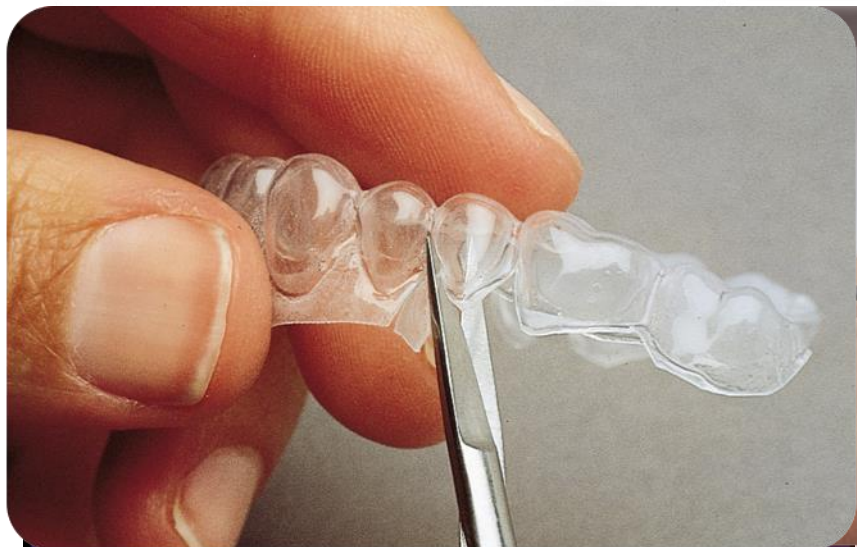
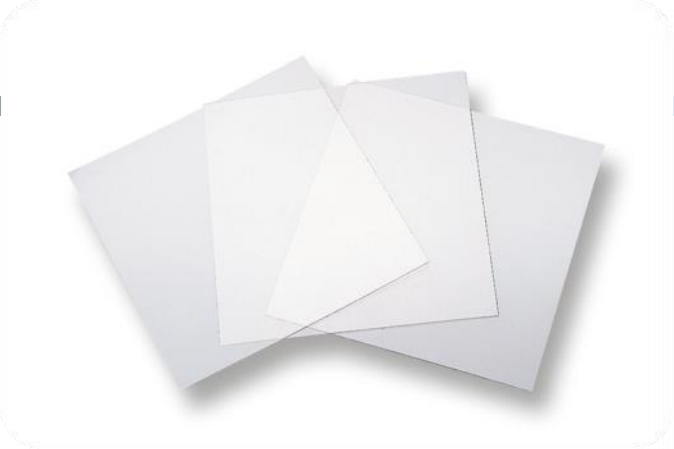
WHITENING STRIPS



# Requires Tray Fabrication









# MODES OF WHITENING FOR VITAL TEETH

## PROFESSIONALLY APPLIED

30 - 40% HYDROGEN PEROXIDE

35 - 44% CARBAMIDE PEROXIDE

APPLICATION TIME 30 - 60 MINUTES

REQUIRES PRECISION ISOLATION & CLOSE PATIENT MONITORING

ONE OR MORE VISITS

## Professionally Dispensed Take Home Kit

16% Carbamide Peroxide= 1 hour per day

22% Carbamide Peroxide= 4 hours (overnight)



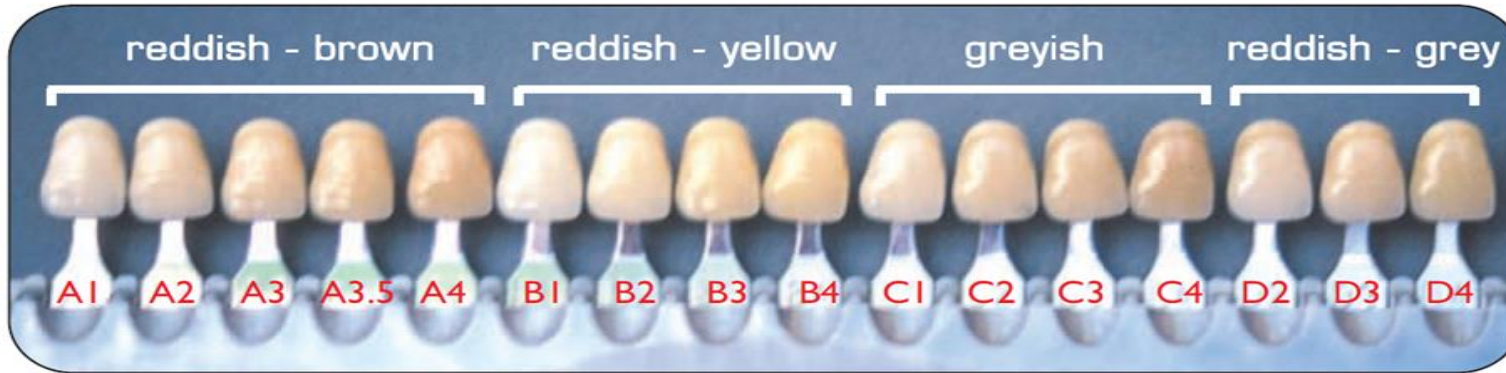
# DETERMINING THE PRE-WHITENING TOOTH SHADE

## TECHNIQUES

1. Arrange the shade guide from the lightest tooth shade to the darkest shade
2. Ask patient to remove any lipstick or cosmetics on the lips
3. Place a neutral drape over the patient clothes
4. Seat the patient in an upright position
5. Take the shade using room ambient light not dental light
6. Hold the vita guide near the tooth, squint briefly to reduce light influence and take shade Quickly( 5 seconds) , do not have a prolonged stare



# LOOKING AT THE SHADES OF TEETH



As Used & Organized  
for Crown and Bridge



Arrangement of the guide  
for tooth whitening

## PROFESSIONALLY APPLIED SEQUENCE



## PROFESSIONALLY APPLIED SEQUENCE





**RECAP SLIDE**



## PATIENT SELECTION

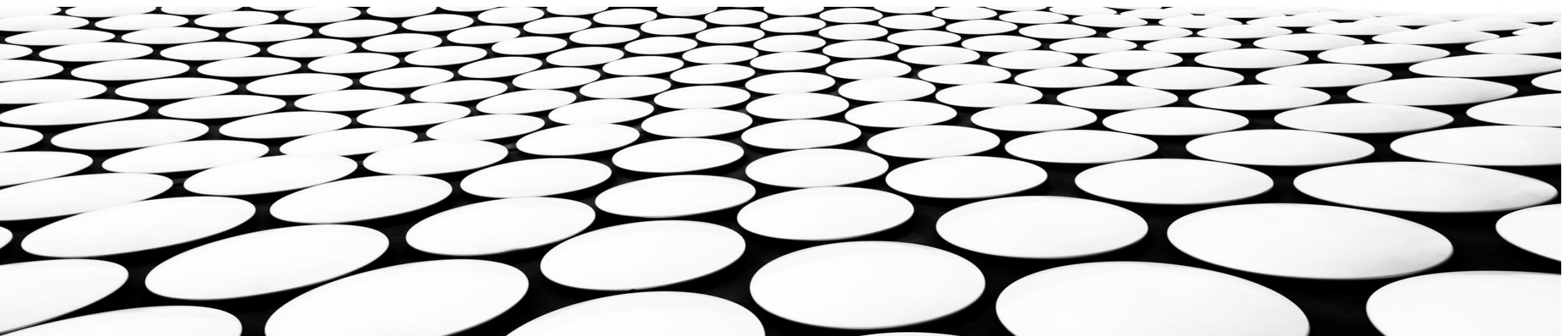
- Need to perform a thorough patient assessment before beginning any procedure
- Determine what the patient needs are and their expectations
- Decide which approach to take – at home or in office based upon the assessment of the patient
- Manage case before, during and after procedure
- Strong Communication Skills with the patient to set realistic goals of the treatment
- Use the procedure as a practice builder



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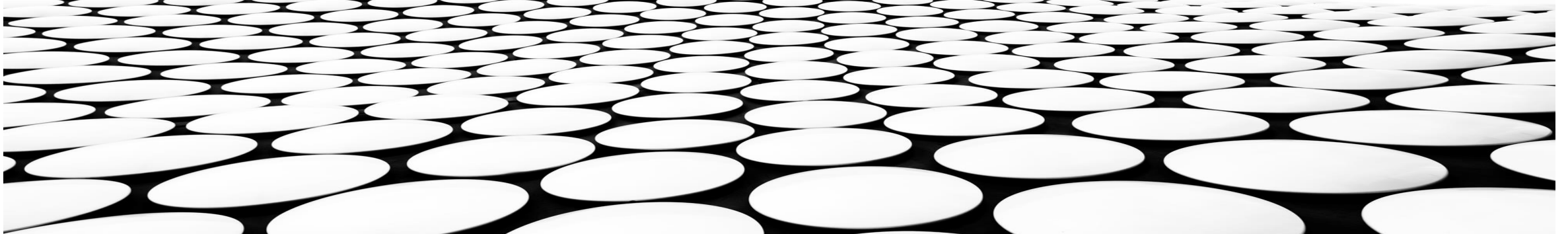
## COMMUNICATION

Establish reasonable expectations  
Emphasize patient responsibilities  
Review instructions  
Desensitizing toothpaste 2 weeks  
before treatment



PATIENT EXPECTATIONS FOR VITAL WHITENING:  
IT IS IMPORTANT:

1. TO EXPLAIN THAT THE RESULTS ACHIEVED WITH ANY TOOTH WHITENING TECHNIQUE ARE NOT PERMANENT.
2. SOME DEGREE OF RELAPSE CAN BE EXPECTED.
  - RETREATMENT IS INFLUENCED BY LIFESTYLE HABITS.
  - FOR THE AVERAGE PATIENT, RETREATMENT FREQUENCY IS APPROXIMATELY 2 YEARS
3. COMMUNICATING ABOUT REALISTIC EXPECTATIONS FROM THE WHITENING PROCEDURE



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## COMMUNICATING REALISTIC EXPECTATIONS



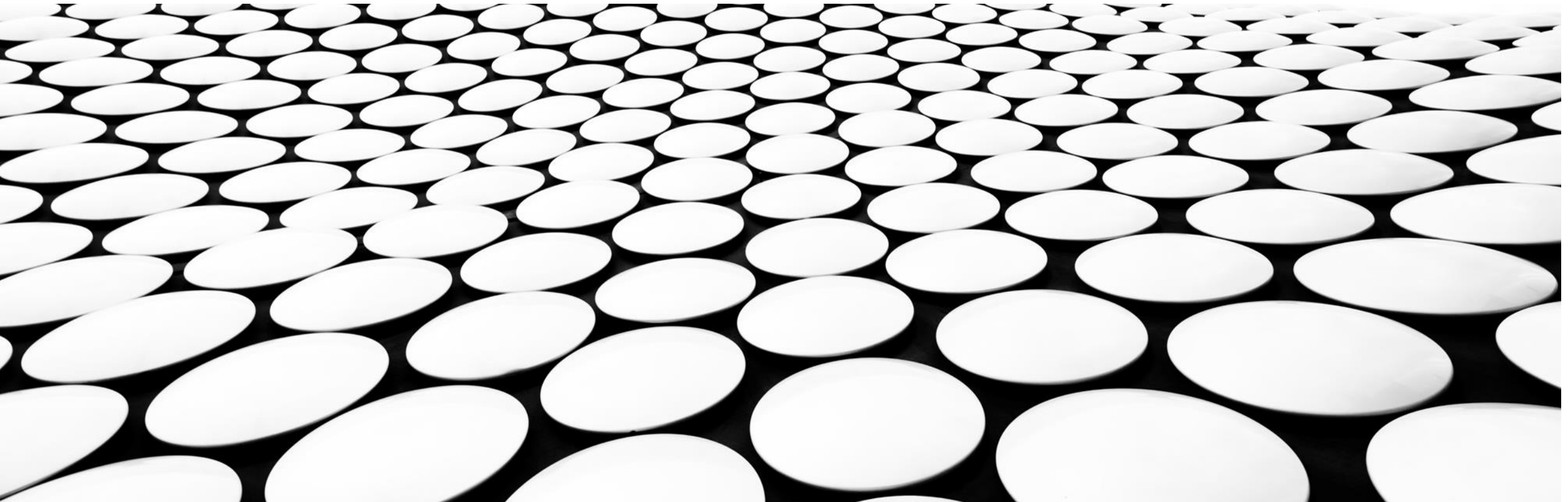
Many patients expect “Paper” White Teeth

Younger Adults may achieve this color, Older Adults do not

# COMMUNICATION

Reminders to patient post treatment:

1. Avoid stain-causing foods, drinks, or tobacco
2. Diet white & clear
3. OTC anti-inflammatory analgesic 1 -2 hours after treatment





# SIDE EFFECTS OF VITAL TOOTH WHITENING



## PRIMARILY

1. Tooth Thermal Sensitivity:
  - a) is related to the pH of whitening agents, many products are acidic
  - b) Is related to the dehydration of the enamel
2. Gingival Burn (Irritation) is related to the whitening product coming in contact with the gingival tissue,

Other potential Side effects:  
TMJ pain/irritation

# RECOMMENDATIONS TO PREVENT OR REDUCE TOOTH SENSITIVITY

- Recommend desensitizing dentifrice
- 5% potassium nitrate or sodium fluoride
- Amorphous calcium phosphate (ACP)
- Reduce quantity of whitening
- Reduce concentration of whitening
- Increase time between treatments

## CONCLUSIONS DRAWN FROM WHITENING LITERATURE

1. Light activation offers no benefits for amount of whitening achieved, persistence of the whitening treatment, or avoidance of tooth sensitivity from the whitening treatment.
2. Home-based bleaching (following manufacturer's instructions) results in less tooth sensitivity than in-office bleaching.
3. The optimal regimen to obtain persistence of tooth whitening is to follow an in-office treatment with monthly home-based touch-up treatments using OTC products.
4. Aggressive bleaching with high concentrations of hydrogen peroxide office-based products causes enamel softening, surface roughness, and an increase in the susceptibility of the tooth to demineralization, based upon in vitro findings.
5. Dental restorations are susceptible to unacceptable color change even when using the home-based OTC systems.
6. In-office bleaching of restored teeth using a 35% hydrogen peroxide product caused tooth sensitivity in all cases. Teeth with restorations have a significantly greater chance of becoming sensitive and result in a greater degree of pain when exposed to whitening regimens.

Supervision of the tooth whitening strategy by an oral health care professional will reduce the potential risks and optimize benefits of tooth bleaching.

## AGGRESSIVE WHITENING BY A YOUNG ADULT WOMEN



Young Adult patient who softened the enamel with aggressive use of whitening products and most likely removed enamel with tooth brushing causing this erosion on #5 facial Patient was using the OTC White Strips more frequently then recommended by manufacture





### Vital Tooth Whitening

Patricia W. Kihn, DDS, MS<sup>a,b,\*</sup>

<sup>a</sup>ORANGE International, Inc., Sunbeltone Commerce Center, 225 West Philadelphia Street, York, PA 17403-0272, USA  
<sup>b</sup>Baltimore College of Dental Surgery, University of Maryland, Baltimore, MD, USA

Aesthetics of the teeth is of great importance to many patients. Public demand for aesthetic dentistry, including tooth whitening, has increased in recent years. Patient interest in whitening and articles on whitening in popular magazines suggest that tooth color is a significant factor in the attractiveness of a smile. An attractive smile plays a major role in the overall perception of physical attractiveness [1]. Studies confirm the importance of attractiveness on perceived success and self-esteem [2]. Compared with restorative treatment modalities, whitening, also referred to as bleaching, is the most conservative treatment for discolored teeth. This public demand for a whiter smile and improved aesthetics has made tooth whitening a popular requested dental procedure, since it offers a conservative treatment for discolored teeth. Whitening often enhances the treatment ages patients to seek further aesthetic treatment [3].

Successful whitening treatment depends on the correct choice of practitioner of the type, intensity, and location of the tooth. It is imperative to determine if the discoloration is extrinsic, associated with the absorption of such materials as tea, red wine, tobacco, iron salts, tobacco, and foods, onto the surface of the tooth, particularly the pellicle coating [4], or intrinsic, where the discoloration is associated with the light-scattering and absorption properties of dentin [5], as seen in tetracycline staining, amelogenesis imperfecta, hypoplasia, erythroblastosis foetalis, and porphyria. Discoloration results from the aging process. As the secondary dentin is formed and the more translucent enamel is lost, the combination of less enamel and darker, opaque dentin makes older-looking, darker teeth [6]. The practitioner must identify



### Tray tooth bleaching

The right thing at the right time

By Van B. Haywood, DMD

If you sit a book and give the answer to the question, how you do the right thing? If you, as a dentist, have the best possible porcelain veneers when the teeth do not need them, have you done the right thing?

Whitening teeth is one of the more common dental procedures. It is important to know the correct time to do it. Once you have determined to do the right thing, then you need to do the right thing



According to the wisdom of my late esteemed colleague Dr. Dick Tucker, "When considering bleaching, the most considerations are safety and efficacy. Safety includes for both the dental office and the patient a generally recognized as tray bleaching using a 15 percent carbamide peroxide (12%) solution. The following checklist on tray bleaching may be helpful.

- 1. Identify each tooth separately, both in how white they get and how quickly that whitening occurs. Tray bleaching expectations include:
  - 1. Normally discolored teeth can take three days to six weeks
  - 2. Nicotine stained need one to three months
  - 3. Tetracycline stained take one to 12 months
- 4. The average for nonsmoking teeth is three to four months lighter, but not necessarily
- 5. Once teeth reach their whitest, further re-staining from products or concerns not improve that shade. To

best when they match the color of the whites of the eyes.

2. Prior to bleaching, the dentist should conduct a proper examination and analysis of the smile. This examination should include:

- 1. Evaluating how much of the teeth are showing in a full smile because the gingival area of teeth does not bleach as well as the initial portion.
- 2. Identifying the primary smile because when teeth make the primary smile more noticeable. Preventional therapy for dental practice expansion may be first indicated.
- 3. Identifying the staining reactions revealed in a full smile because the reactions do not change color.
- 4. Evaluating the results of the preventional conditions because

re-stained teeth do not bleach.

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### Influence of pH on the Effectiveness of Hydrogen Peroxide Whitening

CRG Torres • E Crastechini • FA Felton  
CR Pucci • AB Borges

#### Clinical Relevance

Verification that pH influences the bleaching efficiency will contribute to the development of more efficient bleaching products.

#### SUMMARY

**Objective:** To evaluate the influence of pH on the bleaching effect of hydrogen peroxide on chromogen agents.

**Method:** Hydrogen peroxide 30% was mixed with red wine or with an alcoholic solution of tobacco in glass cuvettes, resulting in final peroxide concentrations of 10.0%, 15.0%, and 20.0%, respectively. The pH of this mixture was measured and adjusted with 0.1 M HCl solution or 0.1 M NaOH solution to obtain the final pH

\*Corresponding author. Tel: +55 11 5082-1100. Fax: +55 11 5082-1101. E-mail: crg@orange.com.br

CRG Torres, DDS, MS, PhD, DENTOP, Univ. Estadual Paulista, Institute of Science and Technology, Department of Restorative Dentistry, São Paulo, Brazil

E Crastechini, DDS, MS, PhD, DENTOP, Univ. Estadual Paulista, Institute of Science and Technology, Department of Restorative Dentistry, São Paulo, Brazil

FA Felton, DDS, MS, PhD, DENTOP, Univ. Estadual Paulista, Institute of Science and Technology, Department of Restorative Dentistry, São Paulo, Brazil

CR Pucci, DDS, MS, PhD, DENTOP, Univ. Estadual Paulista, Institute of Science and Technology, Department of Restorative Dentistry, São Paulo, Brazil

AB Borges, DDS, MS, PhD, DENTOP, Univ. Estadual Paulista, Institute of Science and Technology, Department of Restorative Dentistry, São Paulo, Brazil

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values of 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, and 95. After mixing, the color of these solutions was evaluated in a reflectance spectrophotometer; readings were repeated after 10 minutes for the wine solution and 30 minutes for the tobacco solution. Ten samples were prepared for each solution at each pH. Color changes (Delta E) were calculated. The data were statistically analyzed using analysis of variance one-way and Tukey tests, with a significance level of 5%.

**Results:** There were significant differences among the different pH values for the wine and tobacco solutions ( $p < 0.0001$ ). The Tukey test showed that for both solutions, pH 9.0 resulted in a significantly greater bleaching effect than the other values tested.

**Conclusion:** The efficacy of hydrogen peroxide bleaching is directly proportional to the increase in pH.

#### INTRODUCTION

Tooth bleaching is a treatment widely used in the dental clinic to improve the whitening of discolored teeth. Changes in tooth color may be of intrinsic or extrinsic cause. The intrinsic cause might be from endogenous origin, such as hemochromatosis or discoloration during odontogenesis caused by metabolic or infectious diseases, or even with the intake of certain medications. Extrinsic changes are from external

# Additional Reading Resources

## Vital Tooth Whitening by Patricia Kihn DDS

## Tray Tooth Bleaching by Van Haywood DMD

## Influence of pH on the Effectiveness of H<sub>2</sub>O<sub>2</sub> Whitening by CRG Torres DDS



## HOMEWORK: COMPARE H2O2 AND CARBAMIDE PEROXIDE

Product	H2O2	Carbamide
pH		
Reaction time	30-60 mins	2-6 hours
Contact time required for whitening		
Risk for sensitivity		

Use your Dental materials textbook & Wilkens