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Orthodontic Adhersives: Review

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Abstract

Aim: *The aim of this review is to discuss about orthodontic adhesives and to discuss in detail about their influence on the enamel and colour stability.*

Objective: *To list out the different adhesive available till today and how these affect the colour and structural changes in an enamel.*

Background: *Orthodontics typically involves the use of braces for aligning teeth. Braces consist of brackets that are bonded to the teeth, and arch wires that are threaded through the brackets. Brackets are bonded to the surface of teeth with orthodontic adhesive. Bonding of orthodontic brackets to the tooth enamel has been an important issue since the introduction of direct bonding in orthodontics. Since then, many new bonding agents have been developed such as composite resins, conventional glass ionomer cements, resin-modified glass-ionomer cements and polyacid modified composites (compomers) with different polymerization mechanism such as chemically, light or dual curing. orthodontic cements, adhesive resins, and hybrid cement-resin combinations offer improved physical properties and clinical benefits.*

Reason: *This review is mainly done for better assessment of benefits of various adhesive materials.*

Keywords: *Adhersives, water soluble cement, light cured cements*

Introduction

Orthodontics basically involves in alignment of teeth by use of brackets. Braces consist of brackets that are bonded to the teeth, and arch wires that are threaded through the brackets. Brackets are bonded to the surface of teeth with orthodontic adhesive. Bonding of orthodontic brackets to the tooth enamel has been an important issue since the introduction of direct bonding in orthodontics. Since then, many new bonding agents have been developed such as composite resins, conventional glass ionomer cements, resin-modified glass-ionomer cements and polyacid modified composites (compomers) with different polymerization mechanism such as chemically, light or dual curing [1]. Composite resins are one of the most frequently used adhesives in orthodontic bonding. Although they provide sufficient bonding strength and are easy to handle, they adhere to the tooth enamel only by microretention, require dry field and amount of fluoride release have not been found to be sufficient for anticaries effect. Resin-modified glass ionomer cements as alast generation of glass ionomer cements with improved properties posses some of the good qualities of composite resins as

well as some characteristics that make them very desirable for orthodontic bonding like fluoride release properties that can be renewed by local application of fluoride as well as capability of providing satisfactory bond strength to enamel while bonding is performed in presence of moisture. In addition to micromechanical lock with enamel surface irregularities they provide chemical bonding resulting in superior bonding strength [1] .

Requirements of orthodontic adhesives

Orthodontic adhesives should have the capacity to remain bonded to the enamel part of the tooth surface throughout the duration of the treatment. Orthodontic adhesives should be such that they do not any kind of damage to the enamel surface during the length of the treatment and while removing the brackets[2,3]. The adhesives should also be least discomforting to the patient, short setting time, long working time, less irritating to the oral soft tissue, easier way of application and contains fluoride (lessens the potential of demineralisation by microorganism)[4].

Types of orthodontic adhesives used

Orthodontic adhesives used are as follow, Glass ionomers, Zinc phosphate, Resins modified cements, Zinc polycarboxylate cement, Resins and Polyacid-modified composite resins.

Glass Ionomer Cement

Glass Ionomer cement (GIC) was first introduced by Wilson and Kent in 1972 as a restorative material and later on was modified as luting cement [5]. GIC has the advantage of causing carboxyl chelation with enamel, dentin and other metals. It reacts by polyalkenoic acid with fluroaluminosilicate glass. There is fluoride release before and after setting and periodic release of fluoride on exposure to acids [6,7]. GIC is a brittle material so inorder to enhance its properties 'Cermet' and 'Admix' was introduced. Cermet is fusion of metal particles with conventional GIC cement. Admix is addition of amalgam alloy with conventional GIC[8]. Inspite of its advantage of its higher bond strength with enamel, dentin and other metals, it has some drawbacks like acurrate liquid:powder ratio, moisture contamination, low fracture resistance [9,10] and thereby affects the physical properties of the GIC while setting [5] .

Zinc Phosphate Cement

Zinc phosphate has been used as dental cement for more than a century. Mixing zinc phosphate is a technique sensitive and should be kept cool while mixing[11]. Zinc phosphate cement is the reaction between Zinc oxide and phosphoric acid[12]. The setting time is controlled by in cooperation of small increments of alkaline component[11]. Its major advantage is dimensional stability, low solubility to oral fluids, better physical properties - high compression strength[12]. Its disadvantaeges are it cannot bond with the enamel or metals and cannot be used for braket cementation. the latter is the low tensile strength results in microleckage and demineralisation[11,12] .

Resin Modified Cement

Resin modified GIC was developed by adding 10-20% of resin monomers to conventional GIC that can be light or chemically cured. Mixing of the this cement is by capsulation of powder and liquid components in a triturator. The setting time can be increased by adding monomer to polyalkenoic acid[7,13]. The advantages of this cement is it has improved physical properties , fluoride release, adhesion to the metal and tooth surfaces, micromechanical interlocking , ability to penetrate surface irregularities and fracture resistance[12].

Zinc Polycarboxylate Cement

Zinc polycarboxylate cement is the first chemically adhesive dental cement. Polycarbo-xylate cement is a reaction between zinc oxide and polycarboxylic acid solution. Polycarboxylic acid forms a chemical bond with enamel and dentin by chelating the calcium present in the enamel and dentin[12]. It is biocompatible cement as the

neutralization reaction is less imposed on oral tissues. The mixing of Zinc polycarboxylate takes time to in-cooperate the powder into the liquid[14]. Its advantage is chemical adhesion to the enamel. It has greater number of drawback such as poor tensile strength, short working time, high solubility and low fracture resistance[5,14].

Resin

Newman introduced the use of resin for bonding to enamel surface in orthodontics. Resin contains resin monomers and inert fillers that are flowable in low viscosity [15]. The polymerization reaction (setting reaction) can be light, chemical or dual cured. light cured is available as single component, giving the advantage of lessening the inaccurate mixing [12]. Chemical and dual cure is available as two paste or Power-liquid. They bond to the tooth surface by mechanical interlocking. The advantage of resins are they are insoluble to oral fluids. The disadvantage is they give minimal amount of fluoride release [15].

Polyacid-Modified Composite Resins

Polyacid-modified composite resins are also called as compomers. They contain aluminasilicate glass with carboxyl-modified rein monomers and light activated conventional resins. These are all packed into single component and there is no risk of reaction occurring in the container as there is absence of water[12] . Setting reaction happens only after light curing to create a rigid materials. The setting cement is moisture sensitive. The advantage is it absorbs water and delays the acid-base reaction. This in turn causes release of fluoride and inhibits caries activity. The bonding to the enamel is by mechanical interlocking [15] .

Conclusion

This article is intended to clarify the chemicaland physical distinctions among various orthodontic bonding materials. Clinicians need to be knowledgable about the various cements and orthodontic bonding adhesives so that they may select and use these materials appropriately.

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