Review Article

Dentin Bonding Agents: An Overview

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Abstract
Dentin bonding agents are resin materials used to make a dental composite filling material adhere to bond to both dentine and enamel. Although the dentin bonding agents have expressed its myriad applications in the field of dentistry, a lot more is yet to be improved. The current challenge in adhesive dentistry is to develop a dentin bonding system that will achieve high bond strength to both normal and hypermineralized dentin, in a way similar to those obtained with a resin and acid etched enamel. The purpose of this review article is to discuss the basics of dentin bonding agents including their definition, classification, requirements of "ideal" dentine bonding agent, advantages, disadvantages, and clinical applications.
Key Words: acid etching; adhesion; classification;

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Introduction

During the last four decades use of adhesives in dentistry has been evolving at a rapid rate, leading to a significant expansion of the worldwide base of knowledge and resulting in the development of many new products. Extensive research coupled with the widespread demand for dental adhesives has broadened their range of application.[1]The dentin bonding agents with the use of tooth coloured restorative materials has replaced the traditional mechanical methods of retaining restorative materials with larger preparations using pins, posts etc. to a smaller preparation and more conservative technique, known as prevention of extension, otherwise minimal intervention.[2]

The continued development of adhesive material is now focused on gaining a better understanding of factors affecting adhesion

in the oral environment to improve the clinical longevity of restorative materials.[1] These agents along with their expanded clinical applications dawn a new horizon with a promising outlook towards the future.

Definition of Dentin Bonding Agents

Dentine bonding agents are resin materials used to make a dental composite filling material adhere to bond to both dentine and enamel.[3]

Classification of Dentin Bonding Agents[4-7]

They can be classified in various ways: a) According to composition: polyurethanes, polyacrylic acids, organic phosphonates, mellitic anhydride and methyl methacrylate (4- META); b) According to type of primers or combined primer\adhesive resin: ABC Enhanced, Gluma One Bond, EG Bond, Prime&Bond NT, One step; c) According to mode of action: those that bond with calcium ion, those that bond with organic component of dentin, those that bond with reprecipitated smear layer, d) According to mode of curing: chemical cure, light cure, dual cure, e) Adhesive system with stress bearing potential, f) Adhesive system that include fluoride, g) According to number of steps needed to complete the bonding process: three-step' or conventional' system, two step systems, and `One-bottle' or 'All in one' systems, h) Based on adhesion strategies: total etch adhesives - 3 step and 2 step, self etch adhesives - 2 step and 1 step, resin modified glass ionomer adhesives.

Principle[8]

The adhesion of hydrophilic resin to hydrophobic substrates like enamel and is based upon an exchange process by which an inorganic tooth material is exchanged by a synthetic resin. This process involves two phases: First phase, known as etching phase, consists of removing calcium phosphate which creates microporosities at both the enamel and dentin tooth surface. Second phase known as hybridization phase, involves infiltration and subsequent polymerization of resin within the created surface microporosities, which follows the application of primer. This result in micromechanical interlocking that is primarily based upon the mechanism of interdiffusion.4

Requirements of Dentin Bonding Agents[9]

Criteria for an "ideal" dentin bonding system were enumerated in 1961 at a workshop held at the University of Indiana Dental School (Phillips and Ryge, 1961). These criteria were: Provide high bond strength to dentin that should be present immediately after placement and that should be permanent, provide bond strength to dentin similar to that to enamel, show good biocompatibility to dental tissue, including the pulp, minimize microleakage at the margins of restorations, prevent recurrent caries and marginal staining, be easy to use and minimally technique-sensitive, possess a good shelf life, and be compatible with a wide range of resins.

Advantages of Dentin Bonding Agents[10]

Dentin bonding agents have several merits including: with the use of dentine adhesive systems marginal contraction gap formation at the tooth and the restoration interface is significantly reduced resulting in reduced microleakage of the restoration, reduced hypersensitivity and decreased incidence of secondary caries, and also until recently macromechanical retention factors were the only means of providing retention for a restoration with the advent of dentin adhesion systems, the micromechanical retentive modes have taken the priority eliminating the need for removal of healthy

tooth structure thereby conserving and strengthening the same.

Disadvantages of Dentin Bonding Agents[10]

It is highly technique sensitive. All the instruments to be used should be free of contamination. Utmost care is taken to keep the operative site free of saliva, blood or plaque from the oral environment and oil and moisture contamination from the operating instruments and equipments. It involves a time consuming procedure.

Applications of dentin bonding systems[10]

The various applications of dentin bonding agents include: bonding of directly placed resin based restoration materials, as pit and fissure sealants, for placement of porcelain veneers, inlays, onlays and crowns, adhesive splinting of teeth, adhesive can be applied to exposed root surface dentin in order to prevent the hypersensitivity and also protect it from caries attack, and for bonding of amalgam restorations.

Conclusion

Dentine adhesive systems have created a new era in the field of dentistry. Owing to its property of adherence to the tooth structure by both micromechanical and chemical means, it finds a wide range of application in various fields. It has lead to the most desired form of treatment needs, i.e. the conservation of tooth structure, which is the ultimate goal of conservative dentistry.

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