Treatment Of Discolored Vital Teeth

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The public is placing an increasing demand on the dental profession to provide them with the opportunity to have "white teeth." The public is conditioned, in part, by toothpaste manufacturers that promote their products with advertisement. Discolored teeth have consistently presented a problem where esthetics are involved. Unfortunately, human teeth can be discolored for many reasons. Factors responsible for dental stain determine the color, anatomic location, severity, and treatment of tooth discoloration. Discolorations of the dentition are traditionally classified into two main categories, extrinsic and intrinsic.

The dental practitioners are invariably pressured by the public to have the capability to diagnosis and treat discolored dentitions. Esthetic dentistry is an exciting and rewarding concept that has become a big issue throughout all the dental disciplines. In the past, both medicine and dentistry have been more concerned with the alleviation of physical pain and disease. Only within the past 20 years have tremendous technological advances allowed patients to expect and to receive the very best in the esthetic dental treatment from their dentists. The dentist must guide the patient by presenting all logical treatment alternatives.

Sources of Discoloration

Extrinsic Stains

Extrinsic stains are caused by accumulation and adherence of foreign material on the tooth surface. The color of extrinsic staining depends on the substance involved. Examples of extrinsic dental stains include tobacco stain, coffee and tea stain, stains from certain foodstuffs, discoloration associated with iron supplementation in vitamins, and stains resulting from the use of chemicals such as chlorhexidine.

Intrinsic Stains

Intrinsic stains are caused either by coloration agent entering the dental hard tissues or structural alterations

by genetic or environmental stimuli. The period marked by mineralization of crowns extends from approximately 5 months in utero to 12 years of age and includes the mineralization of both primary and permanent dentitions. Intrinsic discolorations are usually more esthetically displeasing, psychologically traumatic, and more difficult to treat compared to extrinsic discolorations. With the introduction of new materials and techniques, it is possible to successfully treat intrinsic discolorations.

There are several causes of intrinsic tooth discolorations which have either an endogenous or exogenous origin. These changes may occur during odontogenesis or after odontogenesis. During odontogenesis, teeth may become discolored from changes in the quality or quantity of enamel or dentin, or from the incorporation of discoloring agents into the hard tissues. Post-eruption discolorations occur when discoloring agents enter the dental hard tissues. They may originate from the pulp cavity or tooth surface.

Intrinsic Discolorations During Odontogenesis

Ochronosis

Ochronosis, also known as alkaptonuria or phenylketonuria, is a recessively inherited inborn error of metabolism characterized by incomplete oxidation of tyrosine and phenylalanine, causing a build-up of homogentisic acid. This may result in a dark brown discoloration of the permanent teeth.

Porphyria

Congenital erythropoietic porphyria (Günther's disease) is a very rare disorder of porphyrin metabolism resulting in an increase of the formation and excretion of porphyrin that can result in discolored teeth. It is usually congenital, but may be acquired later in life. The hematoporphyrin pigment causes a characteristic reddish-brown discoloration of the teeth, called "erythrodontia". The primary dentition is more commonly affected than the permanent dentition. In some cases, illumination with an ultraviolet light will demonstrate red fluorescence of the teeth.

Hemolytic Anemia

Erythroblastosis fetalis is a disease of the newborn that is caused by the Rh incompatibility of the blood of the mother and the child. The circulating blood pigments may discolor the deciduous teeth and those permanent teeth calcifying around birth. They appear greenish-blue, bluish-black, tan or brown in color. Treatment of this disorder is not necessary because the staining resolves as the child matures.

Thalassemia and sickle cell anemia are hereditary blood dyscrasias that may present with similar dental findings as erythroblastosis fetalis. One exception is that the permanent dentition is more extensively affected in thalassemia and sickle cell anemia.

Amelogenesis Imperfecta

Amelogenesis imperfecta is a general term describing a variety of enamel defects, genetically determined disorders. Enamel form, mineral content, thickness, and coloration can all be affected in patients with amelogenesis imperfecta, and there are specific modes of inheritance of such defects. The three types of amelogenesis imperfecta are hypoplastic, hypomaturation, and hypocalcific. All three types show variations in clinical appearance between each type and within each type.

The enamel in the hypoplastic type appears thin, to the extent that the teeth do not contact each other mesiodistally, Clinically, the crowns are usually yellow, smooth, glossy, and hard, although they may present with roughness and pitting.

The hypomaturation type of amelogenesis imperfecta is characterized by teeth having normal enamel thickness but a low value of radiodensity and mineral content. The problem is related to the persistence of organic content in the rod sheath, resulting in poor calcification,

low mineral content, and a porous surface that becomes stained.

The enamel of hypocalcific amelogenesis imperfecta is of normal thickness, but presents soft, to the extent that it is abraded away soon after eruption. The crowns appear from a dull opaque white to a dark brown, and usually are rough and pitted.

Patients with amelogenesis imperfecta are excellent candidates for full coverage restorations. This will provide adequate esthetics, protect the pulp tissue, and allow improvement in the efficiency of hygiene procedures.

Dentinogenessis Imperfecta

Dentinogenesis imperfecta is inherited as an autosomal dominant trait. It is the most prevalent hereditary dystrophy affecting the structure of teeth. Dention that is characteristically reddish-brown to gray opalescent. Teeth affected with ''hereditary opalescent dentin'' cent. Teeth affected with ''hereditary opalescent dentin'' usually develop pulp space closure, have short roots and short bulbous crowns. Patients often complain of tooth sensitivity to thermal stimulus.

Fluorosis

Fluoride is most beneficial to the teeth in water concentrations of approximately 0.5 to 1 ppm. Higher concentrations, such as twice higher than optimal concentrations, may cause mottling and hypoplasia of the enamel and hypomineralized dentin, with increased interglobular spaces. Depending on the severity, the enamel may appear with white flecks or spots in the mildest forms to mottled or pitted in the more severe forms. A brown stain of extrinsic origin is acquired a few years after the affected tooth has erupted. Despite their unsightly appearance, these teeth are almost completely free of caries.

Tetracycline

Tetracycline is derived from a yellow-gold fungus whose color is maintained in the purified antibiotic and transferred to the hard tissue in which it is incorporated. On prolonged exposure to light, tetracycline-stained dental tissue will change to a brown to gray color (i.e., these shades of discolorization are eventually seen in the teeth). The effects of tooth discoloration by tetracyclines was first reported in 1956 by Schwashman and Schuster. During enamel formation, tetracycline binds to the calcium to form a Calcium-Phosphate-Tetracycline complex. Staining is most notable in the dentin, expecially in the first-formed dentin at the dentinoenamel junction. Tetracycline staining of teeth is permanent; staining of bone is not permanent because bone is remodeled continuously. Cervical staining is most characteristic of tetracycline because this agent deposits primarily in the dentin.

The severity of the discoloration is related to the dose, duration, time of administration, and the type of drug during ingested:

1. Chlortetracyline (Aureomycin) --------- Gray-brown
2. Demethylchlortetracyline (Ledermycin) ---- Yellow
3. Oxytetracycline (Terramycin) - Yellow (least amount)
4. Tetracycline (Achromycin) ---------- Yellow
5. Doxycycline (Vibramycin) ---------- No Change

Bile Duct Abnormalities

Another type of tooth discoloration associated with a systemic disorder is green stain from bile duct abnormalities (i.e. jaundice). If for any reason bile salts are released into the circulation in sufficient quantities, they can be incorporated into developing tooth structure and cause green stain.

Intrinsic Discoloration After Odontogenesis

Trauma

Injuries such as bicycle accidents or impact from falls may cause internal hemorrhang and subsequent discolorization of individual teeth, without loss of vitality. In some cases, the crown will return to its original

color within a few weeks after injury. Prolonged discoloration usually indicates pulp necrosis and a localized "pink point" on the enamel surface indicates internal resorption. Occasionally, patients will have one or two vital anterior teeth that have darkened or discolored for no known reason (idiopathic discolorization).

Tooth Tissue

Aging, secondary and tertiary(atypical) dentin formation, and pulp stones can cause the tooth to appear a yellow-brown color.

Metals

By direct contact and oxidation or by precipitation from the blood stream or saliva, metals may deposit in the dentin, cementum, or enamel. The most common cause of metallic staining is corrosion products from amalgam restorations.

Dental Materials

Materials containing therapeutic agents can discolor the dentition. Examples of these are polyantibiotic pastes, oils of cloves, creostote, etc.

Food and Beverages

Intrinsic staining may result from smoking, tobacco chewing, and coffee or tea drinking. The tendency for staining is dependent on the quantity, type, and the length of exposure of the discoloring agents, the surface texture of the enamel, and the oral hygiene of the individual.

Treatment Options

For normal stain removal, routine prophylaxis buffing with the abrasive paste will suffice. However, some discolored teeth may need to be treated by one or a combination of the following techniques: full coverage restorations, labial venerring with composite or porcelain, bleaching, or microabrasion. The method of treatment is dictated by the etiology and the severity of the stain, the finances of the patient, and the practitioner's personal preference. The following table illustrates the over-all summary of conservative treatment of the discolored dentition.

After the table, all the treatments will be discussed in detail. The procedures will be explained step by step.

Bleaching

Bleaching involves applications of concentrated hydrogen peroxide and mild heat to vital teeth, usually over a series of three to five visits. The same technique is used for all forms of dental discoloration.

The effectiveness of bleaching depends on the extent and source of the discoloration and on clinical factors such as degree of heating, age of the peroxide solution, and duration of application. Since vital teeth are relatively resistant to color changes, several treatment at weekly intervals usually are required to achieve the desired results. Evidence of bleaching effectiveness may not be apparent after the first dental visit, and the patient should be told of this before treatment begins. Results (or lack of results) are usually evidence after three treatments. The degree change can be readily documented by sequential photography of the case as it progresses. Once the sequence is completed, reversal of the color change is not likely.

The steps of the procedure:

1. Protect the patient's skin and clothing with a plastic drapes and provide rubber dam gloves for all dental personnel.
2. Do not administer local anesthetic.
3. Apply petroleum jelly to the gingival tissues to prevent tissue burn if the bleach should leak through the rubber dam.
4. Isolate teeth with close-fitting rubber dam to prevent leakage of bleach onto the gingival tissues.
5. Thoroughly clean the exposed teeth with pumice in

a prophy cup to remove all biofilm and petroleum jelly.

6. Etch exposed teeth with 37% to 50% phosphoric acid for 30 to 60 seconds. This pretreatment increase the surface area of the tooth, remove any residual biofilm, and enhances the effectiveness of bleaching.
7. Apply 30% to 50% hydrogen peroxide (as Superoxol®) to the labial surface of the teeth with a cotton pledget.
8. Enhance the bleaching process either by touching the tooth with a heating instrument or by exposing the teeth to a heating light.
9. Apply heat and hydrogen peroxide for 20 to 25 minutes per treatment.
10. At the end of treatment rinse the tooth with water, and remove the rubber dam. The effects of both bleach and acidetch procedures should have produced a distinct lightening of the treated teeth. The patient should be told that there will likely be some reversal of the lighter color over the next 2 to 3 days. The patient may also experience slight discomfort in the treated teeth that evening due to mild hyperemia. This reversible condition rarely persists beyond 24 hours.
11. Repeat bleaching treatment until the desired shade is obtained.

Microabrasion

The advantages of this technique are:

1. Gives permanent results
2. Causes insignificant loss of tooth structure
3. Causes no damage to the dental pulp or associated periodontal tissues
4. Requires a minimum of treatment time
5. It will be easy for the patient to tolerate and for the dentist to perform.

The indications of this technique are:

1. Enamel dysmineralization
2. Enamel demineralization
3. Cooperative patient
4. Tooth completely erupted.

The contraindications of this technique are:

1. Intrinsic stains (In some cases, improvement of a tooth discolorization problem is best accomplished using enamel microabrasion in conjunction with composite resin bonding procedures.)
2. Poorly cooperative patient
3. Inability to place rubber dam
4. Teeth with restorations into dentin.

Hydrochloric acid-pumice abrashion

A remarkably simple and effective method of eliminating superficial stains on the tooth was described by McCloskey. The McCloskey technique consists of cotton pellet application of 18% hydrochloric acid to stained enamel surfaces. The first application will approximately remove 30 μm of enamel, subsequently each additional application would remove 25 μm. With repeated application of the solution, the enamel discoloration gradually disappears. After polishing and remineralization, the freshly exposed enamel attains and retains normal color and surface characteristics.

The steps of the procedure:

1. Pumice teeth thoroughly to remove any superficial stains.
2. Isolate teeth with rubber dam. The entire labial surfaces of the teeth to be treated must be exposed. (Extreme care should be exercised when using the acid to prevent soft tissue contact and injury to either the patient or the operator. The operator should wear gloves and both operator and patient should have protective eye wear.)
3. Seal rubber dam with Copalite® or another ap-

propriate sealant to prevent seepage of the acid to the gingiva.

4. Use a trimmed wooden cotton-tipped applicator to apply the acid-pumice paste to the area of the tooth requiring treatment. (have sodium bicarbonate, baking soda, available as a thin paste to neutralize any accidental spill of acid on the soft tissues or teeth.)
5. Apply the acid-pumice paste with an erasing motion for five seconds, then rinse for five seconds. Apply the paste on the enamel adjacent to the stain to get a more uniform appearance. (After several applications, the stains will begin to disappear gradually. The color change should be evaluated when the tooth is wet.)
6. Repeat up to a maximum of ten applications. Each application is estimated to cause a total loss of enamel surface of approximately 10 μm. (If the stain is still present after a maximum of ten 5-second applications, the stain is too deep for this procedure and another restorative approach should be considered. At the end of the etching phase, the entire labial surface of the teeth will appear slightly dull.)
7. Apply a solution of 2% sodium fluoride on the treated teeth and allow it to remain for three minutes.
8. Polish the enamel with a Vivadent® green cup using the fluoride solution as a lubricant.
9. A fine prophylaxis paste can also be used to polish the enamel surfaces to restore the gross; however, the polishing cups give a better luster clinically. (Polishing the enamel surface at the end of the procedure is very important to prevent or minimize the formation of new extrinsic stains.

Within a few weeks, the enamel gloss tends to improve through additional remineralization from the calcium salts in the saliva. There is also a tendency for the color of the tooth to improve within six months of application.

Prema®

The advantages of this Prema® microabrasion technique are:

1. Can use rotary instrument.
2. Low acid concentrations, better safety.
3. Using rubber dam is important, but not critical. The main disadvantage is the cost, which is around $200

Enamel microabrasion is performed as followed:

1. Applying a rubber dam on the discolorized teeth, then seal the rubber dam-enamel margin with copal varnish.
2. In operating field, note the perfect isolation with the rubber dam. The operator should wear gloves and both operator and patient should have protective eye wear.
3. Apply the microabrasion compound with the rotary mandrel and 10:1 gear reduction angle. (Always use s 10:1 gear reduction angle: higher-speed application causes dangerous splattering of the compound.
4. The mandrel tips are designed so that the rotating fluted lateral surface can concentrate pressure in local areas or, when used across the surface, can apply the material over a broad plane.
5. Use the fine tip of the hand applicator to compress the compound into local regions of stain.
6. Use the hand applicator tip in any situation that seems appropriate.
7. The large end of the hand applicator can be used to concentrate finger pressure in certain areas of the tooth surface, but over a broader plane. (The configuration of the broad end of the hand applicator tip can also be modified to your liking.)
8. After remove the superficial enamel discoloration, apply a fine-grit fluoridated prophylaxis paste in the same manner you would use to routinely polish tooth surfaces.
9. Rinse the teeth and evaluate surface color. (Evaluate tooth surfaces when they are wet. Some enamel stain,

particularly white stain, becomes very vivid on desiccated tooth surfaces, and except in people who are chronic ''mouth breather,'' tooth surfaces usally are moist with saliva.)

10. Apply a topical application of a fluoride gel solution for four minutes after the prophylaxis paste polishing is completed.

Veneers

The art of veneering teeth has progressed over the past 25 years so that today it can be categorized into two main segments:

1. Direct fabricated veneers. These are composite resin materials applied the tooth suface freehand by the clinician.
2. Indirect fabricated veneers. These are laboratory-fabricated veneers developed on a cast of the patient's mouth. This category can be further subdivided according to the materials used: composite and etched porcelain.

Although both systems and each material has its own proponent, there does appear to be definite indications for each. The fabricaiton of direct composite veneers are invariably more time-consuming and are obviously considerable more complex because the technique sensitivity and procedural limitations within the confines of the oral cavity. They are dependent upon the dentist's technical skills and artistic ability to create that ultimate result. The clinician, with a lesser degree of artistic interpretation, may find it considerably easier to utilize the skills of a laboratory technician to develop the artistic form of the veneers in the laboratory and then later bond these onto the teeth.

Indications for Veneers:

1. Teeth are discolorized and bleaching and microabrasion are not effective.
2. Unesthetic contour and shape of teeth.
3. Incisal edge defects.
4. Orthodontic movement required when orthodontics not feasible.
5. Weak coronal tooth structure.

Direct Resin Veneers

Direct light-cured composite veneer restorations are ideal for the conserative treatment of abrasion-erosion wear, moderate intrinsic discolored teeth and/or enamel hypoplasia.

When the direct composite veneer restorations are indicated, the question quite naturally arises, ''What is the best choice of composite material? Generally speaking, if occlusion is normal and can be adjusted in protrusive or protrusive lateral movements to prevent inordinate stress on the restorations, the light-cured, microfilled composite materials are the best choice because of their superb polishing characteristics and overall esthetic acceptability. Should occlusal factors be more damanding, the hybrid materials would be the better choice.

Direct composite veneer is performed as followed:

1. Isolation of the field: Proper isolation of the field is accomplished by placement of a rubber dam and a properly placed clamp.
2. Preparation: The chamber-shoulder preparation is then completed on the labial enamel surface. Three important reference points serve as guidelines for the labial veneer chamfer-shoulder margins, namely, the free gingival crest, the proximal cntact areas, and the incisal edge. The gingival margin of the preparation should extend cervically to the free gingival margin. The mesio- and disto-proximal borders of the preparation end just sligtly labial to the contact areas to allow convenient access for finishing purpose. Incisally, the preparation extends to the crest of the incisal edge usually without palatal overlap.
3. Acid etching: Many light-cured composite materials

come with gel-type etchants. An etching gel is painted over the enamel surface area and left in place for 60 seconds. After thorough water rinsing, the labial enamel is thoroughly air dry.

4. Bonding: A small ball of bond resin is applied to the midenamel region on the end of a soft fine-tipped brush. Then it is spread peripherally toward the enamel cavosurface periphery and gently blown with air.
5. Insertion: A polyethylene strip is placed between the proximal chamfer margins and the adjacent teeth in order to control the placement of the composite material. The composite paste is applied and contoured over the labial surface. Wetting the side of instrument with a little bond resin prior to contouring facilitates the procedure and allows for proper shaping and forming of the composite material without ''pull back''. The flat-bladed composite instrument wetted with a slight amount of bond resin mat be used to shape and form the marginal areas before curing. The composite material is then cured by means of a 30-40 seconds application of visible light from both labial and lingual directions. If the diameter of the light source end is considerably less than the mesiodistal width and incisogingival length of the composite restoration, the light should be slowly rotated around the periphery of the restorative material and the period of light application extended.
6. Finish: In finishing, most of the smooth labial surface should be left intact if at all possible. Marginal finishing should be carried out by means of a tapering, multifluted finishing bur, and final finishing is carried out with aluminum oxide discs. Careful adjustment of the occlusion in centric, protrusive, and protrusive lateral positions should follow. Group function is mandatory.

Porcelain Veneers

Procelain veneers are indicated when the veneer must accept significant functional loading. For example porcelain is the veneer of choice for lengthening the functional incisal edges of anterior teeth. Porcelain is often regarded as the best restorative material available because of its esthetic quality, resistance to degradation, and low thermal and electrical conductivity. The plaque retention on porcelain is lower than on other restorative materials. This implies that gingival health around a well-fitting porcelain veneer is likely to be better than that adjacent to acrylic or composite veneers, providing the composite lute is of minimal width and adequately finished.

Porcelain veneer is performed as followed:

First Appointment

1. Shade selection: Clean teeth with pumice, if necessary to remove external stains, etc. Selective tentative shade. The shade selection at this appointment is mainly to establish how light your patient want their teeth to be. This is important to know before preparing their theeth since you will want to remove the maximum amount of enamel from teeth needing a dramatic color change. The final shade determination will be done during the try-in of the veneers.
2. Prepare teeth: If teeth are in alignment and only moderate color change is desired, approximately 0.5 mm enamel reduction is needed. If the are any misaligned teeth, there are also contoured and are brought into alignment. This frequently means removing more than 0.5 mm of enamel. In interproximal extension, the preparation is extended to the gingival crest and into the interpoximals without breaking contact. If your are not lengthening the teeth, the incisal finish line should be a chamber and placed at the facioincisal line angle, otherwise, the finish line placed slightly (0.5 mm) onto the lingual surface. After the basic preparation is completed, cord is packed to ensure complete visualization of your margins. Local anesthesia may be necessary at

this stage. Since some tissue shrinkage may occur as a result of cord placement, the gingival margin is now apically prepared 0.5 mm. This will insure that the veneers will be even with the gingival crest or just slightly subgingval. Finally, smooth all sharp edges and corners. This is necessary to prevent cleavages lines from forming in the veneer which can lead to premature fracture.

3. Take impression: The retraction cord can be left in place unless it is covering your finish line. It is best to use a high quality, dimensional stable material such as a polysiloxane or polyether since several pours of the impression may be necessary. Placing soft wax or Oraseal® putty in the lingual embrasures prior to taking impression is helpful to minimize tearing the impression. A full arch impression is usually warranted if six or more teeth are to be veneered. Make bite registration and opposing arch impression.
4. It should have already been determined whether you will be placing temporary veneers. If you do, they should be done before removing the cord. The great majority of patients do not require temporary veneers. But if they are necessary or desired, they are hand-sculpted individually, contoured to keep them supragingivally and out of occlusion, and attached by etching a small area of the enamel away from the margins. Do not overcontour. If the gingival embrassures are open, you can even eliminate the etching and retain the temporary by wrapping it around the line angles. Temporary veneers are time-consuming and this should be taken into account when deciding on your fee.
5. Remove cord and dismiss patient: Caution patient that their gums may be tender for several days and to be gentle when cleaning their teeth. Use of Toothettes is helpful.

Between Appointment

1. Lab prescription: Prescription to the lab should be very specific concerning type of veneer (material), length of veneers, degree of opacity, shade, surface texture, thickness, etc. Sending study models, the shade matrix and color slides is also helpful.
2. Checking veneers returned from lab: There are something we need to check, like seating and alignment, veneer dimension, veneer margins, and veneer etch.

Second Appointment

1. **Remove temporary veneers:** The temporary veneers (if used) are ''popped off'' by wedging a sharp instrument between the margins of the temporary and the tooth. If any resin remains on the tooth, it should be removed with a coarse finishing disc that will only remove resin, not tooth structure.
2. **Try in veneers for fit:** Clean the teeth with pumice to remove plaque and stains. This is just a preliminary cleaning. A more definitive cleaning of each tooth will be necessary prior to bonding each veneer. The veneers are carefully placed on the teeth initially without and trial bonding medium to assess the fit. all the veneers should be placed at this time to make sure one veneer does not prevent the seating of another one. If two veneers are binding at the contact, carefully adjust the contact with a finishig diamond.
3. **Try in for shade:** After confirming the fit, the veneers are removed and then carefully replaced on each tooth using K-Y jelly or glycerin as a trial bonding agent, since both are untinted and water soluble. This allows you to see what the fine color will be if an untinted bonding agent is used. Be sure to tell the patient to be careful not to bite down. The color of the teeth with the veneers in place is compared to the shade you had tentatively selected. If the color is acceptable, you are ready to proceed with bond. If it is not, then a trial insertion of one veneer is done using either the try-in paste of the bonding system you are using

or the actuary material if a try-in paste is not included in the kit. This is done by placing the try-in paste or bonding material in the veneer, placing it on the unetch tooth and again checking it against the shade tab. Note: If you are using the actuary bonding material for your color check, be aware that it could start to polymerize if the room light is very bright. Therefore, do these color checks quickly.

4. **Clean veneers:** Carefully scrub the inside of the veneer with a soft toothbrush under running water to remove try-in paste or K-Y jelly. The veneers are then dried with air and regular phosphoric acid etchant is applied to the inside of the veneers to act mainly as a decontaminating agent. You should brush it on and rinse it off immediately. After rinsing, dry the veneers thoroughly. Note: Some bonding kits have different instructions. If in doubt, follow the manufacture's procedure.
5. **Apply silane or special bond:** Apply the silane coupling agent with a disposable brush to the etched surface of the veneers. Only a thin layer is necessary. It usually will evaporate very quickly, but you should still air-dry with the air syringe.
6. **Apply dental adhesive to veneers:** Apply a dental adhesive to the etched surface of the veneers with a disposable brush and thin it out with the air syringe. Do not cure. This adhesive is only being used as a wetting agent. If your luting resin is fairly fluid, this step may not be necessary.
7. **Fill veneers with luting resin:** If you using a single-component light-cured bonding material, load the veneers directly from the luting material's bottle or syringe and distribute the material with a brush. Make sure the veneers are fully loaded up to their margins and that no air bubbles are present in the luting material. Do not cure. After doing this to all the veneers, place them in a light-protected area or box and set them aside for the time being. If you are using a dual-cure, two component system, you must wait until you are ready to bond the veneers before mixing the material.
8. **Clean teeth to prepare for bonding:** You are now ready to prepare the teeth for bonding. Place a single strand of retraction cord on the facial of each tooth. Anesthesia may be necessary. Scrub as much of the preparation with chlorhexidine soap using a prophy cup or prophy brush in the slowspeed handpeice. Areas of the preparations not accessible with the cup or brush can be scrubbed with a cotton pellet saturated with the soap. For extra cleaning power, use a mixture of chlorohexidine soap and pumice to scrub the preparation. Carry the soap interproximal with floss. Wash and dry.
9. **Isolate six anteriors:** Place plastic strips or ultrathin (0.001 in.) deadsoft metal strips distal to both canines to isolate them from the premolars. Insert lip retractors and Saliva Ejector/Tongue Holder (Unitek®). These devices effectively keep the lips and tongue away from the bonding area.
10. **Etch teeth:** To prevent overetching, it is prudent to etch two or three teeth at a time for 15 seconds even though some of the etchant will spill over onto the adjacent teeth. It is not critical, you just don't want to each for more than 60 seconds. Initially, wash the etchant off each tooth for just a few seconds. Then, after all the teeth have been etched, wash each tooth for 10 seconds and dry with air syringe followed by a hot air dryer.
11. **Apply adhesive to teeth:** Do not cure.
12. **Seat veneers:** Start with the centrals and work back to the canines. Each veneer should be seated firmly but in a gentle rocking motion until it is in the correct position. The absence of strips at this point is a great advantage-you have an unencumbered view of the veneers and can assess their alignment very accurately.
13. **Remove bulk excess:** With a sable brush, remove the bulk excess of resin cement off the veneers.

14. **Sport-cure:** When you are satisfied with their position, use a small (2 mm, Demetron®) curing tip to spot-cure for 5-10 seconds the veneers to place. Spot-curing will tack down the veneers in a semi-permanent manner to keep them from moving during the more definitive cement removal step.
15. **Remove additional excess cement:** After the veneers are ''tacked down'' by spot curing, you can more definitively remove all but a slight excess of cement that should be left at the margins to prevent voids. If the veneers fit well, cleaning this small amount of resin cement off the tooth after the veneers are cured will not require much time.
16. **Cure each veneer:** Each veneer should be cured for 60 seconds on the facial and 60 seconds on the lingual. This assumes the tip of your curing light completely covers the veneer. Two light with large diameter tips help to speed up this curing.
17. **Remove cured excess cement:** Finish the veneers by removing as much as possible with the #12 and #15 scapel. This excess usually comes off the facial surface of the veneer fairly easily. If cement is lodged interpoximately, use a Ribbon Saw or a Cerisaw® to remove it.
18. **Contour veneers and refine margins:** The gingival margin and emergence profile are refined using finishing diamonds on porcelain while retracting the gingiva with a plastic instrument. The incisal edge of a porcelain veneer is contoured with discs and finishing diamonds. The lingual is then contoured with finishing diamonds or burs. The diamonds are always used with water while the burs can be used wet or dry. Check the occlusion and adjust as necessary.
19. **Smooth and polish veneers:** The final finish on the lingual is with finishing burs dry to allow better visualization for more complete removal of excess bonding material on the tooth itself. Use the smoothest finishing diamonds on the margin of the porcelain. The proximals may need further smoothing with the diamond finishing strip followed an aluminum oxide polishing strip, making sure not to open the contacts. The final polish is with a dporcelain polishing paste in a prophy cup. Carry the polish interproximal with floss. Remove the cord (if used) and rinse well with water.

Indirect Composite Veneers

Indirect laboratory-processed composite veneers have similar indications to porcelain veneers. These materials are essentially laboratory light-cured, microfilled systems which are often vacuum-cured nuder strictly controlled laboratory conditions, It has been suggested that the composite veneer requires less tooth preparation than the porcelain veneer. Any time a veneer is being utilized to dramatically change the shade of the tooth, it requires a certain thickness of veneering material. The porclain can achieve this in less dimension than the composite. This leads to less overbuilding of the tooth both esthetically as well as within the gingival area, where the extra bulk may pose a periodontal problem. The thinnest that an indirect composite veneer can be made is 0.3 mm; the porcelain will be 0.5 mm. This 0.2 mm difference is clinically insignificant when weighing the other advantages and is barely measurable when preparing the teeth. The clinical technique for indirect composite veneers is similar to that already described for porcelain veneers.

Although both porcelain and indirect composite veneers are indicated for similar clinical situations, the clinician, when making a choice, must consider esthetics, technique-sensitivity, and cost. Porcelain veneers provide the ultimate in esthetic acceptability. However, they are more technique-sensitive and more costly than indirect composite veneers. Porcelain veneers are more technique-sensitive in two respects: (1) a primarily micro-mechanical bond exists at the composite-porcelain interface, and (2) should fracture of the porcelain occur, it is difficult to

repair simply by the addition of composite material. As for cost, the laboratory fee for a porcelain veneer is usually somewhat higher than that for an indirect composite veneer. Despite the excellent esthetic results, indirect composite veneers lack the super enamel-like reflectively of fused porcelain surfaces. However, composite veneers are less technique-sensitive than porcelain veneers for a chemical bond is attainable at the composite-veneer interface. In addition. should fracture occur, the indirect composite veneers are easily repaired by means of a direct add-on composite technique.

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