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Esthetic and Functional Adhesive Treatments: Materials and Techniques for Everyday Practice

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1 Treatment of Tooth Discoloration

Reference

Treatment of Tooth Discoloration

Discolored Tooth

Fluorosis

Enamel Hypoplasia

Tetracycline Stain

Amalogenesis Imperfecta

Dentinogenesis Imperfecta

Treatment of Tooth Discoloration

Discolored Tooth

Minimally Invasive Esthetic Rehabilitation

I. Bleaching of vital teeth

Diagnosis and Treatment of Teeth Discoloration

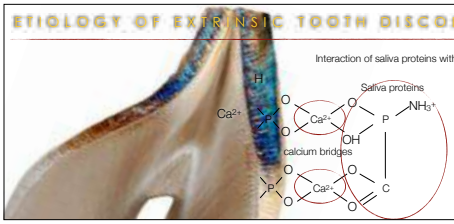
Dental bleaching is the most conservative and effective method to lighten discolored teeth. Knowledge of the etiology of the tooth discoloration allows the dentist to better predict the outcome of the treatment and select the most adequate bleaching technique.

Etiology of Tooth Discoloration

Knowledge of the etiology of the tooth discoloration allows the dentist both to better predict the outcome of the treatment and select the adequate bleaching technique.

Discolorations of dental structures are caused by many factors and is normally classified as *extrinsic* or *intrinsic*.

Etiology of Extrinsic Tooth Discoloration



Interaction of saliva proteins with enamel via calcium bridges

Saliva proteins

Etiology of Extrinsic Tooth Discoloration

Extrinsic discolorations are retention of residue on the enamel surface, which can be influenced by irregularities of the enamel, salivary composition, salivary flow rates, and poor oral hygiene.

Extrinsic dental stain is found on the tooth surface and has been subdivided or classified into two categories: metallic and nonmetallic stain

Treatment of Extrinsic Tooth Discoloration

All extrinsic discolorations are normally removed by dental prophylaxis

Thorough dental and medical histories should be taken before starting any treatment

Advice on correct toothbrushing technique with dentifrice

Patient should be advised to reduce the intake of stain-inducing beverages

Workers exposed to industrial chemicals should wear a mask

Pumice/water slurry with a rotating rubber cup for 30 s removes about a 3micron of enamel

Etiology of Intrinsic Tooth Discoloration

Unlike extrinsic discolorations that occur on teeth surfaces, intrinsic discolorations are the result of color changes within the teeth structures during teeth formation or after the eruption. Intrinsic teeth discoloration are more difficult to treat, but with the advent of modern tooth bleaching techniques most intrinsic stains can be removed. The expected degree of bleaching is dependent upon the type of discoloration.

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

ENAMEL HYPOPLASIA

It is a defect of the teeth in which the enamel is hard but thin and deficient in amount, caused by defective enamel matrix formation. Usually the condition involves part of the tooth having a pit in it. In some cases, the natural enamel crown has a hole in it, and in extreme cases, the tooth has no enamel, exposing the dentin.

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

ENAMEL HYPOPLASIA

Hereditary syndromes that can cause enamel hypoplasia:

- Usher syndrome
- Seckel syndrome
- Ellis-van Creveld syndrome
- Treacher Collins syndrome
- otodental syndrome
- 22q11 deletion syndrome (velocardiofacial syndrome)
- Heimler syndrome

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

ENAMEL HYPOPLASIA

Enamel hypoplasia can also result from prenatal issues such as:

- Maternal vitamin D deficiency
- Maternal weight gain
- Maternal smoking
- Maternal drug use
- Lack of prenatal care
- Premature birth or low birth weight

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

Trauma from a deciduous tooth

ENAMEL HYPOPLASIA

Caused by environmental factors and other problems in infancy:

- Trauma to the teeth
- Infection
- Calcium deficiency
- Deficiencies of vitamins A, C, or D
- Jaundice, liver disease
- Celiac disease
- Cerebral palsy due to maternal or fetal infection

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

AMELOGENESIS IMPERFECTA

It is a genetic defect that can affect both primary and permanent dentitions.

The category of amelogenesis imperfecta can be further subdivided into four groups, according to their clinical appearances.

Mutations in the AMELX, ENAM, MMP20, and FAM83H genes may cause amelogenesis imperfecta

Aldred MJ, Savarirayan R, Crawford PJ.Amelogenesis imperfecta: a classification and catalogue for the 21st century. Oral Dis. 2003;9:19

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

AMELOGENESIS IMPERFECTA

Type 1 - Hypoplastic. Enamel is usually thin, to the point of eliminating interproximal contacts. The enamel is usually hard, smooth or pitted, and a yellow appearance.

Aldred MJ, Savarirayan R, Crawford PJ.Amelogenesis imperfecta: a classification and catalogue for the 21st century. Oral Dis. 2003;9:19

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

AMELOGENESIS IMPERFECTA

Type 2- Hypocalcified: The enamel exhibits normal thickness, but it is soft and often is completely abraded away soon after eruption. Teeth are usually rough, pitted, and the shade ranges from a dull opaque white to a dark brown.

Aldred MJ, Savarirayan R, Crawford PJ.Amelogenesis imperfecta: a classification and catalogue for the 21st century. Oral Dis. 2003;9:19

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

AMELOGENESIS IMPERFECTA

Type 3 - Hypomaturation: The enamel has chipped away from the underlying dentin.

Aldred MJ, Savarirayan R, Crawford PJ.Amelogenesis imperfecta: a classification and catalogue for the 21st century. Oral Dis. 2003;9:19

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

AMELOGENESIS IMPERFECTA

Type 4 - Hypoplastic-Hypomaturation with taurodontism: The enamel has chipped away from the underlying dentin.

Aldred M.J., Savarirayan R, Crawford P.J.Amelogenesis imperfecta: a classification and catalogue for the 21st century. Oral Dis. 2003;9:19-

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

DENTINOGENESIS IMPERFECTA

It is the most prevalent hereditary dystrophy affecting the structure of teeth. It typically affects the primary dentition more seriously than the permanent dentition. The dental crowns appear reddish-brown to gray opalescent discoloration. The enamel is friable and can easy breaks off, exposing the softened dentin that is normally abrades away.

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

DENTAL FLUOROSIS

It is the most common cause of intrinsic discoloration and manifests as a subsurface hypomineralization of tooth enamel. It is caused by excessive chronic intake of fluoride during odontogenesis.

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

DENTAL FLUOROSIS

The nature and severity of dental fluorosis depend on the dosage, duration of exposure, stage of ameloblast activity, and susceptibility of the individual. Clinically, signs of mild fluorosis range from delicate accentuation of the perikymata pattern to white opaque spots or lines. In severe cases, brown pitting patches or localized loss of external enamel may occur.

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

DENTAL FLUOROSIS

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

TETRACYCLINE STAINS

It can affect both the deciduous and permanent dentitions, making the teeth vulnerable throughout all odontogenesis. Even as short a tetracycline exposure, as three days, between the second trimester in utero to approximately 8 years of age can promote teeth discoloration.

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

TETRACYCLINE STAINS

The tetracycline molecule chelates with calcium in hydroxyapatite crystals, forming a tetracycline-calcium orthophosphate complex. The tooth discoloration increase upon exposure to sun and artificial light due to the photooxidation of the orthophosphate complex.

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

TETRACYCLINE STAINS

The severity of stains depends on the type of tetracycline and time, duration, and amount of drug intake. Tetracycline staining is considered one of the most difficult stains to remove.

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

TETRACYCLINE STAINS

Drug	*Color stain on teeth*
Chlortetracycline (Aureomycin)	Grey-brown
Demethylchlortetracycline(Ledermycin)	Yellow
Oxytetracycline (Terramycin)	Yellow -least amount
Tetracycline (Achromycin)	Yellow
Doxycycline (Vibramycin)	No reported changes
Minocycline	Black

Hayes PA, Full C, Pinkham J. The etiology and treatment of intrinsic discolorations. J Can Dent Assoc. 198

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

TETRACYCLINE STAINS

Degree	*Description*
First Degree	Uniform light yellow, brown, or gray stain confined to incisal three quarters of the crown

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

TETRACYCLINE STAINS

Degree	*Description*
Second Degree	Deep yellow, brown, or gray stain, without banding

INTRINSIC TOOTH DISCOLORATION - ODONTOGENESIS

TETRACYCLINE STAINS

Degree	*Description*
Third degree	Dark gray or blue stain with marked banding

INTRINSIC TOOTH DISCOLORATION - POST-ERUPTIVELY

SILVERA, 2009

DENTAL TRAUMA

It may cause internal hemorrhage, diffusion of bilirubin into the dentinal tubules, and a pink discoloration that may diffuse in reddish-brown discoloration. If the tooth vitally is maintained, the natural tooth color returns to normal a few weeks.

INTRINSIC TOOTH DISCOLORATION - POST-ERUPTIVELY

SILVERA, 2009

DENTAL TRAUMA

If the pulp necrosis, the discoloration become darken. Moreover, the presence of a slowly growing pink spot on the enamel surface indicates ongoing internal resorption.

INTRINSIC TOOTH DISCOLORATION - POST-ERUPTIVELY

IDIOPATHIC PULPAL RECESSION

It causes a yellow to brown discoloration on vital teeth. The teeth present a diminished pulp chamber size and the shade appearance of a non-vital tooth.

INTRINSIC TOOTH DISCOLORATION - POST-ERUPTIVELY

IDIOPATHIC PULPAL RECESSION

It causes a yellow to brown discoloration on vital teeth. The teeth present a diminished pulp chamber size and the shade appearance of a non-vital tooth.

INTRINSIC TOOTH DISCOLORATION - POST-ERUPTIVELY

NON-ALLOY DENTAL MATERIALS

Eugenol, formocresol, root canal sealers and others dental materials can potentially promote teeth discoloration.

INTRINSIC TOOTH DISCOLORATION - POST-ERUPTIVELY

DENTAL METALS

Leeching from amalgams, threaded stainless steel and gold-plated pins are the most common sources of tooth discoloration by dental metals. These stains might be extremely dark and pose a significant challenge for any whitening efforts.

INTRINSIC TOOTH DISCOLORATION - POST-ERUPTIVELY

PHYSIOLOGICAL DISCOLORATION

*N*atural formation of secondary dentin causes a gradually discolor the teeth over time. Teeth become more yellowish-brown discolored as they age.

INTRINSIC TOOTH DISCOLORATION - POST-ERUPTIVELY

FOODS AND BEVERAGES

Natural or artificial dark colorants, such as red wine, tea, coffee, sodas, and the *habit* of smoking and chewing tobacco are well-known agents that promote teeth discoloration. The intense of teeth discoloration is directly related to the type, frequency, and length, of exposure to of staining agents.

TREATMENT OF INTRINSIC TOOTH DISCOLORATION

Intrinsic discolorations occur within enamel or dentin and, therefore, are more difficult to treat than external stains, which occur on the tooth surface. Intrinsic stains can affect vital or nonvital teeth as well as endodontically treated teeth.

TREATMENT OF INTRINSIC TOOTH DISCOLORATION

Different types of intrinsic stains require different approaches for removal, according to location and etiology of the stain. In general, surface enamel stains can be treated using enamel ***microabrasion***, whereas deeper internal stains can be removed by ***bleaching techniques.***

INTRINSIC TOOTH DISCOLORATION - DENTAL BLEACHING

Dental bleaching is indicated for patients that desire lighter teeth. The choice of the particular whitening technique used will depend upon the specific etiology of the discoloration.

INTRINSIC TOOTH DISCOLORATION - DENTAL BLEACHING

INDICATIONS

- Generalized discolored teeth due to aging, diet, and lifestyle
- Tetracycline and monocycline staining
- Yellow/brown stains from enamel fluorosis or from idiopathic causes
- Discolored tooth caused by calcific metamorphosis

INTRINSIC TOOTH DISCOLORATION - DENTAL BLEACHING

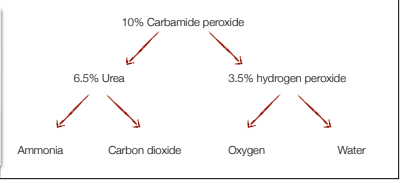
BLEACHING AGENTS AND TECHNIQUES

The first report of dentist-prescribed at-home bleaching was published in 1989 by Haywood and Haywood. The technique is effective in bleaching teeth discolored by aging, smoking, chromogenic materials, tetracycline, or fluorosis.

INTRINSIC TOOTH DISCOLORATION - BLEACHING THEORY

The most accepted theory to through which peroxides promote dental bleaching whitening is the "chromophore theory". Where the hydrogen peroxide (H_2O_2) converts the chromophore chains, within the tooth structure, into simpler structures and that lead to optical changes. The result of these process is a lighter final shade, with no or minimal damage to the tooth structure.

INTRINSIC TOOTH DISCOLORATION - BLEACHING THEORY



AT-HOME DENTAL BLEACHING - CLINICAL PROCEDURES

BLEACHING TRAYS DELIVERY

- Try the bleaching trays in the patient mouth to verify a tight fit
- Confirm the patient does not feel any sharp edges
- Demonstrate how to dispense the right amount of 10% CP into the tray.
- Place the trays in the patient mouth
- Gently press the tray to adapt against the teeth
- Remove any excess material

INTRINSIC TOOTH DISCOLORATION - DENTAL BLEACHING

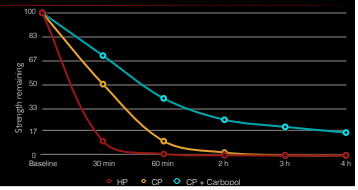
DIFFERENCES BETWEEN CARBAMIDE PEROXIDE (CP) AND HYDROGEN PEROXIDE (HP)

	Carbamide peroxide	Hydrogen peroxide
Active time	2 to 10 hours due to carbopol amount	30 to 60 minutes
pH level	Neutral; elevates pH due to urea production	Low; pH stays constant during treatment
Lowest concentration	10% CP = 3.5% HP	6% HP = 17% CP
Effect of pH level	Caries process may not advance during bleaching due to elevation of pH to a basic level	pH does not change during treatment

INTRINSIC TOOTH DISCOLORATION - DENTAL BLEACHING

Carbopol (hydrogen peroxide stabilization)

- Release oxygen slowly
- Enhances viscosity of the bleaching agents



AT-HOME DENTAL BLEACHING - BLEACHING TIME

Discolorations caused by aging and chromogenic foodstuff usually achieve a satisfactory lighter color after 2–4 weeks of overnight tray with 10 % carbamide peroxide.

Shades C's and D's, Vita Classical shade guide, 4–6 weeks of overnight tray with 10 % carbamide peroxide, with the prospect of a residual darker area at the cervical third

Discolorations caused by Tetracycline-stained after, up-to 6 months of overnight tray whitening with 10 % carbamide peroxide, with the prospect of a residual darker areas

AT-HOME DENTAL BLEACHING - SIDE EFFECTS

Pulp Injury

The at-home bleaching therapy with 10 % carbamide peroxide agents has been considered the safest method for tooth bleaching since minimal clinical adverse effects have been reported in literature. The application of 10% CP gel from 1.5 to 8 h onto dental structure does not result in significant toxic effects on both odontoblast-like cells and human dental pulp cells

Tooth Sensitivity

Tooth sensitivity seems to be the most common lateral effect of whitening with carbamide peroxide, which results from the penetration of peroxides into the pulp space, but sensitivity usually relapses with termination of treatment

FREQUENTLY ASKED QUESTIONS

How does the efficacy of OTC bleaching products compare to that of the dentist-prescribed at-home whitening?

6 % hydrogen peroxide whitening strips applied twice a day for 30 min each for 2 weeks are not as effective as at-home whitening with 10% carbamide peroxide overnight for 2 weeks.

Is it OK that I wear my tray filled with 10 % carbamide peroxide for 2 h per day?

That would be perfectly fine, but it will take longer to achieve the desired lightening effect compared to bleaching overnight.

I have some yellowish tooth-colored fillings in my front teeth. Will they get whiter if I bleach my teeth?

They may look slightly lighter as a result of the oxidation of the surface pigment, but in most cases tooth-color filling materials will not bleach. Existing tooth color fillings may need to be replaced after the bleaching treatment is completed to make your smile look uniform.

FREQUENTLY ASKED QUESTIONS

Do dentists have to wait for 2 weeks after the conclusion of the whitening treatment before they can place bonded restorations?

Yes. This principle applies to all peroxide-based whitening regimens and techniques.

Does fluoride help in preventing sensitivity during the bleaching treatment?

The use of sodium fluoride daily after bleaching does not affect the bleaching efficacy of carbamide peroxide and may reduce the intensity of tooth sensitivity.

Do higher concentrations of carbamide peroxide result in whiter teeth?

Current evidence from controlled clinical trials suggests that higher concentrations result in a faster rate of whitening than lower concentrations with a similar final result.

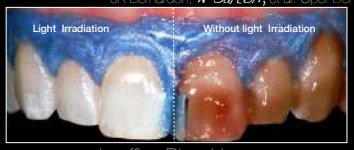
What concentration of peroxide is best for our patients?

10 % carbamide peroxide, except for cases of external whitening of lightly discolored endodontically treated teeth in which the stain is recent.

AT-HOME DENTAL BLEACHING - CLINICAL PROCEDURES

BLEACHING VITAL TEETH

JK Bernardon, N Sartori, et al. Oper Dent 201

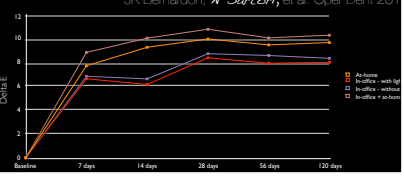


At-home Bleaching

In-office Bleaching

BLEACHING VITAL TEETH

JK Bernardon, N Sartori, et al. Oper Dent 201

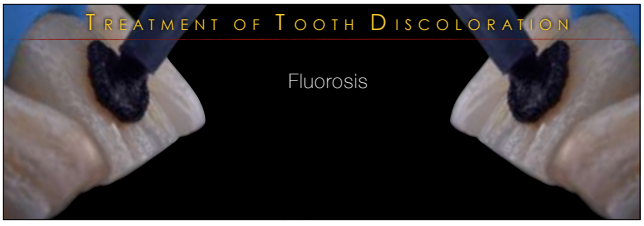


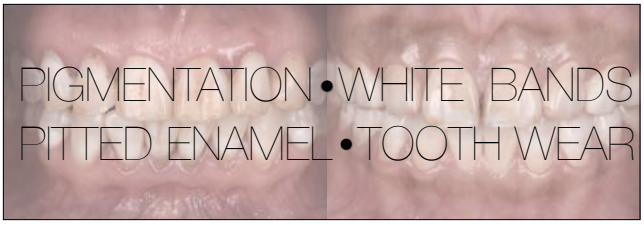
EFFECTIVENESS OF BLEACHING

I. Bleaching of vital teeth

II. Bleaching of non-vital teeth


Walking Bleach
In-office /At home Bleaching


Treatment of Tooth Discoloration
Fluorosis


PIGMENTATION • WHITE BANDS
PITTED ENAMEL • TOOTH WEAR

DENTAL FLUOROSIS - FINDINGS

Increased enamel porosity along the striae of Retzius.
Hypomineralized lesions that extend throughout the enamel.
Pits, bands, attrition, abrasion and loss of extensive areas occur post eruptively.

Fejerskov O, Kidd E, Nyvad B, Baelum V. Dental Caries: The Disease and its Clinical Management. 2nd Ed. Blackwell Munksgaard Ltd 2008

DENTAL FLUOROSIS - FINDINGS

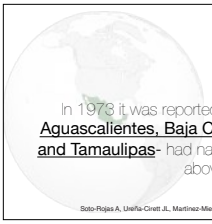
Opaque and thin enamel
Presence of white, opaque lines or entire chalky white surface
Staining ranging from yellow to dark brown

Fejerskov O, Kidd E, Nyvad B, Baelum V. Dental Caries: The Disease and its Clinical Management. 2nd Ed. Blackwell Munksgaard Ltd 2008

FLUORIDE

ENDEMIC AREAS

Soto-Rojas A, Ureña-Cirett JL, Martínez-Mier EA. A review of the prevalence of dental fluorosis in Mexico. Rev Panam Salud Publica. 2004 Jan;15(1):9-18.



MEXICO

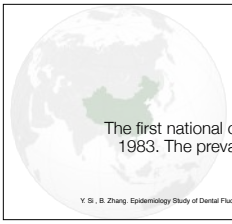
In 1973 it was reported that at least 19 communities in Mexico - in the states of Aguascalientes, Baja California Norte, Chihuahua, Durango, Jalisco, Sonora, and Tamaulipas- had natural concentrations of fluoride in the drinking water that were above the optimal level of 0.7 to 1.5 ppm.

Soto-Rojas A, Ureña-Cirett JL, Martínez-Mier EA. A review of the prevalence of dental fluorosis in Mexico. Rev Panam Salud Publica. 2004 Jan;15(1):9-18.

MEXICO

In all 10 of these states there were several communities where a high prevalence of dental fluorosis was of concern.

Soto-Rojas A, Ureña-Cirett JL, Martínez-Mier EA. A review of the prevalence of dental fluorosis in Mexico. Rev Panam Salud Publica. 2004 Jan;15(1):9-18.



CHINA

The first national oral health survey in China was carried out in 1983. The prevalence of fluorosis varied from 0 to 69.5 %.

Y. Si , B. Zhang. Epidemiology Study of Dental Fluorosis in China. International Workshop on Fluorosis Prevention and Defluoridation of Water; 22-18.

MICROABRASION

Correct application of the microabrasion technique, complemented or not by the bleaching or the use of composite resin, allowed for significant improvement in the appearance and color uniformity of the teeth.

Sundfeld RH, Sundfeld-Neto D, Machado LS, Franco LM, Fagundes TC, Briso AL. Microabrasion in tooth enamel discoloration defects: three cases with long-term follow-ups.J Appl Oral Sci. 2014 Jul-Aug;22(4):347-54.

MICROABRASION

Long-term follow-up concluded that microabrasion is a safe technique, providing favorable results in the patients' smiles overtime.

Sundfeld RH, Sundfeld-Neto D, Machado LS, Franco LM, Fagundes TC, Briso AL. Microabrasion in tooth enamel discoloration defects: three cases with long-term follow-ups.J Appl Oral Sci. 2014 Jul-Aug;22(4):347-54.

OPALUSTRE

A study compared two commercially available products for microabrasion for removal of fluorosis stains, and found that treatment with **Opalustre** was more effective than **Prema Compound.**

Loguercio AD, Correia LD, Zago C, Tagliari D, Neumann E, Gomes OM, Barbieri DB, Reis A. Clinical effectiveness of two microabrasion materials for th removal of enamel uorosis stains. Oper Dent 2007; 32: 531-538.

INTRINSIC TOOTH DISCOLORATION - MICROABRASION

1. Discolored teeth are cleaned with pumice and water slurry or prophylactic paste in a slow-rotating rubber prophylaxis cup.

INTRINSIC TOOTH DISCOLORATION - MICROABRASION

2. Teeth are isolated with a rubber dam to prevent seepage of the acid onto the gingiva.

INTRINSIC TOOTH DISCOLORATION - MICROABRASION

3. The operator should wear gloves, and the operator, RDA and patient must wear protective glasses.

INTRINSIC TOOTH DISCOLORATION - MICROABRASION

4. The acid-pumice slurry is applied to the stained area of the tooth with a wooden applicator.

INTRINSIC TOOTH DISCOLORATION - MICROABRASION

5. The area is rinsed thoroughly with air-water spray directly into an aspirator tip.

INTRINSIC TOOTH DISCOLORATION - MICROABRASION

6. The procedure is repeated until the stain is removed or to a maximum of 10 applications

Ten 5-second applications of acid and pumice slurry with a rubber cup remove about 160 microns of enamel surface

INTRINSIC TOOTH DISCOLORATION - MICROABRASION

7. Neutral fluoride gel solution is applied for 4 minutes

INTRINSIC TOOTH DISCOLORATION - MICROABRASION

8. Polishing the enamel surface is important to prevent or minimize the formation of new extrinsic stain

INTRINSIC TOOTH DISCOLORATION - MICROABRASION

9. The rubber dam is removed

Bleaching & Microabrasion

TREATMENT OF TOOTH DISCOLORATION

Enamel Hypoplasia

Possible Causes of Tooth Discoloration

1. Fluorosis
2. Systemic disease
3. Development disorder
4. Enamel hypoplasia

Enamel Hypoplasia

Approach 1: Bleaching

Approach 2: Microabrasion

Approach 3: Restorative

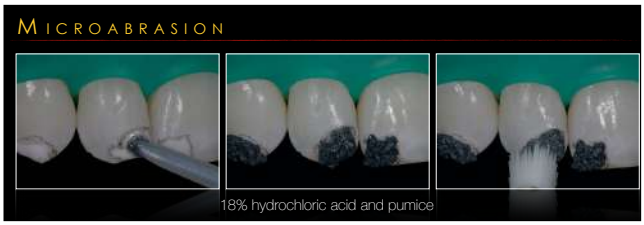
At-Home Bleaching - 10% CP

At-Home Bleaching - 10% CP

Enamel Hypoplasia

Microabrasion

Microabrasion

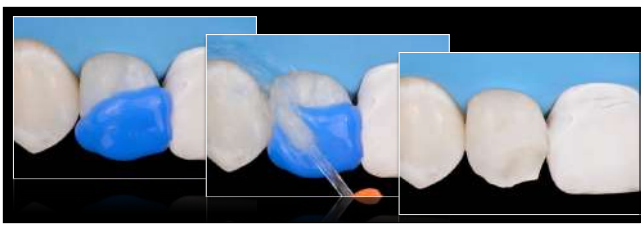

MICROABRASION
18% hydrochloric acid and pumice


MICROABRASION
Initial
After microabrasion

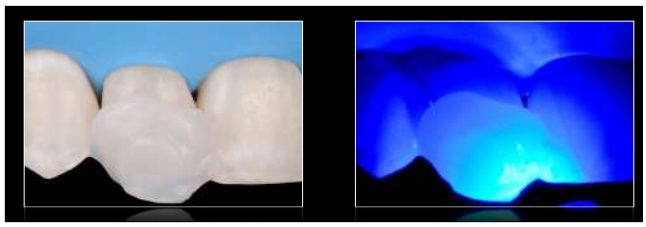

ENAMEL HYPOPLASIA
Restorative Treatment

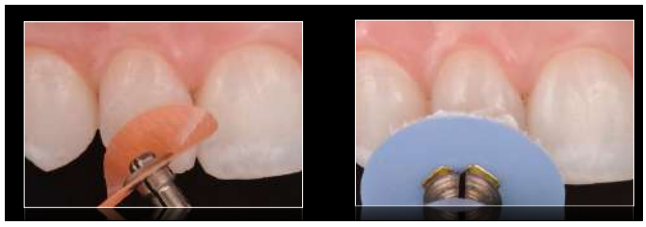

Shade Matching


Removal of enamel hypo-mineralization




Primer
2 bottle etch-and-rinse
Adhesive

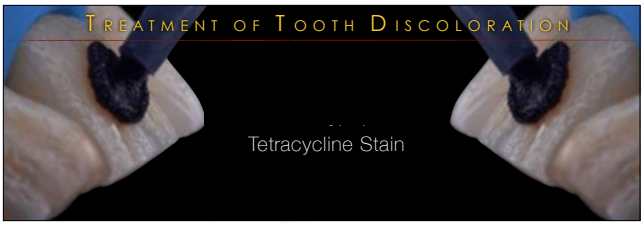





Initial
Final

Treatment Sequence

Treatment of Tooth Discoloration

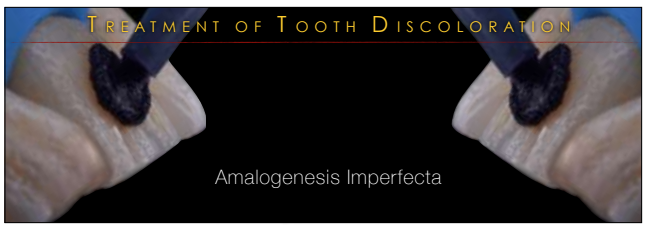


Tetracycline Stain

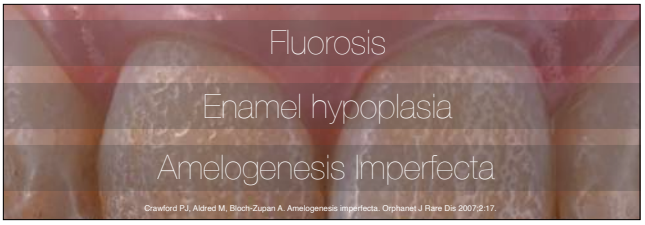
At Home - Bleaching

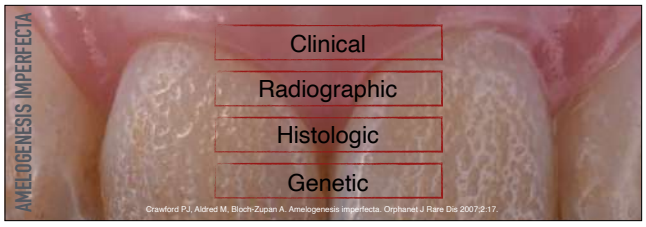
Tetracycline Stain

Tetracycline Stain

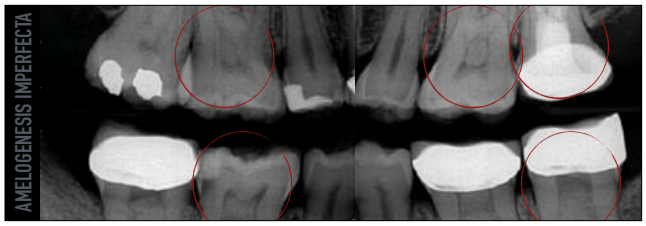

Treatment of Tooth Discoloration
Amalogenesis Imperfecta


Ahmad I. Anterior dental aesthetics: gingival perspective. Br Dent. 2006;199:403-409.


Fluorosis
Enamel hypoplasia
Amelogenesis Imperfecta
Crawford PJ, Aldred M, Bloch-Zupan A. Amelogenesis imperfecta. Orphanet J Rare Dis 2007;2:17.


AMELOGENESIS IMPERFECTA
Clinical
Radiographic
Histologic
Genetic
Crawford PJ, Aldred M, Bloch-Zupan A. Amelogenesis imperfecta. Orphanet J Rare Dis 2007;2:17.


AMELOGENESIS IMPERFECTA


AMELOGENESIS IMPERFECTA


Amelogenesis Imperfecta
Crawford PJ, Aldred M, Bloch-Zupan A. Amelogenesis imperfecta. Orphanet J Rare Dis 2007;2:17.

AMELOGENESIS IMPERFECTA

TYPE I

Type I. Hypoplastic

Type IA. Hypoplastic, pitted autosomal dominant

Type IB. Hypoplastic, local autosomal dominant

Type IC. Hypoplastic, local autosomal recessive

Type ID. Hypoplastic, smooth autosomal dominant

Type IE. Hypoplastic, smooth X-linked dominant

Type IF. Hypoplastic, rough autosomal dominant

Type IG. Enamel agenesis, autosomal recessive

TYPE II

Type II. Hypomaturation

Type IIA. Hypomaturation, pigmented autosomal recessive

Type IIB. Hypomaturation, X-linked recessive

Type IIC. Hypomaturation, snow-capped teeth, X-linked

Type IID. Hypomaturation, snow-capped teeth, autosomal dominant?

TYPE III

Type IIIA. Autosomal dominant

Type IIIB. Autosomal recessive

TYPE IV

Type IV. Hypomaturation-hypoplastic with taurodontism

Type IVA. Hypomaturation-hypoplastic with taurodontism, autosomal dominant

Type IVB. Hypoplastic-hypomaturation with taurodontism, autosomal dominant

Witkop CJ Jr: Amelogenesis imperfecta, dentinogenesis imperfecta and dentin dysplasia revisited: problems in classification. J Oral Pathol 1988,17:547-53.

Diagnosis

Amelogenesis Imperfecta Type IV, Attrition, Chipping, Defective restorations, Caries

Etiology

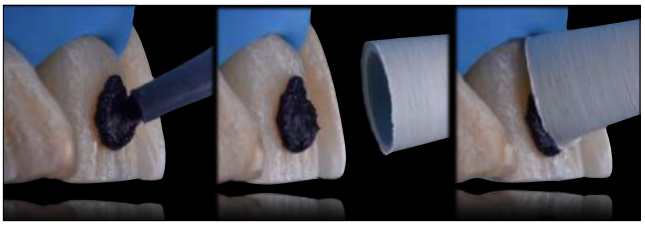
Genetic Disorder

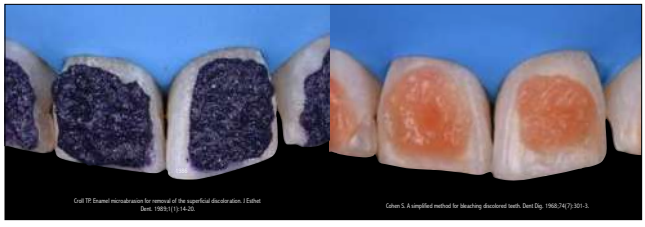
Malocclusion

Diet & Hygiene Habits

Overall prognosis

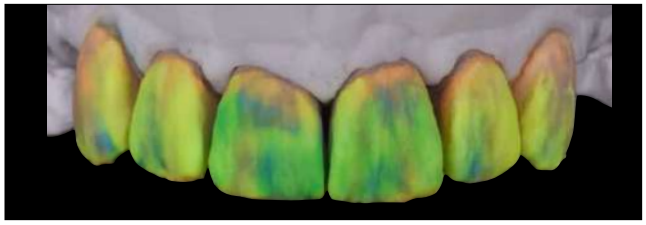
Fair

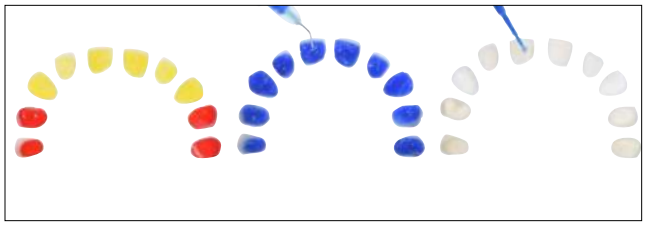


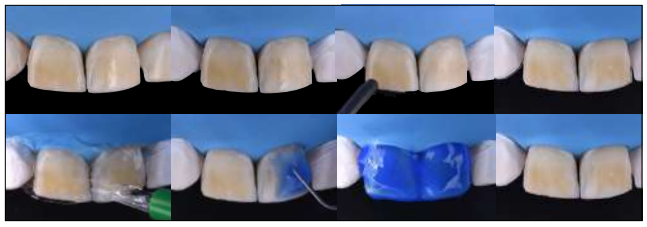


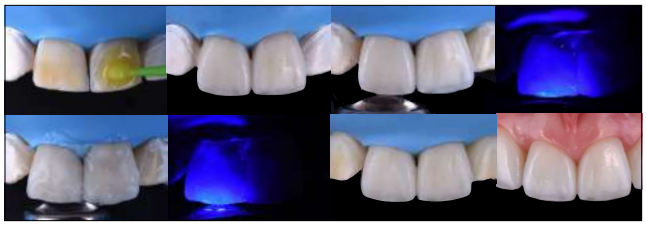
Croll TP. Enamel microabrasion for removal of the superficial discoloration. J Esthet Dent. 1989;1(1):14-20.

Cohen S. A simplified method for bleaching discolored teeth. Dent Dig. 1968;74(7):301-3.



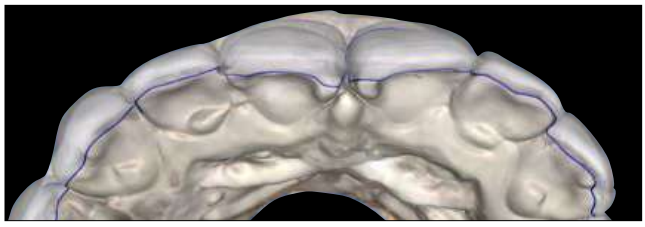







Treatment of Tooth Discoloration
Dentinogenesis Imperfecta


Andres Sanchez, Advanced Operative & Adhesive Dentistry




MT A1
Impulse

1 Treatment of Tooth Discoloration

2 Direct Esthetic Restorations

3 Indirect Esthetic Treatments

2 Direct Esthetic Restorations

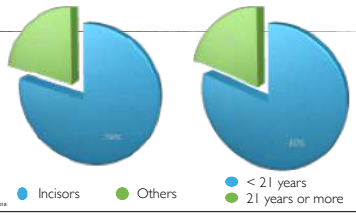
2 Direct Esthetic Restorations

Anterior Teeth

Dental Trauma

Reference

Dental fracture

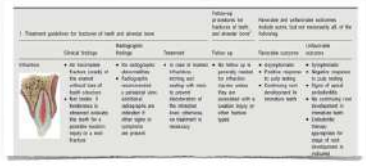


Prevention - Mouth guard

Dental Trauma


Dental Traumatology

International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth



Questions relating to the injury

How did the injury occur?

When did the injury occur?

Was there a period of unconsciousness?

Is there any disturbance in the bite?

Is there any reaction in the teeth to cold and/or heat exposure?

Clinical examination

Evaluate the face, lips and oral muscles for soft tissue lesions.

Palpate the facial skeleton for signs of fractures.

Inspect the dental trauma region for fractures, abnormal tooth position, tooth mobility and abnormal response to percussion.

Pulp testing (usually electrometric) completes the clinical examination.

Radiographic examination

Periapical radiograph with a 90° horizontal angle with central beam through the tooth in question.

Occlusal

Periapical radiograph with lateral angulations from the mesial or distal aspect of the tooth in question.

Treatment guidelines - Fracture injuries

Enamel-dentin fracture

A fracture confined to enamel and dentin with loss of tooth structure, but not involving the pulp.

Treatment guidelines - Fracture injuries

Enamel-dentin fracture

A fracture confined to enamel and dentin with loss of tooth structure, but not involving the pulp.

Clinical findings

A fracture confined to enamel and dentin with loss of tooth structure, bu not exposing the pulp.

Radiographic findings

Enamel-dentin loss is visible

Treatment

If the tooth fragment is available, it can be bonded to the tooth
Restoration with composite resin

Treatment options

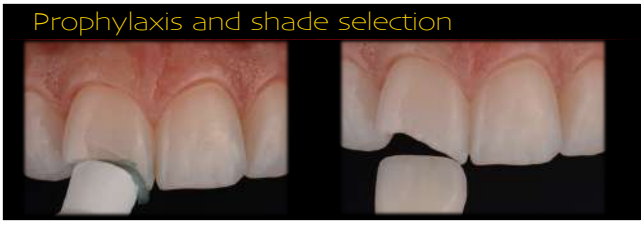
Tooth Reattachment

Composite Restoration


Tooth Reattachment - Case 1


Evaluate and hold the tooth fragment


Verify tooth fragment adaptation


Prophylaxis and shade selection


Rubber dam isolation


Hold the fragment in position


Positioning stent fabrication


Positioning stent fabrication

Positioning stent fabrication

Bonding Procedures

Bonding Procedures

Protection of Adjacent Teeth

Bonding Procedures

Bonding Procedures

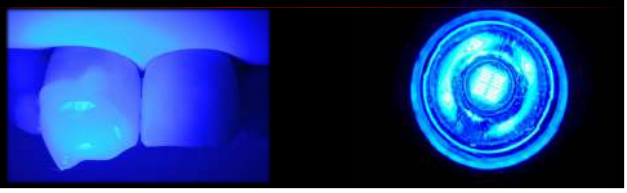
Tooth Reattachment

Light Cure

After removing stent

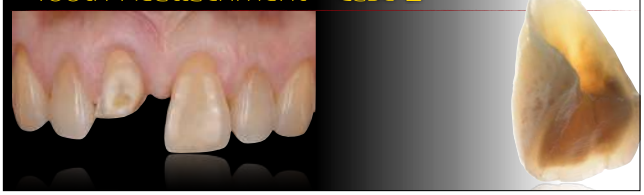
Composite resin

Final cure

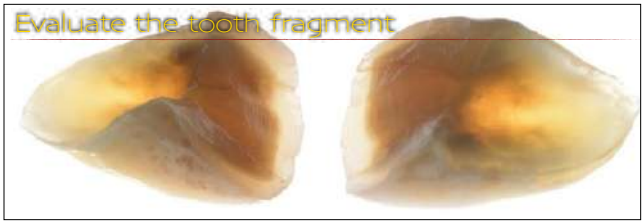


Tooth Reattached

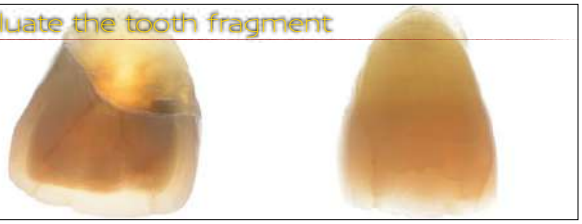
Tooth Reattachment - Case 2



Evaluate the tooth fragment



Evaluate the tooth fragment

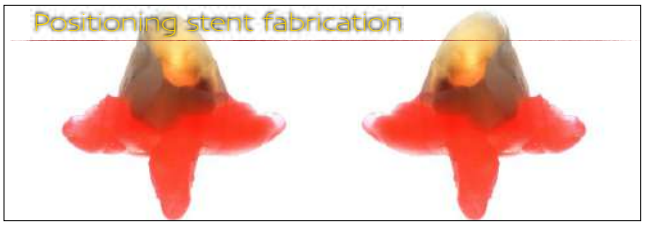


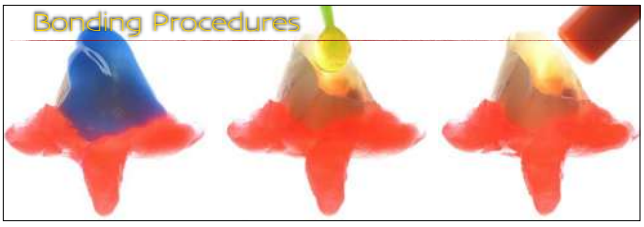

Prophylaxis and shade selection


Positioning stent fabrication


Positioning stent fabrication


Positioning stent fabrication


Positioning stent fabrication


Bonding Procedures


Rubber dam isolation

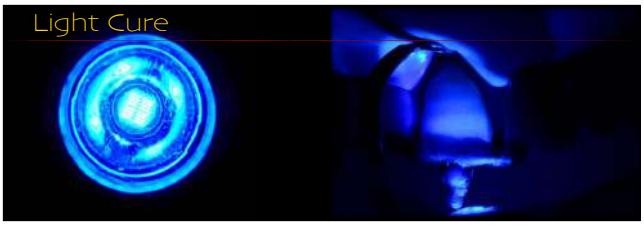

Protection of Adjacent Teeth


Bonding Procedures


Bonding Procedures


Tooth Reattachment


Tooth Reattachment


Light Cure


Final cure


Bonded Interface Polishing


Tooth Reattached


Occlusal Adjustment


Occlusal Adjustment


Occlusal Adjustment


Tooth Reattached

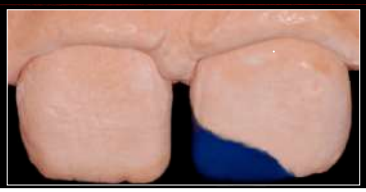

Tooth Reattachment - Case 3


Treatment options
Tooth Reattachment
Composite Restoration

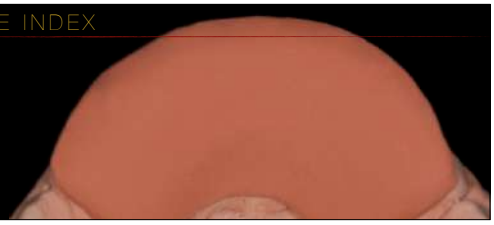
Clinical evaluation

PVS impression

Wax-up



Silicone index



Silicone index

Shade matching

Shade matching

Restoration Try-In

Shade matching

Shape evaluation

Temporary restoration

Initial

Restoration Try-In

Shade matching

Shape evaluation

Temporary restoration

After 24h

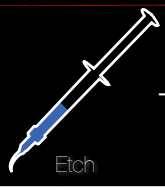
Operative field isolation

Adjacent teeth protection

Adhesive Systems

Etch-and-rinse systems

Three Steps



Etch + Primer + Adhesive

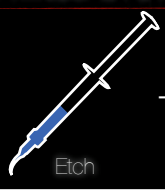
Late 1980s

Etch-and-rinse systems

Three Steps

Etch-and-rinse systems

Three Steps



Etch + Primer + Adhesive

Early 1990

Etch-and-rinse systems

Two Steps

Etch + Primer/Adhesive

Early 1990

Etch-and-Rinse Systems

Two Steps

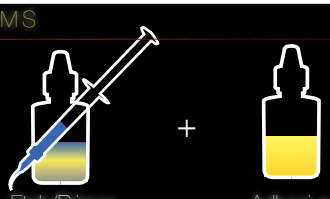
Etch-and-Rinse Systems

Three Steps

Late 1990s

Self-Etch Systems

Two Steps



Late 1990s

Self-Etch Systems

Two Steps

Self-Etch Systems

Two Steps

Early 2000s

Self-Etch Systems

One Steps

Early 2000s

Self-Etch Systems

One Steps

Multi-Mode Systems

Etch-and-Rinse Mode

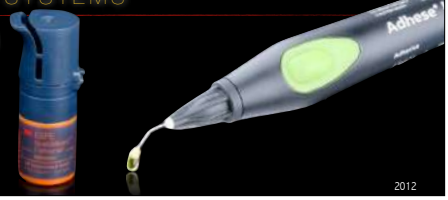
Self-Etch Mode

2012

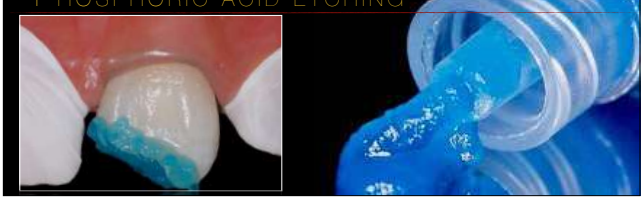
Multi-mode systems

Etch-and-Rinse Mode

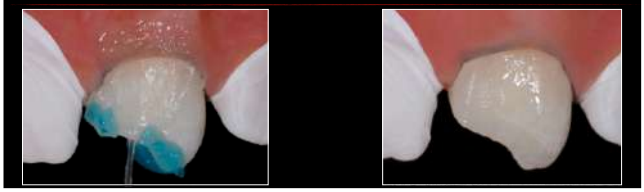
Self-Etch Mode



Phosphoric acid etching



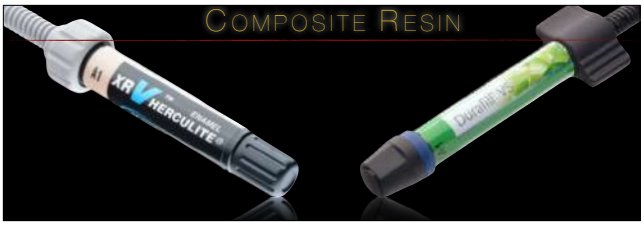
Rinse



Adhesive system

Light cure

Composite Resin



Microfilled composite

- ✓ Filler size: 40 to 1200 nm
- ✓ Filler loading: 30% to 55% by volume
- ✓ Highly polishable and long-term gloss retention
- ✓ Limited to non-stress-bearing restorations

Hybrid composite

- ✓ Broad range of filler sizes and shapes
- ✓ Filler loading: 60% to 65% by volume
- ✓ Acceptable polish and variable gloss retention
- ✓ Universal use

Hybrid composite

- ✓ Hybrids (> 600 nm)
- ✓ Microhybrids (400-600 nm)
- ✓ Nanohybrids (200-300 nm, some fillers <100 nm)

Hybrid composite

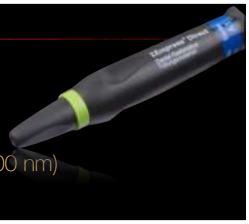
- ✓ Hybrids (> 600 nm)

Hybrid composite

- ✓ Microhybrids (400-600 nm)

Hybrid composite

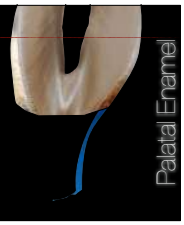
- ✓ Nanohybrids (200-300 nm, some <100 nm)



Nanofilled composite

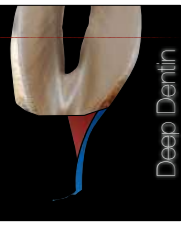
- ✓ All fillers below 100 nm
- ✓ Filler loading: 55% to 70% by volume
- ✓ Highly polishable and adequate gloss retention
- ✓ Universal use

Restoration



Restoration

Restoration




RESTORATION
Opaque Halo


RESTORATION
Superficial Dentin


RESTORATION
Opalescence


RESTORATION
White Spots


RESTORATION
Facial Enamel


Finishing and Polishing

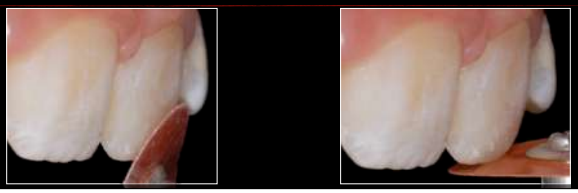

Maxillary Central Incisor
Mesial
Facial
Incisal
Lingual
Distal


FINISHING AND POLISHING
Enamelize

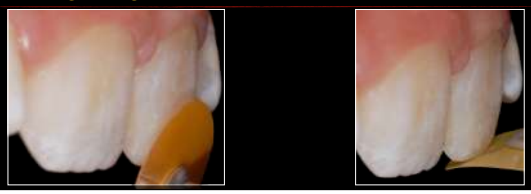
Primary morphology

- ✓Tooth contours
- ✓Lines angles
- ✓Shadow areas (Transitional contour to proximal contact)
- ✓V-shaped grooves

Finishing



Finishing



Finishing

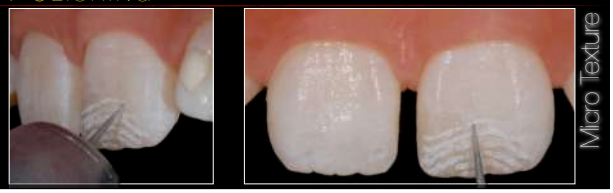
Finishing

Secondary morphology

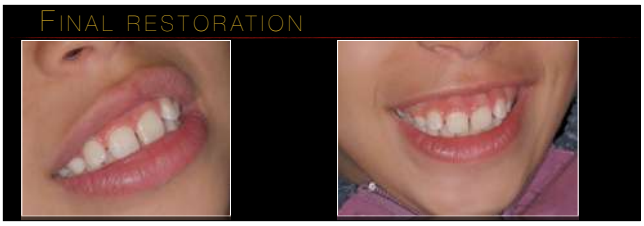
- ✓Initial polishing (fine silicone points)
- ✓Texture (Perikymata)
- ✓Final luster (Felter disc + polishing paste)

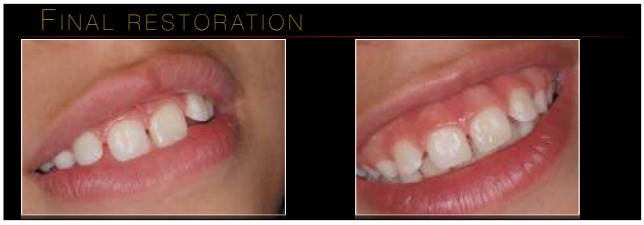
Polishing

Polishing

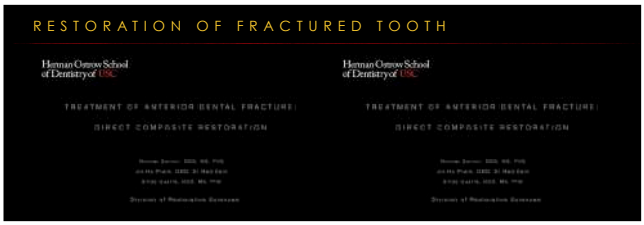


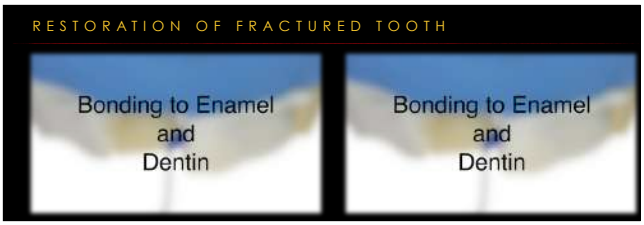

FINAL LUSTER


FINAL RESTORATION


FINAL RESTORATION


FINAL RESTORATION


RESTORATION OF FRACTURED TOOTH
Herman Ostrow School of Dentistry of USC
TREATMENT OF ANTERIOR DENTAL FRACTURE:
DIRECT COMPOSITE RESTORATION
Herman Ostrow School of Dentistry of USC
TREATMENT OF ANTERIOR DENTAL FRACTURE:
DIRECT COMPOSITE RESTORATION


RESTORATION OF FRACTURED TOOTH
Bonding to Enamel and Dentin
Bonding to Enamel and Dentin


RESTORATION OF FRACTURED TOOTH
Composite restoration
Composite restoration


FINISHING AND POLISHING
Finishing and Polishing
Finishing and Polishing


Composite Restoration - Case 3 - BRB Matrix


Composite Restoration - Case 3 - BRB Matrix


Composite Restoration - Case 3 - BRB Matrix


Composite Restoration - Case 3 - BRB Matrix

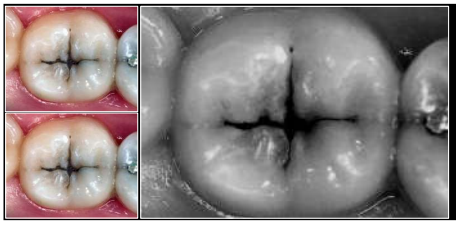

Composite Restoration - Case 3 - BRB Matrix


Composite Restoration - Case 3


Composite Restoration - Case 4


2
Direct Esthetic Restorations
Posterior Teeth

When can we restore posterior teeth using direct composite resin?



Primary carious lesions

Replace composite and amalgam restorations

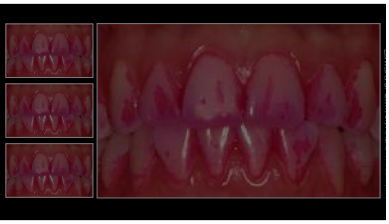
When direct composite resin is contraindicated?

Large restorations

When the tooth cannot be adequately isolated

Tooth with heavy occlusal stress

High risk of caries



Advantages

- Esthetics
- Conservative tooth structure removal
- Easier, less complex tooth preparation
- Decreased microleakage
- Increased short-term strength of remaining tooth structure

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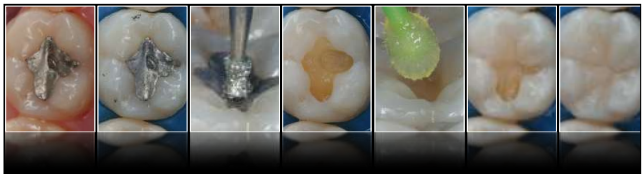
Disadvantages

- Polymerization shrinkage effects
- Lower fracture toughness than most indirect restorations
- More technique-sensitive than amalgam restorations
- Possible greater localized occlusal wear
- Unknown biocompatibility of some components (bisphenol A [BPA])

Edward J. Swift Jr, Andre V. Ritter, 20



Class I restorations: Clinical Protocol

Class I composite Restoration

Anesthesia

Class I composite Restoration

Anesthesia

Pre-oper. occlusion

Class I composite Restoration

Anesthesia

Pre-oper. occlusion

Prophylaxis

Class I composite Restoration

Anesthesia

Pre-oper. occlusion

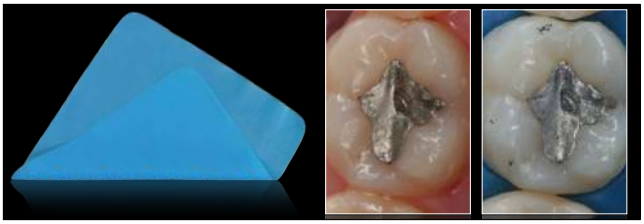
Prophylaxis

Tooth color matching

Shade Matching

Class I composite Restoration

Anesthesia
Pre-oper. occlusion
Prophylaxis
Tooth color matching
Operative field isolation



Class I composite Restoration

Anesthesia
Pre-oper. occlusion
Prophylaxis
Tooth color matching
Operative field isolation
Cavity preparation

Shade Match Verification

Class I composite Restoration

Anesthesia
Pre-oper. occlusion
Prophylaxis
Tooth color matching
Operative field isolation
Cavity preparation

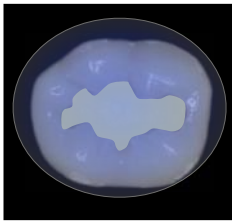
Adhesive System

Composite Selection

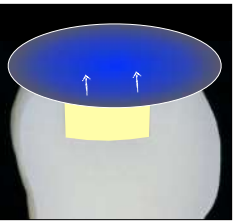
- ✓ Micro-hybrid
- ✓ Nanofilled
- × Microfilled

Cavity configuration factor (C-factor)

$$CF = \frac{\text{Bonded surfaces}}{\text{Unbonded Surface}} = \frac{5}{1} = 5$$

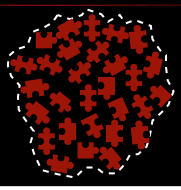


C-factor



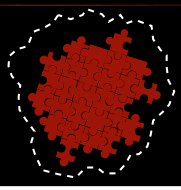
Composite Resin

Polymerization Shrinkage



Composite Resin

Polymerization Shrinkage



Composite Placement

Bulk-Filling Technique

↓

Small area unbonded

Composite Placement

Bulk-Filling Technique

↓

Small area unbonded

↓

Adhesive fail

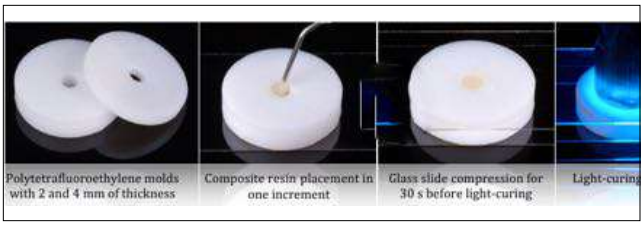
- ✓ Few studies
- ✓ High post-gel shrinkage
- ✓ Not all low-shrinkage/bulk-fill composites demonstrated reduced polymerization shrinkage (3-6%)
- ✓ Polymerization depth reached by trans-dental polymerization
- ✓ Polymerization depth does not reach the bottom of the preparation

ACTA STOMATOLOGICA CROATICA
www.ascro.hr

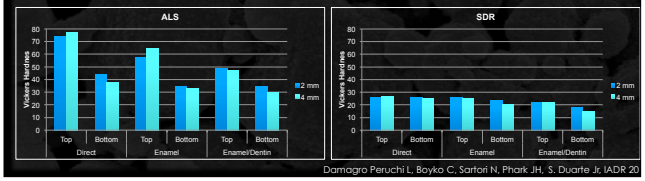
Acta stomatol Croat. 2019;53(2):95-105.
DOI: 10.15644/asc53/2/1
ORIGINAL SCIENTIFIC PAPER
IZVORNI ZNANSTVENI RAD

Neimar Sartori[1], Alena Ksezevic[1], Lais Dalmagro Peruchi[2], Jin-Ho Phark[1], Sillas Duarte Jr[1]

Effects of Light Attenuation through Dental Tissues on Cure Depth of Composite Resins



LOW-SHRINKAGE VS BULK-FILL



Damagro Peruchi L, Boyko C, Sartori N, Phark JH, S. Duarte Jr. IADR 20

COMPOSITE PLACEMENT

Incremental Technique

COMPOSITE PLACEMENT

Incremental Technique

↓

Large area unbonded

Composite Placement

Incremental filling technique

Incremental filling technique

Incremental filling technique

Class I composite Restoration

- Anesthesia
- Prophylaxis
- Tooth color selection
- Field isolation
- Cavity preparation
- Adhesive System
- Composite placement
- Final light cure

Class I composite Restoration

- Anesthesia
- Prophylaxis
- Tooth color selection
- Field isolation
- Cavity preparation
- Adhesive System
- Composite placement
- Final light cure
- Checking the occlusion

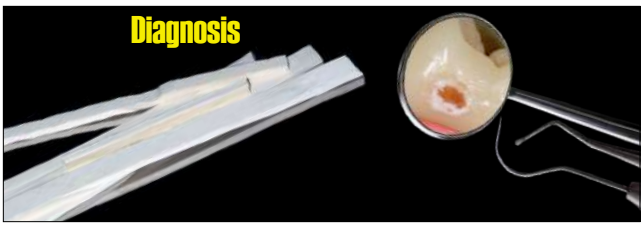
Class I composite Restoration

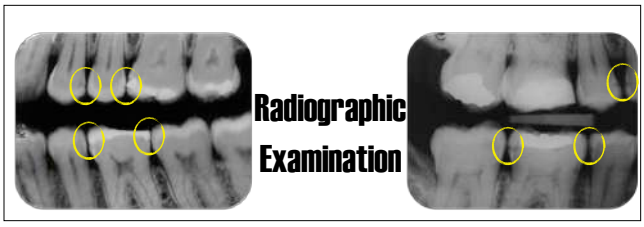
- Anesthesia
- Prophylaxis
- Tooth color selection
- Field isolation
- Cavity preparation
- Adhesive System
- Composite placement
- Final light cure
- Checking the occlusion
- Finishing and polishing


Posterior
Composite Restorations : Class II

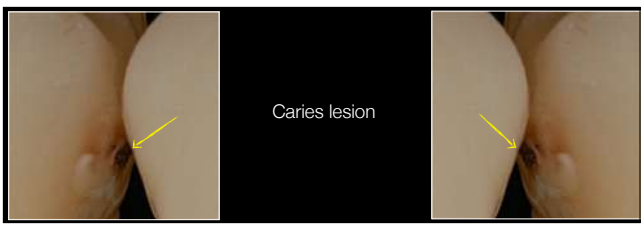

Contraindications
Absent of enamel on
the gingival margin


Class II composite Restoration
Diagnosis
Anesthesia and prophylaxis
Tooth color selection
Checking the occlusion
Field isolation
Cavity preparation
Matrix selection and placement
Adhesive System
Composite placement
Light-activation
Checking the occlusion
Finishing and polishing


Diagnosis


Radiographic
Examination


Clinical Examination


Caries lesion

Accessing the caries Lesion

Direct access

Accessing the caries Lesion

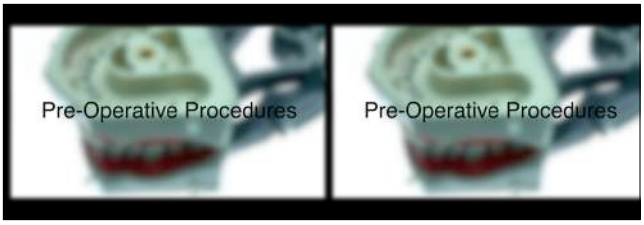
Box-only preparation

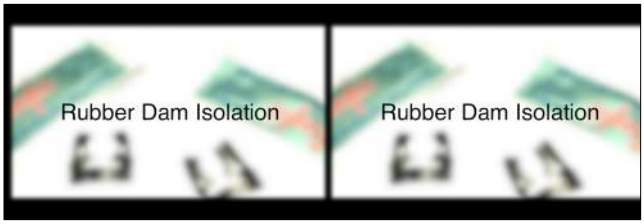
Slot preparation

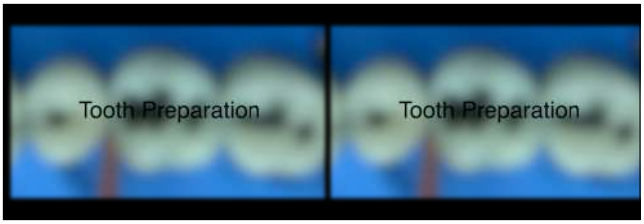
Accessing the caries Lesion

Removing marginal Ridge

Removing old restoration

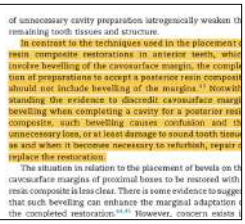






Tooth Preparation - Proximal Bevel

Guidance on posterior resin composites: Academy of Operative Dentistry - European Section



of unnecessary cavity preparation iatrogenically weaken th
remaining tooth tissues and structure.

In contrast to the techniques used in the placement
resin composite restorations in anterior teeth, whic
involve bevelling of the cavosurface margin, the comple
tion of preparations to accept a posterior resin composit
should not include bevelling of the margins.[1] Notwith
standing the evidence to discredit cavosurface margi
bevelling when completing a cavity for a posterior resi
composite, such bevelling causes confusion and th
unnecessary loss, or at least damage to sound tooth tissu
as and when it becomes necessary to refurbish, repair
replace the restoration.

The situation in relation to the placement of bevels on th
cavosurface margins of proximal boxes to be restored with
resin composite is less clear. There is some evidence to sugge
that such bevelling can enhance the marginal adaptation
the completed restoration.[2,3] However, concern exists

Matrix selection and placement

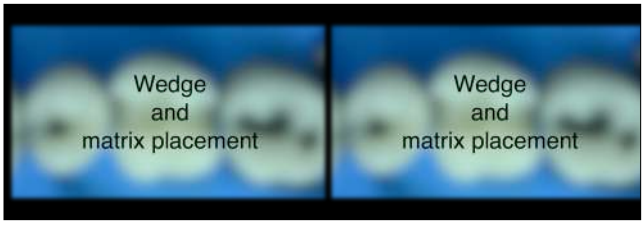
Matrix selection and placement

Comparison of
Proximal Contacts of Class II
Resin Composite Restorations
In Vitro

BAC Loomans • SJM Opdam • FJM Roeters
EM Bronkhorst • BCW Burgersdijk

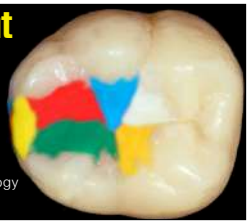
resulting in 160 identically prepared teeth. These teeth were divided into 8 groups (n=20). In groups, circumferential matrix bands (flat or contoured) in a Tofflemire retainer were applied. In the remaining 6 groups, 3 different separation rings were combined with 2 types of sectional matrix bands. All the cavities were restored using Clearfil Photo Bond and Clearfil AP-X. The tightness of the proximal contact was measured using the Tooth Pressure Meter. Data were statistically analyzed using SPSS 12. ANOVA was used to find differences in proximal contact tightness between the groups. Tukey tests were used to find differences between the homogeneous subgroups. The use of sectional matrices combined with separation rings resulted in tighter proximal contacts compared to when circumferential systems were used ($p<0.001$). The use of these devices is therefore recommended when posterior resin composite restorations are placed.

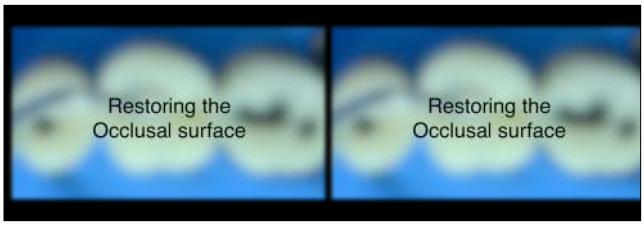
Matrix selection and placement



Incremental composite placement

- Decrease C-factor
- Improve bonding strength
- Improve marginal adaptation
- Improve light-curing
- Decrease amount of bubbles into the restoration
- Allow to build up multi colored restorations
- Allow to fill out the cavity quickly with better morphology
- Reduce excess of materials





UNRESTORED CARIOUS TEETH
#12 & #13

RUBBER DAM ISOLATION

SUPERFLOSS TO REMOVE
INTERPROXIMAL PLAQUE

MICROLUX TRANSILLUMINATOR®
ADJUNCT CARIES VERIFICATION

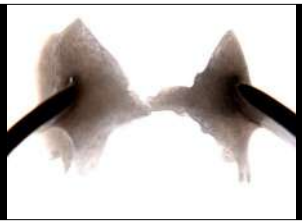
LUBRICATION OF TEETH
WITH GLYCERIN PRIOR TO
PLACEMENT OF CUSTOM
MATRIX RING

FINAL SET OF CUSTOM
MATRIX RING WITH
ULTRADENT OPALDAM®

CUSTOM MATRIX RING

CUSTOM MATRIX RING

CUSTOM MATRIX RING

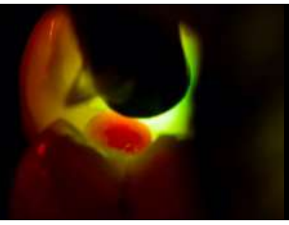


GARRISON FENDERWEDGE®

INTERPROXIMAL WEDGING AND SEPARATION

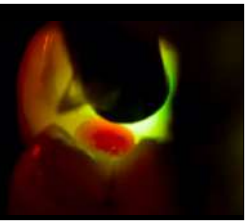
FLUORESCENCE AIDED CARIES EXCAVATION (FACE)

EXACT CARIES DETECTION



FLUORESCENCE AIDED CARIES EXCAVATION (FACE)

- Carious dentin areas exhibit red fluorescence when using FACE; non-carious areas exhibit green fluorescence
- The red fluorescence is emitted by porphyrin compounds, which are generated by bacteria
- Red-fluorescing areas exhibit a strong bacterial penetration and should be removed as part of the caries excavation.
- Red-fluorescing areas are removed until a green fluorescence appears



IDEAL BOX FORM FOR CLASS II TOOTH PREPARATION

OUTLINE

- Inclusion of enamel decalcification that is contiguous with the area of caries
- Inclusion of discoloration that would adversely affect the esthetic restoration
- Inclusion of weakened tooth structure that cannot be strengthened through acid etching
- No damage to adjacent teeth or periosteum

INTERNAL

- Sufficient depth to identify and conservatively remove the caries
- Conservative removal of tooth structure in a pulpal or axial direction
- Removal of all carious tooth structure
- Removal of discolored dentin that might negatively affect the esthetics of the final restoration

MARGINAL FINISH

- Finish line smooth, contiguous, and enamel properly supported
- Removal of all debris

CUSTOM WOODEN WEDGE

UNMODIFIED MATRIX POSITIONED TOO CORONALLY

MATRIX WAS CUSTOMIZED AND MODIFIED TO FIT IN PROPER POSITION WITH RESPECT TO MARGINAL RIDGES

CUSTOM WEDGE SUPPORTING BOTH CUSTOM WEDGES

- Ensure proper contour
- Ensure tight gingival seal

REAPPROXIMATION OF CUSTOM MATRIX RING

37% PHOSPHORIC ACID ETCH

ENAMEL 30 SECONDS

DENTIN 15 SECONDS

PRIMER APPLICATION

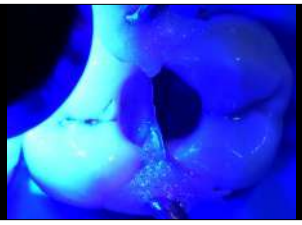
APPLY BRUSHING MOTION FOR 15 SECONDS

AIR THIN
THE PRIMER

OPTIBOND FL
BONDING AGENT

OPTIBOND FL
BONDING AGENT

LIGHT CURE FOR
20 SECONDS



INITIAL NANOFILLED
COMPOSITE RESIN
PLACEMENT WITH
CUSTOM MATRIX RING

BUILDING MESIAL
MARGINAL RIDGE OF
TOOTH #13

BUILDING DISTAL
MARGINAL RIDGE OF
TOOTH #12

CONTINUATION OF
INCREMENTAL
PACKING OF
COMPOSITE RESIN

FINAL RESULT OF
INCREMENTAL COMPOSITE
RESIN PACKING

REMOVING EXCESS FROM FINAL RESTORATION

GLYCERIN JELLY TO CURE THE UNCURED OXYGEN INHIBITED LAYER (OIL)

COMPOSITE RESIN RESTORATION AFTER GLYCERIN AIR-BLOCK

REMOVING OCCLUSAL STAINING OF #13 WITH CARBIDE FISSURE BUR

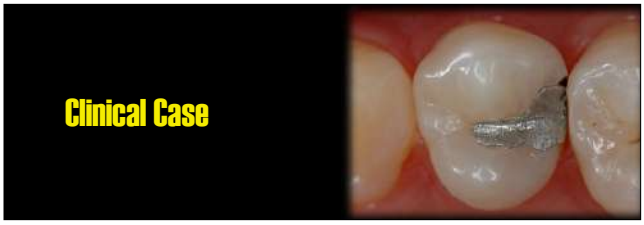
REMOVING OCCLUSAL STAINING OF #13 WITH CARBIDE FISSURE BUR

POLISHED RESTORATIONS FOR #12 & #13 WITH RUBBER DAM INTACT

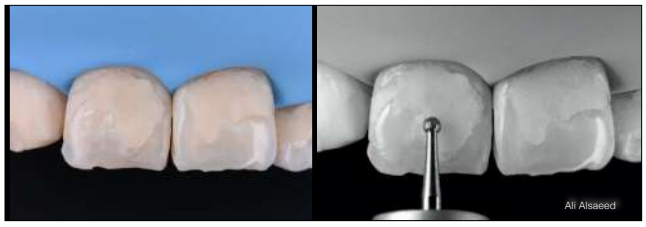
FINAL POLISHED RESTORATION FOR #12 & #13 AFTER OCCLUSION ADJUSTED

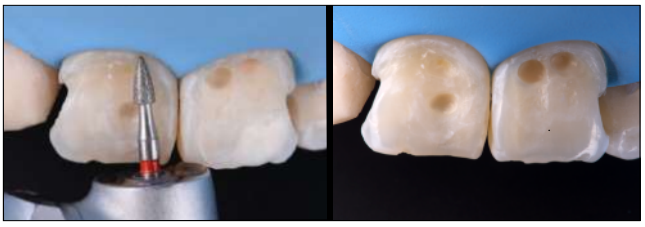
FINAL BITEWING RADIOGRAPH OF #12 & #13

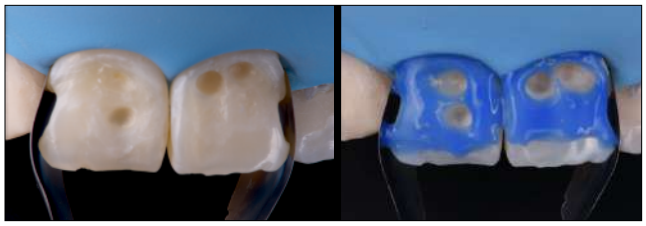

2
Direct Esthetic Restorations
Clinical Cases

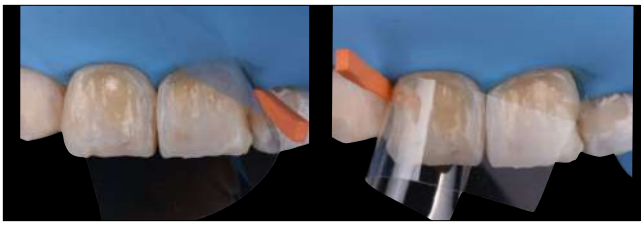

Clinical Case


Ali Alsaeed / Andrés S. Monescillo


Ali Alsaeed








1 Treatment of Tooth Discoloration
2 Direct Esthetic Restorations
3 Indirect Esthetic Treatments


TORONTO
CROWN
&
BRIDGE
STUDY CLUB