# المشـــرفـــون

الأسـتاذ الدكـتور/ هشـام أحمـد عفيفي

**أســـتاذ تقـــويم الأسـنان**

**كلية طب الفـم والأسنان**

**جامعة القاهرة**

الدكتـــور / عصـام محمد ناصف

**أستاذ تقويم الأسنان المساعد**

**كلية طب الفـم والأسنان**

**جامعة القاهرة**

# تقيم التقنيات المختلفة لإعادة ربط الحاصرات

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# Abbreviations

- **ANOVA=** *analysis of variance*
- **Adh. Prom. =** *Adhesion Promoter*
- **LED =** *Light emitting diode*
- **MPa=** *Megapascals*
- **Plastic Cond. =** *Plastic Conditioner*
- **SEM=** *Scanning electron microscope*
- **SBS=** *Shear Bond Strength*
- **TCB=** *Tungsten carbide bur*

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# Aim of the Study:

The objectives of this study are:

1. Evaluate the shear bond strength of different bracket rebonding procedures.

2. Evaluate the effect of adhesion promoters on the rebond shear bond strength of new and reconditioned brackets.

3. Examine the enamel surface and the bracket base after debonding each procedure to evaluate the type bond failure and amount of residual adhesive using the Adhesive Remnants Index (ARI).

# Introduction

Over the last three decades, tremendous advances in orthodontic adhesives have allowed orthodontists to bond brackets to tooth surfaces quite successfully. Ideally, the bond strength of adhesive and attachments should be sufficient to withstand the forces of mastication; the stresses exerted by the archwires, and patient abuse as well as allow for control of tooth movement in all 3 planes of space. At the same time, the bond strength should be at a level to allow for bracket debonding without causing damage to the enamel surface.

As development of the adhesive systems continues, yet none possesses all the properties that an operator might desire. A commonly encountered problem is the bond failure of a bracket during the course of treatment.
Rebonding a tooth is a different clinical situation where both the tooth and the failed bracket have been altered by the initial bonding process.

When rebonding a tooth, the clinician is faced with many elements to consider: the removal of the residual resin on the enamel surface to rebond, whether he can reuse the failed bracket or apply a new one, and the fact the enamel surface has been altered by the first bonding procedure; as the rebonding process includes chemical union of the previous resin with the new bonding agent, as well as the penetration of the new resin into newly created micropores.

Reconditioning the bases of orthodontic brackets is an option available to practitioners provided that they are aware of the various aspects of the reconditioning process. The aim of any bracket reconditioning method is to remove the adhesive from the bracket base completely without causing structural damage, so that the bracket can be rebonded to enamel producing a new adhesive bond of adequate strength. Ideally, a rapid office method of treating recently debonded brackets to produce clinically acceptable bond strengths with minimal changes in the physical properties of the brackets would benefit the profession economically.

The words “adhesion promoters” were first used to designate molecules that adhered chemically to dental structures. The incorporation of hydrophilic monomers to adhesive systems facilitates the infiltration of resin into the etched enamel, reducing interfacial porosity and therefore adhesive defects, achieving greater bond strength after polymerization. Based on these concepts, adhesion promoters have been introduced in Orthodontics.
According to the manufacturers, they are universal dental adhesives designed to enhance the bond strength of any composite to enamel, dentin, metals, old composite, treated porcelain and set amalgam.

As promising as these adhesion promoters may seem, relatively few investigators have studied the effect of adhesion promoters on the bond strength of orthodontic brackets and the results are still inconclusive.

# Review of Literature

As development of the adhesive systems continues, yet none possesses all the properties that an operator might desire. A commonly encountered problem is the bond failure of a bracket during treatment.

Studies have shown that clinical bond failure still occurs within 5% to 7% of brackets for different reasons. Many factors can contribute to the likelihood of a bond failure, including operator technique, patient behavior, variation in the enamel surface, and bracket properties.

Factors predisposing to bond failure have been investigated in the literature. Poor access and moisture contamination have been linked to bond failures especially in posterior teeth by ***Wretz (1980)***[1]. According to ***Gorelick et al (1984)***[2] excessive occlusal forces during function are a major cause of debonding. Patients may accidentally apply excessive occlusal forces to the bracket, or in cases of excessive overbite, mandibular anterior brackets are especially susceptible to increased occlusal forces and failure. Increased resin thickness, has been shown by ***Evans and Powers (1985)***[3] to produce decreased bond strength. Clinically, increased resin thickness is associated with unusual buccal contours, especially with morphologically diverse posterior teeth. Thus, rebonding a tooth is a common procedure in orthodontic treatment.

When rebonding a tooth, the clinician is faced with many elements to consider: the removal of the residual resin on the enamel surface to rebond, whether he can reuse the failed bracket or apply a new one, and the fact the enamel surface has been altered by the first bonding procedure.

**Removal of Residual Resin**

***Retief and Denys (1972)***[4] examined seven different methods of enamel “clean up”. The seven methods were: bracket remover, hand scaler, high speed diamond bur, high speed tungsten carbide bur, stainless steel bur, finishing/polishing discs, and finishing/polishing wheels. The polished enamel surfaces were examined using scanning electron microscopy. They showed that the bracket remover produced deep enamel gouges, and deep grooves were produced by the hand scaler and diamond bur. The stainless steel bur was ineffective at removing composite, and the tungsten carbide bur created grooves in the enamel. Cleaning using discs impregnated with aluminium oxide and the polishing ceramiste wheels both produced smooth enamel surfaces. They recommended that gross composite removal should be undertaken using a tungsten carbide bur followed by final polishing using aluminum oxide discs or ceramiste wheels.

***Zachrisson and Artun (1979)***[5] employed the replicating stereomicroscopy and scanning electron microscopy for an in vivo and in vitro assessment of the polished enamel surface using five basic methods. The five methods were: diamond bur, coarse sandpaper disc, green rubber wheel, low speed tungsten carbide bur, and various polishing cups and wheels. The last method proved impossible for composite removal; the first two methods