NEW PERSPECTIVE ARTICLE

Clinical Challenges on Adhesive Dentistry on its 60th Anniversary

Desafíos Clínicos en Odontología Adhesiva en su 60 Aniversario

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ABSTRACT

Adhesive dentistry allowed restoring lost tooth structures using Minimally Invasive direct or indirect bonded restorations. Adhesive systems and bonding techniques have been constantly evolving since the introduction of Sevriton Cavity Seal, in 1940 by Oskar Hagger. As we celebrate the 60th anniversary of adhesive dentistry in 2015 the future of the Minimally Invasive Adhesive Dentistry is more promising than ever. A better understanding of long-term resin-dentin bonds interaction is guiding the development of materials and techniques that overcome the limitation of current bonding agents and restorative procedures. A brief statement would be stated.

KEYWORDS

dental sciences; adhesive dentistry; operative dentistry; dental research

RESUMEN

La odontología adhesiva ha permitido la restauración de piezas dentales las cuales inicialmente se daban por perdidas, mediante restauraciones directas o indirectas utilizando un protocolo de odontología mínimamente invasiva. Los sistemas adhesivos han evolucionado de forma constante desde la introducción de Sevriton Cavity Seal®, en 1940 por Oskar Hagger. Al celebrar el 60 aniversario de la odontología adhesiva en este 2015, el futuro de la Odontología Mínimamente Invasiva es más prometedora que nunca. Una mejor comprensión de la interface adhesiva resina-dentina con estudios evaluando su desempeño a largo plazo están guiando el desarrollo de nuevos materiales y técnicas, los cuales tienen como objetivo superar la limitación de los actuales sistemas adhesivos.

PALABRAS CLAVES

Ciencias dentales; odontologia adhesiva; operatoria dental; investigación dental

Adhesive dentistry allowed restoring lost tooth structures using Minimally Invasive direct or indirect bonded restorations. Adhesive systems and bonding techniques have been constantly evolving since the introduction of Sevriton Cavity Seal, in the late 1940, by Oskar Hagger (Anusavice et al., 2013). This first adhesive system had limited clinical durability and couldn't stand the elevated

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stress generated by the polymerization shrinkage of the unfilled methacrylate-based resins used at that time (Anusavice et al., 2013).

Fifteen year later, the introduction of phosphoric acid as enamel acid-etching by Buonocore (1955) launched the current era of adhesive dentistry. Adhesive technology has evolved rapidly since this event and nowadays, we are living an era of micromechanical retentive interfaces and Minimal Invasive Dentistry Procedures associated to esthetic dentistry. Current adhesive systems in the market can be classified as 'etch-and-rinse' (or 'total etch'), 'self-etch' (or 'etch-and-dry'), and 'universal' (or 'multi-mode').

Bonding to enamel using the etch-and-rinse approach has demonstrated long-term reliability, however bonding to dentin using this technique still a challenge. Dentin is a complex substrate with the presence of water in its composition (Pashley, 1989). When etch-and-rinse approach is selected, water must be maintained on the etched dentin surface to prevent the collapse of exposed collagen matrix (Kanca, 1992). However, excess of moisture during the bonding procedures dissolve adhesive components, as well as prevent the adequate penetration and polymerization of the monomers into the demineralized dentin complex (Lin et al., 2010). In other words, the success of dentin etch-and-rinse bonding technique depends on the amount of water present during the bonding procedures.

Self-etch adhesives do not require a separate etching step because they contain acidic monomers that etch and prime the dental substrate at the same time (Van Meerbeek et al., 2011). This approach is user-friendlier and less technique-sensitive than the etch-and-rinse approach, which can result in a more reliable short-term dentin bonding in dentin. However, self-etching adhesive systems have limited etching capability on enamel, mainly on un-cut enamel, where a thin aprismatic layer acted as a barrier, hindering the adhesive to infiltrate (Mine et al., 2010). Therefore, to create a long-term bonding interface with self-etch adhesive systems is highly recommended to combine selective etching of enamel with phosphoric acid.

A new category of dental adhesives designed to bond to tooth structures via etch-and-rinse or self-etch technique has been recently introduced in the market. Universal (or multi-mode) adhesives are highly sophisticated cocktails of chemical components, which embrace virtually every element used in previous generations of dentine adhesives (Chen et al., 2015). Studies comparing universal adhesives showed that the best results are obtained when universal adhesives are actively applied using the selective enamel etching approach (Loguercio et al., 2015).

Dental researchers and manufactures are working to develop products and techniques to improve long-term strength and quality of resin-dentin bonds. Adding matrices metalloproteinases (MMPs) inhibitors into the adhesive systems, experimental bonding approaches to remove water from the demineralized dentin surface without collapsing the collagen fibrils, and "back-filling" empty spaces within the hybrid layer with apatite-like mineral crystals are some examples of these researches. However, to get the best long-term bonding strength results with current adhesive systems clinician should always follow these steps: properly isolate the tooth; clean the tooth structure using pumice and water (or oil- and fluoride-free prophylaxis paste) before starting the bonding procedures, etch enamel for 30 s, independently of the adhesive system; Etch dentin for 15 s for etch-and-rinse approach; rinse the cavity preparation for 30 s to thoroughly remove phosphoric acid; air-dry etched enamel; keep dentin moist for the etch-and-rinse approach (if self-etch approach is used dentin can be air-dried); actively apply multiple coats of primer (if using a two bottle system) or adhesive (if using a one bottle system) within the manufacturer's recommended time; air-dry the

primer (or etch-and-prime and prime-and-adhesive) to evaporate solvent and water from the adhesive layer; air-thin the adhesive to remove excess of material; and properly light-cure the adhesive layer and restorative material (output of the light-cure unit must be periodically monitored – Minimum of 600 mW/cm2).

As we celebrate the 60th anniversary of adhesive dentistry in 2015 the future of the Minimally Invasive Adhesive Dentistry is more promising than ever. A better understanding of long-term resin-dentin bonds interaction is guiding the development of materials and techniques that overcome the limitation of current bonding agents and restorative procedures.

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