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Dental Bleaching

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INTRODUCTION

Bleaching is one of the most commonly sought elective dental procedures to brighten a smile. It is a simple, fast and effective treatment to change darker tooth shades into lighter ones.

Chemistry of bleaching

Bleaching process is based on the oxidation of bleaching agent. Oxidation is the chemical process by which organic materials are converted into carbon dioxide and water. The oxidation reduction reaction that takes place in the bleaching process is called the redox reaction.

Bleaching slowly transforms the organic substance in the stained tooth into chemical intermediates that are lighter in color than the original tooth shade. In a redox reaction the perioxide (oxidizing agent) has free radicals with unpaired electrons, which it gives up, becoming reduced. The stained tooth structures accept these electrons and becomes and oxidized, thereby reducing the organic colorants. The free radicals produced by the peroxides are per hydroxyl and nascent oxygen. Of these, the perhydroxyl is a more potent free radical which is responsible for a better bleaching action.

In order to promote the formation of perhydroxyl radicals, the peroxide is buffered to a pHrange of 9.5 to 10.8. The buffering provides a greater amount of perhydroxl radicals, which resultsin a better bleaching effect. The most common bleaching materials used are hydrogen and carbamide peroxide. Carbamide peroxide first breaks down into hydrogen peroxide which then further liberates the abovementioned free radicals. Unlike the hydrogen peroxide, the carbamide peroxide bleaching agent mustremain in contact with the teeth for a longer period of time to obtain complete efficiency of the reaction. Carbamide peroixde is less irritating to the gingival tissues thus better tolerated by the patients when used as a home bleaching agent.[2]

Mechanism of Bleaching

In the presence of moisture as well as surface debris on the tooth, the ionization by hydrogen peroxide occurs by decomposition into water and nascent oxygen which is a weak radical making the peroxide which is a weak radical making the peroxide inefficient as a bleaching agent. Hence, it is important to have teeth dry and free of surface.

Increase in the temperature, higher peroxide concentration and the duration of exposure of the tooth structure to the peroxide within the oxidation process leads to a greater degree of color change.

Saturation Point

Prolonged used of a bleaching agent causes the whitening action to slowdown beyond a point during the treatment, this is the saturation point. Bleaching should thus be stopped at or before the saturation point. If bleaching is done beyond the saturation point, it clinically manifests an increase in porosityon the tooth surface. A fluoride application is recommended and no bleaching agents should beapplied allowing the enamel to re-mineralize.

Procedure for Bleaching

Use of concentrated carbamide peroxide solution available in standard 35% concentrations. In a technique described as ‘assisted office technique’, 35% carbamide peroxide is tray loaded for 45minutes, after following required protocols. Some bleaching materials are available in a combination of a hydrogen peroxide and carbamide peroxide in 20% and 16% concentrations respectively.

Preparation of Trays

The procedure is recommended for the number of teeth seen in the patient's active smile. 1 millimeter reservoir for the bleaching gel. On the modified cast soft and clear vacuuform matrix of 0.035" thickness is made. The matrix is carefully trimmed to cover only the clinical crowns. Contact of the bleaching gel with marginal gingiva may result in tissue irritation hence vacuuform trays should have a marginal seal to eliminate contact of the caustic bleaching gel with the gingival [64].

Isolation of Teeth

Proper isolation of area with cotton rolls or rubber dam is mandatory. The gingival surface is wiped and dried sufficiently.

Etching of tooth surface

Each tooth is etched on labial surface for 10 to 20 seconds using 32% - 37% orthophosphoric acid. This step removes any superficial surface stains and enhances the penetration of the bleaching solution into the tooth surface producing a greater stain reduction. Excessive etching causes the demineralization of the enamel matrix, leading to surface irregularities and causing sensitivity.

Application of bleaching material

The bleaching materials is slowly loaded in to the vacuufrom trays so that it spreads all over the labial surface of the teeth to be bleached. The trays are kept in place for an average duration of 30minutes depending on the type of material used and the manufactures recommendations.

Micro-finishing and polishing
Following bleaching, the teeth are micro-finished using fine abrasive disks. Final polishing isdone with aluminium oxide or fine grit diamond.

Office bleaching of non vital teeth

The two most commonly used agents for bleaching of non-vital teeth are hydrogen peroxide and sodium perborate.

Home bleaching

Bleaching may be carried out at home by the patient. The home bleach technique involves the application of bleaching agent through the use of vacuuform trays. The frequently used bleaching agent is 10% - 15% carbamide peroxide.

Bleaching in relation to bonded restorations

It was determined in clinical studies that the bond strength of composite to enamel is reduced when the tooth is bleached. The primary cause for the reduced bond strength is the presence of the residual peroxide or oxygen, which interferes with the polymerization of resin bonding systems and restorative materials. Any bonded restorations in the bleached teeth need to be done after a period of two weeks.

Enamel microabrasion

Hydrochloric acid (18%) pumice abrasion can remove white enamel opacifiers, multi-coloured defects and many brown, orange, yellow enamel spots and streaks, regardless of etiology. These stains can be eliminated with insignificant

enamel loss if the stain is limited to a thin layer of tooth surface (approx. 0.5mm). This procedure can be used independently or prior to bleaching to give optimal results.

Management of Fluorosis stained teeth

A solution of anaesthetic ether, hydrochloric acid and hydrogen peroxide may also be used for bleaching teeth with fluorosis stains. The anaesthetic ether removes surfaces debris, the hydrochloric acid etches enamel and hydrogen peroxide bleaches it.

ESTHETICS WITH COMPOSITES

Considerations in preparation design for anterior teeth.

The preparation design for anterior composite restorations should encompass elimination of decay, function and longevity, and esthetic predictability.

Function and longevity

A pre-operative analysis of the occlusion is crucial to determine the palatal extensions and the acceptable length in upper anterior restorations. Checking the lateral and protrusive excursions willgive an idea as to how far palatally the final restoration can be placed. Researchers have found that a minimum of 1.5mm – 2mm of the composite thickness is essential to give sufficient strength to the material.

Esthetic predictability

After elimination of the decay and determining the extent of preparation required for function and longevity, the preparations are evaluated and if required redefined. The preparation design is extended to allow a smooth transition of shade from the composite restoration to the rest of the tooth. This enables the restorations to achieve esthetic excellence. To create proper tooth from, shape, shade and texture, and to optimize function, all cavity preparations designs should have extension for function and esthetics (EFE).

The EFE ensures that the margin of the restoration overlays the defects. The esthetic advantages are:

- Successful masking of the defect
- Better marginal adaptation
- Natural transition of shade between composite and tooth
- Ease of finishing and texturing

EFE and placement of composite for malaligned teeth

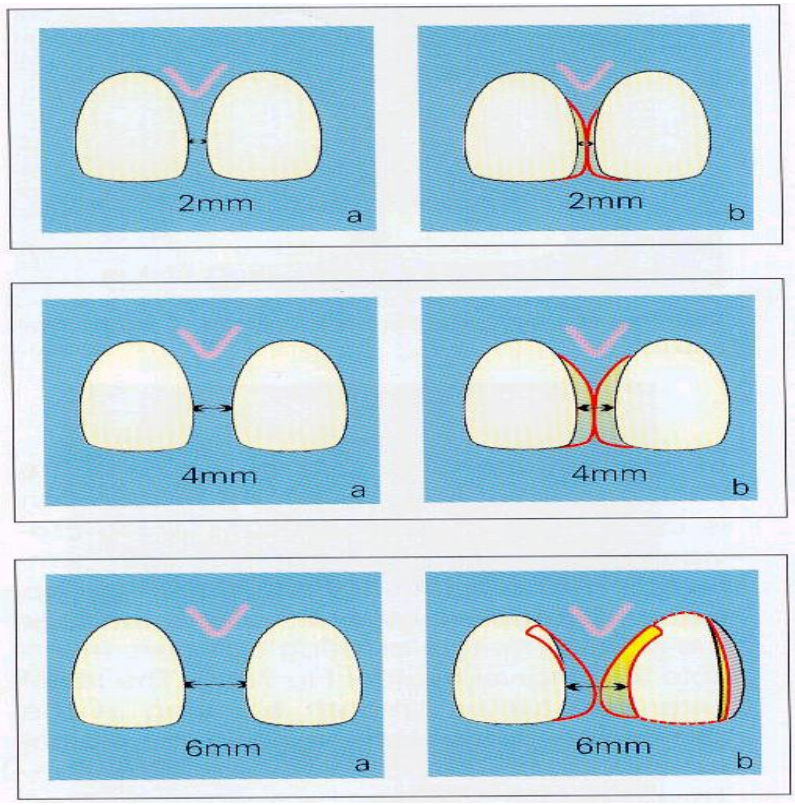
The preparation in malaligned teeth depends upon the degree of rotation and angulation exhibited by the teeth and hence a uniform layer of composite cannot be placed to treat such teeth. The effective use of opaque composites in areas having no tooth or thin palatal structure, improves the blending of the restoration. Creating surface char acteristics and effectively placing the transitional angles on the facial surface can help to overcome deficiency in tooth reduction.

EFE and placement of composite for closing spaces

Diastema may be manifested to due to microdontia, discrepancy between tooth size and the available ridge and also due to variation in the tooth morphology. Although some natural spaces may be esthetically and phonetically acceptable, others are not and need corrective restorative procedures. However, in cases where the size of the teeth is normal and a diastema still exists, restorative creations using principles of illusion is recommended.[7]

When a diastema is small up to 2mm, no tooth preparations is required. The minimal thickness of composite can be adequately shaped especially at the cervical region to allow good maintenance. However, in cases of a moderate diastema between 2-4mm the EFE should be given on the proximal curvature of the labial surface of the tooth. The extension preparation is close to the gingival margin and follows the contour of the interdental papilla to end on the palato-proximal lineangle. The preparation is in the form of a depression, which provides a definite stop and is done with a chamfer bur.[3]

The preparation design ensures adaptation of sufficient bulk of the composite at the gingival margin creating contours favourable for gingival health. The labial extension allows smooth blending at the composite tooth interface while the palatal extension provides stability and retention. In cases with diastema larger than 4mm a similar preparation coupled with recon touring of the otherproximal surface of the tooth to maintain tooth proportions and form may be required. Diastemataare filed in one tooth at a time. A celluloid matrix is effectively used to get the desired contour[7]



EFE and placement of composites in cervical defects

Cervical defects are caused due to caries, abrasion, erosion or abfraction and combination of above. Although management of these defects involves similar procedures, their proximity to thegingiva makes it difficult to restore. Before any preparation, a gingival cord is placed in the sulcus to allow a proper access to the defect and to keep away sulcular fluid or blood from the cavity margins. Since bond strengths with the cementum are weak, no additional bevel is recommended at the cervical region in cases where the base is in the cementum.[6]

A round bur is used to roughen the surface of the cavity and a long bevel is placed on the occlusal edge of the cavity. After etching, the cord is changed and bonding adhesive is applied followed by flow able composite which is used as an intermediate layer. The gingival cord is removed after completion of the filling to facilitate finishing and polishing. The

occlusion is adjusted, especially eccentric contacts, to take care of primary or secondary abfractions. Fine diamonds or carbides are used to finish the margins.

Shade matching

Shade selection is done following standard protocol with references to the incisal third, middle third and the cervical third of the tooth. The uniqueness of composites permits pilot shade test to reconfirm shade attributes before final restorations. The pilot shade test is carried out using as elected shade in a bulk of 1.5mm- 2mmon the involved tooth and a contra lateral or guide tooth. The composite is then cured and finished and the accuracy of the shade match is confirmed. Any changes in the value, translucency and chroma are recorded and the shade is changed if required**.**

Three procedural steps for finishing and polishing

Gross reduction, contouring, defining the margins. Fine grit diamond abrasive or tungsten carbide finishing bur can be used for the these purposes (100µm size abrasives).

Intermediate finishing is used to reduce scratches left by gross reduction and to blend all surfaces with each another keeping the orientation of various facial planes intact (less than 100µmbut more than 15-20 µm particle size).

Final abrasive polishing imparts enamel like effect on the restorations. Loose abrasive devices, disks, pastes with particle size less than 20µm is used.

ESTHETICS WITH CERAMICS

Ceramics laminate veneers

In 1930 Charles Pincus used a unique procedure to improve the smiles of certain Hollywood actors. This technique was non-invasive and gave good esthetic results with resin and air fired ceramics. But the veneer coping made then lacked permanent retention and later this technique was discontinued.

Considerations in tooth preparations for ceramic laminates

Tooth preparation design will depend upon the existing color of the teeth, whether change in alignment or an increase in height of the final restoration is sought. When a mild to moderate discoloration has to be masked the preparation can be minimal from 0.3mm cervicaly to 0.5 mm atthe incisal edge. Whenever a severe discoloration has to be masked the preparation has to be deeperto allow more die spacer to be applied on the model. This excessive space allows use of resin curing cement to mask the severe discoloration. Adding more opaque ceramic in the veneer will mask undesirable tooth color but will limit the display of vitality.

A more translucent ceramic will allow more light transmission and reflection internally making the restoration more vital. If change in alignment is indicated then more preparation will be required in certain areas. When length of the veneer has to be increased a palatal extension isrecommended.[4]

Preparation of maxillary teeth for ceramic laminates

Mock preparation on the pre-operative casts and diagnostic wax up gives valuable information about the amount of tooth preparation and helps to visualize the end result. Local anesthesia may be required when the preparations reaches the dentin and to facilitate easy gingival retraction procedures. Self-limiting three-tiered depth cutting burs of known dimensions (0.3mm and 0.5mm) facilitate rapid, adequate and conservative tooth reduction. The depth roves are made by moving them on the facial surface from the mesial to the distal and by changing the angle of the bur to facilitate their orientation in two planes. Then the facial reduction is achieved following the labial contour of the tooth till the depth grooves. Besides, the contra-lateral tooth can be used as a reference to check adequate tooth preparation. Selective labial tooth preparation is required to create afavourable arch form.

A modified chamfer margin is preferred to allow distinguishable finish line in the impression, definite seat and adequate bulk for laminates. The margin is usually supra-gingival or at the gingival level. The margin is taken intra-crevicularly in certain cases to mask the underlying discolored tooth and cover cervical lesions.

The proximal finish line is placed into the embrasure area to ensure that the margin between the laminate and the unprepared tooth structure is well hidden. Deficient preparation reveals unaesthetic margins proximally. Incisal preparation depends on whether an increase in tooth height is required or not. In case where the increase in not sought, the incisal preparation ends midway between the labio-lingual width of the incisal edge. In case when the length of incisor is to be increased, the incisal table isflattened with a bevel of 45o palatally. The palatal preparation is a wrap-around design with the margin placed inferior or superior but never at the contact of the mandibular incisor in centricocclusion.[8]

Similarly, window preparations are advocated for canines and premolars when increase inheight in not required.

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