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CERAMIC BRACKET DEBONDING: A REVIEW

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ABSTRACT

Elimination of all the attachments and adhesive resin from the tooth surface is the main objective of orthodontic debonding. Debonded tooth surface sholud be restored without inducing any iatrigenic damage .The objective of this paper is to review the different techniques which are used for debonding of ceramic brackets.The impact of debonding on enamel and method for reversal of decalcification is also cosidered

INTRODUCTION

The ceramic bracket is extreamly hard and brittle.hence it is more susceptible to fracture .Their removal in orthodontic clinic become very difficult and more time consuming.

DEBONDING METHODS

I. Delamination technique
II. Wrenching technique
III. Lift-off debracketing technique
IV. Electrothermal debonding
V. Ultrasonic debonding
VI. Chemical technique -Peppermint oil application
VII. Laser aided debonding

Delaminating method[1]

Introduced by **Swartz**

In this method, a sharp-edge instrument(ETM Pliers#346) is placed at the enamel-adhesive interface.(Fig.1).The application of force produces a wedging effect which delaminate the adhesive from the tooth surface

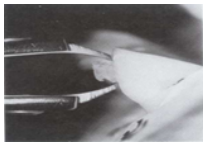

Fig.1ceramic debonding using ETMplier#346

Wrenching method[2,3]

Debonding is carried out by a special tool that uses a **torsional or wrenching** force at the base of the bracket(Fig.2)

Fig.2 Wrenching tool

Lift-off debracketing method[2,4]

A **pistol grip debonding** instrument is used. The jaw of the instrument kept horizontally over the bracket in an occluso-gingival direction over the tie wings. Handles are then squeezed and the jaws contact the tie wings and **pull the bracket** away from the tooth surface.Sinha & Nanda 5 compared these 3 debonding technique. They found that more effective debonding method is delamination type,when compared with twisting and tensile type forces.

Electrothermal debonding[6]

It involves heating the bracket with a rechargeable heating elament that is heated approximately 4500F while applying a gentle clockwise rotational force to the bracket.(Fig.3).The bracket separates from the tooth once sufficient heat has penetrated through the bracket/adhesive interfaceSheridan et al (1986) reported that the mean increase in pulpal temperature, when debonding metal brackets with electrothermal debonding method was 2.4 0C; when cooling water spray was used, the mean increase was only 0.120C .These values are well within the range of biological limits specified by Zach and Cohen (1965)

Advantage: Reduced bracket failure,short debonding time, The minimal potential for enamel damage Disadvantages:Potential for pulp damage ,Bulky nature of the handpiece,Risk of dropping a hot bracket into patient mouth , Compatible only with the Starfire bracket series

Fig.3Electrothermal unit

Ultrasonic debonding technique[3]

Ultrasonic unit is used for debonding(fig.4)

Advantages : Less tendency for enamel damage, a decreased likelihood of bracket failure, removal of the residual adhesive also done with the same instrument after debracketing.

Disadvantage:Time-consuming procedure, excessive wear of the expensive ultrasonic tips & requires water spray

Fig.4 ultrasonic unit

Chemical debonding: peppermint oil

Derivative of peppermint oil(menthol) that is applied around the bracket base and is left for 2 minutes before debonding can facilitate ceramic bracket removal without damaging the tooth surface. (Waldron et al)[7]

Lasers

Since the early 1990s, laser have been used for debonding ceramic brackets.Debonded by irradiating the labial/buccal surfaces of the brackets with laser light. Reduces the residual debonding force and thus reduces the risk of enamel damage.

Mechanism of laser debonding (Tocchio et al AJO 1993)[8]

Laser energy can degrade the adhesive resin by three methods : 1. Thermal softening 2. Thermal ablation 3. Photo ablation

Thermal softening: laser heats the bonding agent until it get softened Thermal ablation : Heating is fast enough so that the temperature of the resin raised into its vaporization range.

Photoablation : Very high – energy laser interacts with the adhesive material.

During lasing, the energy level of the bonds between the bonding resin atoms rapidly rises above their bond dissociation energy levels, and the material decomposes. High gas pressure would rapidly develop within the interface, and the bracket would be explosively blown off the tooth after a single light pulse

LASERS used for debonding:Nd:YAG , Er:YAG , CO2 , Tm:Yap , diode or ytterbium fiber laser , Ceramic bracket with vertical scribe line

Modification of bracket base design for ceramic debonding
A ceramic bracket with vertical scribe line at the base allow the bracket to fold on vertical line by applying force in a mesio distal direction(fig.5)

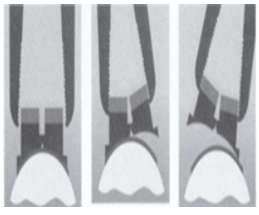

Fig.5 bracket base with vertical scribe line

REMOVAL OF RESIDUAL ADHESIVE
Because of the color similarity between present adhesives and enamel, it is very difficult to remove all the adhesives from the tooth surface.Debonding leaves approaximately 0.6-2.48 mm3 of adhesive on the tooth surface.Removal of excess adhesive may be accomplished by

1. Scraping with band or bond-removing pliers or with scaler.
2. Using a bur in a contra –angle hand piece

Dome shaped TC bur (No.1171 or No.1172), Ultrafine diamond bur, White stone finishing bur etc can be used. But the preferred alternative is to use a suitable dome tapered TC bur in a contra-angle handpiece. Approximately 30,000 rpm of speed is optimal for rapid adhesive removal without enamel damage. Light **painting movements** of the bur is preferred so as not to scratch the enamel surface.Water cooling should not be employed when the last remnants are removed,as water lessens the contrast with enamel.

Adhesive remnant index (ARI)
Artun and Bergland9 used to evaluate the amount of adhesive left on the tooth after debonding.

Score 0 : No adhesive left on the tooth surface
Score 1 : Less than half of the adhesive left
Score 2 : More than half of the adhesive left
Score 3 : All adhesive left on the tooth, with distinct bracket base impression

Influence on enamel by different debonding instruments
Zachrisson and Artun ranked the degrees of surface marking on young permanent teeth by different instrument and concluded that TC burs produced the finest scratch pattern with the least enamel loss and are superior in their ability to eliminate remnants from difficult to reach areas of the tooth.Researches shows use of carbide bur along with multi step Sof-Lex disks and pumice slurry is preferred method to reduce the risk of enamel surface alteration

STAINBUSTER burs
The use of stainbuster burs to remove adhesive remnant close to the enamel surface is indicated.(fig 6)These burs are made up of fiber section with abrasive power and spilt into small fragments as they act on the hard surface

Fig.6 stainbuster bur

IMPACT ON ENAMEL
Reported amount of enamel loss after ceramic debonding is between 4.1 and 30 microns which is approximately 0.05mm^3 in volume.This enamel loss is not significant in terms of total thickness of enamel

ENAMEL TEAROUTS: Localized enamel tearouts have been reported to occur associated with debonding .They may be related to: The type of filler particles in the adhesive resin,the location of bond breakage. On debonding ,the adhesive with small fillers reinforce the adhesive tags. The macrofillers, create a more natural breakup-point in the enamel-adhesive interface and with unfilled resins there is no natural breakpoint.

clinical implications: Use brackets that have mechanical retention and use debonding instruments and techniques that primarily leave almost all composite on the tooth, avoid scraping the remnants with hand instrument.

A recent study demonstrated that enamel tearout in 26%of polycrystalline bracket is 144 mm^3 and 1%of monocrystalline bracket is 36 mm^3

ENAMEL CRACKS
Zachrisson BU et al (AJO 1980) described the prevalance of cracks, their distribution , type and location on the tooth surface :

Vertical cracks are common, Few horizontal and oblique cracks are observed . The most notable cracks are on the maxillary central incisors and canine.

Clinical implication:Pretreatment examination of cracks ,notifying the patient and parent if pronounced crack is present

REVERSAL OF DECALCIFICATION
White spots or areas of demineralization are susceptible to carious lesions The highest incidence was in the **maxillary incisors**, particularly the laterals.

Preventive measures
This obvious degree of iatrogenic damage suggests the need for preventive programs using fluoride associated with fixed appliance orthodontic treatment. Daily rinsing with dilute (0.05%) sodium fluoride solution regular use of a fluoride dentifrice is recommended. Professional means of fluoride application by Fluoride releasing bonding agent,Flouride varnish,10% casein phophopeptide-amorphous calcium phosphate, 1%chlorhexidine collagen gel-to control streptococcus mutans level..

Remineralization of subsurface lesion is slower than surface lesions , probably because of lesion arrest by widespread use of fluoride,so that complete repair is not possible. This limits remineralization to the superficial part of the lesion Hence immediate fluoride application after orthodontic debonding should be avoided. At present it is advisable to recommend a period of 2 to 3 months of good oral hygiene without fluoride supplementation. This should reduce the distinct clinical visibility of the white spots.

Microabrasion

When the remineralizing capacity of oral fluids is exhausted, microabrasion can be employed to treat whitespot The abrasive gel is applied professionally with a electric toothbrush tip for 3-5 mins; followed by rinsising for 1 minute.

Resin infiltration

WSL is infiltrated using a low viscosity resin. HCl etching done to make the outer surface more permeable. The porous surface beneath is infiltrated using TEGDMA-based resin.This resin has light refractive index similar to sound enamel.

CONCLUSION

Ideal technique for debonding of ceramic bracket is not yet available.Delamination method of debonding is safe and inexpensive. Introduction of laser reduced the chairside time and amount of force applied during debonding.monocrystalline ceramic brackets cause less enamel damage during debonding. Preventive measures using flouride and proper oral hygiene measures are adviced for getting a good orthodontic treatment result.

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