



## New pre-coated flash free orthodontic brackets and their role in reducing enamel surface hazards



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### Abstract:

Conventional bonding of orthodontic brackets causes many unfavorable changes to teeth enamel surfaces. Although there is no direct relationship between brackets bonding and teeth surface changes, we must keep attention to them and inform the patients about their possibility at the start of orthodontic treatment.

Many attempts were made to reduce enamel surface changes during and after orthodontic treatment, APC flash-free technology (adhesive coated brackets) is the most recent attempt, which reduced the demineralization around and under the base of orthodontic brackets by eliminating the need for removal of excess adhesive material.

### Changes of teeth enamel because of bonding conventional orthodontic brackets are:

#### a- Enamel damages

Enamel may undergo irreversible changes due to bonding of conventional orthodontic brackets, these changes depend on multiple factors as acid-etch type, time of application, concentration and the amount of remaining adhesive on the enamel surface after bonding. Self-etching bonding technique was developed to eliminate the separate etching step, so it is considered more hygienic than conventional acid-etch resins. However, Self-etching adhesive produces less enamel changes, it has the disadvantage of lower bond strength. Resin modified glass ionomer cement also reduces the teeth enamel changes due to the continuous fluoride release and it has a bond strength similar to acid-etched resins. Although It has the disadvantage of difficult de-bonding.<sup>(1,2)</sup>

Enamel surface changes depend on many factors: brackets, type of adhesive and de-bonding method. Enamel changes is little when metallic brackets with glass ionomer adhesive are used. However, ceramic brackets and conventional acid-etch adhesive resin cause many enamel changes. Also, Improper bonding techniques produce horizontal and vertical enamel cracks which is always present in the patients after orthodontic treatment.<sup>(3,4)</sup>

#### b- Caries

White spot lesions, enamel cavities and demineralization of maxillary incisors occur with a high prevalence in patients with previous orthodontic treatment.<sup>(5,6)</sup> Demineralization around and under Orthodontic brackets occurs due to improper oral hygiene, high plaque index, decrease of salivary PH, increase of 2 main bacteria causing caries; Streptococcus-mutans and Lactobacillus during orthodontic treatment.<sup>(7,8)</sup>

Patient's oral hygiene should be evaluated before the start of orthodontic treatment. Orthodontic treatment may be cancelled or delayed in patients with bad oral hygiene. Lots of preventive methods can be used during fixed orthodontic treatment to avoid bad oral hygiene hazards:

patient education, diet modification, using of fluoride-releasing adhesives and fluoride-containing mouth rinse.<sup>(32,33)</sup>

After removal of orthodontic fixed appliances, white spot lesions may show spontaneous remineralization due to improvement of patient's salivation which can be motivated by chewing of sugar-free gums.<sup>(9,10)</sup> Also, Enamel surface micro abrasion may be indicated.<sup>(35)</sup>

#### c- Color alterations

Severe enamel color changes occur upon using chemical cured bonding resins (more than light cured resins). This occur due to formation of resin tags, which cause enamel surface changes during their removal as: changes of the enamel texture, reflective properties and optical perception.<sup>(11,12)</sup>

Adhesive resin used for bonding orthodontic brackets shows gradual yellow discoloration especially surrounding the periphery of the brackets. This is induced by orthodontic appliances' corrosion products combined with food dyes<sup>(13,14)</sup>

The remineralized enamel surfaces after orthodontic appliances removal are usually different in minerals composition from the untreated enamel surfaces.<sup>(15,16)</sup>

#### Flash free Brackets

Recently, many orthodontic adhesives were developed. Lots of clinical and laboratory studies were performed to compare between them. The most important factors that affect bonding of differences orthodontic adhesives are: the enamel surface shape, mechanical interlocking characteristics of the base of the bracket and composition of adhesive material.<sup>(17)</sup>

Many adhesives are available to orthodontist nowadays: chemical activated, light-cured and resins with different filling. The most critical point is to achieve a complete bracket seal at the margins and minimum remnant adhesive surrounding the periphery of the brackets to avoid caries or white spot lesion formation. For decades, the dentist used to remove remnant-bonding adhesive after positioning

brackets by the probe or bracket positioner before light curing. 3M-Unitek in 2014 invested the adhesive pre-coated

APC flash free brackets, which has no need for removal of remnant adhesive. <sup>(18)</sup>

The use of these brackets is easier than conventional system. It provides a bracket pre-pasted with adhesive resin material. After bracket application and pressing on the enamel, the extruded resin forms channels at the bracket edges for the squeeze out of resin before light curing. <sup>(18)</sup>

The advantages of this system are the reduced time for bracket bonding, improved orthodontist concentration on bracket positioning and improved marginal seal at the periphery of the bracket. There is only one clinical study about this system focusing on de-bonding features. <sup>(19)</sup>

Stereomicroscopic images of the periphery of flash free brackets when bonded to the tooth revealed remarkable less excess resin, with a layer thickness vary between 0.16 and 0.18 mm. In addition, the resin-filled edges formed a firm smooth interlocking around the bracket. <sup>(20)</sup>

Plaque accumulation usually occurs in the areas with excess resin surrounding the brackets. The bracket material (metallic or ceramic) has no significant microbial accumulation variation, and similar common bacterial species are present. However, the adhesive material and bracket base shape are plaque accumulation causative factors. <sup>(21)</sup> Microscopic study showed less excess adhesive material at the periphery of flash free brackets, which may reduce accumulation of the plaque. It recommended that there is a need for other studies to prove this. <sup>(22)</sup>

#### Flash free brackets and micro-leakage

Using of a self-etch primer and a light cure adhesive were the most popular methods to establish a reliable

bracket bonding to the enamel surface. However, the light cure adhesive may lead to gap formation between adhesive resin and the enamel. <sup>(23)</sup> Bacterial micro-leakage underneath the orthodontic brackets may lead the development of white spot lesions on the enamel surface which supposedly reduce the bond strength. <sup>(24)</sup>

Many researchers studied the micro-leakage under orthodontic different: brackets systems, <sup>(25)</sup> light curing devices, bonding methods and adhesives. <sup>(26)</sup> Unfortunately, there is a great variation among clinicians about the method of bonding and the bracket type which produce the least micro-leakage. Metallic brackets bonded with self-etch primer or resin modified glass ionomer show less micro-leakage, <sup>(27)</sup> compared with ceramic brackets bonded with conventional acid etch primer. <sup>(28)</sup>

The APC flash free system consist of brackets pre-coated with low viscosity resin applied to a non-woven mesh. These brackets eliminate the need for removal of the excess resin, create a peripheral seal which reduce the micro-leakage<sup>(5)</sup>, produce adequate bond strength and reduce bonding time<sup>(28)</sup> compared to conventional orthodontic brackets. Grunheid et al. <sup>(29)</sup> detected less micro-leakage of silver nitrate under flash-free brackets using microcomputed tomography.

#### Conclusion:

As Flash free APC brackets are believed to have the merits of reduction of enamel demineralization complication that take place with the conventional types of brackets, we decided to evaluate the enamel demineralization around flash-free and conventional adhesive pre-coated orthodontic brackets after debonding using atomic force microscope and spectrophotometer.



APC Flash free pre-coated brackets

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