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Perspective

Factors involved in the stability and durability of adhesive in the dentin.

Factores que intervienen en la estabilidad y durabilidad del adhesivo en la dentina.

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The aim of this communication is to disseminate information among the dental community about the factors involved in the stability and durability of the adhesive in the dentin.

Dentin is a collagen-based tissue. In the collagen mesh there are proteins such as proteoglycans, phospholipids and enzymes. Metalloproteinases (MMP) have generated the most interest among researchers who study bond strength on dentin. The stability of the adhesive in the collagen mesh is essential for the longevity of the hybrid layer. MMPs are responsible for degrading collagen fibrils that are exposed within the hybrid layer, due to the lack of infiltration of the monomer. These MMPs are activated in a low pH environment and the enzymatic activity occurs in the lower part of the hybrid layer, resulting in nanoporosities.[1]

To achieve a stable bond of the adhesive to the dentin, a chemical interaction is required.[2] The bonding of the adhesive systems to the dentin is of the micromechanical type, as the mineral phase of the dentin is completely or partially removed by acid etching. Once the adhesive has infiltrated into the collagen mesh and after photopolymerization, the hybrid layer is formed and the etch and rinse adhesives have provided micromechanical retention on the dentin.

The infiltration of the monomer in the collagen mesh has been improved with the use of universal adhesives that include functional monomers capable of removing dentin smear layer and demineralizing hydroxyapatite.[4]

Ionic interaction of a functional monomer, capable of binding with calcium from hydroxyapatite, establishes the bonding stability of the adhesive on the dentin. As 10-methacryloyloxydihydrogenphosphate (10-MDP) can create this bond, etching is not necessary to demineralize the hydroxyapatite present in the collagen mesh. Etch and rinse adhesives with MDP can deepen demineralization with the monomer incapable of infiltrating the base of the demineralized zone, promoting the degradation of the collagen mesh and the resulting in nano-gaps.[2-4]

Etched dentin results in weaker bonds and water content of universal adhesives can affect their bond strength, and so does the presence of 4-methacryloxyethyl trimellitic acid (4-MET), which has less chemical bonding potential than 10-methacryloyloxydecyl dihydrogen phosphate (10-MDP).[4] As such, the application protocols of adhesives with functional monomers are different. Due to different concentrations present in the

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different adhesives, the acidity and even the solvent contained in the adhesive, differences in the bond strength of adhesives result.[2]

One-step adhesives have a variety of components that make their behavior different in the diverse substrates involved in dental restoration, resulting in limited durability with respect to bond strength in dental and restorative substrates.[5]

Adhesive bond strength is also influenced by the content of hydroxyethylmethacrylate (HEMA). HEMA-free adhesives increase the bond strength of the adhesive to the dentin before applying light, but the use of this component places the strain and stress on the adhesive layer once it has been polymerized.[5,6]

The use of photoinitiators in adhesives, such as camphorquinone, improves the conversion of monomers to stronger bonds after applying the polymerization light.[6] Solvents such as ethanol are also one of the most accepted components for the monomer to infiltrate into the dentinal tubes, and the application of small puffs of air on the tissue will increase adhesive strengthFactores que intervienen en la estabilidad y durabilidad del adhesivo en la dentina.[7]

The characteristics of the substrate, the depth of the dentin, the direction of the dentinal tubules and their permeability, also play a role in the adhesive strength to the dentin.[2] The moisture level of the dentin is a factor that also influences bond strength,[8] making it difficult for the adhesive to infiltrate. Universal adhesives can produce moisture control without drying out, and to improve this bond, the application of a second layer of adhesive on the dentin is recommended.[3,5,8-9] Dentin dehydration can affect the mechanical properties of the hybrid layer.[6,8]

Dentin smear produced by cavity preparation also hinders the impregnation of the adhesive. It was believed that the use of fine-grain burs during cavity preparation would decrease the thickness of the dentin smear layer and favor the retention of the adhesive. However it has been demonstrated that there are no differences in the bond strength of dentin adhesive when using fine or coarse grinding burs in cavity preparation.[8]

The success of adhesive systems will not simply depend on including all the components that promote bonding in one single formulation; it is necessary to know the quantity of each one, since this can affect the stability and durability of the bonds to the dentin, even after having achieved a good initial bond strength.[9]

From this perspective, the different strategies of adhesive systems that achieve a satisfactory bond with the dentin have revolutionized clinical practice and became an area of scientific research. Studies on the stability and durability of adhesives show that there is more than one factor responsible for the success of the bonding procedure. It should be noted that most of these studies are *in vitro* and the behavior of the substrate immersed in the oral cavity may differ, and is not accounted for.

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