Today’s conservative dentistry primarily involves minimal invasive care. This means that only diseased or lost tooth tissue is replaced by restorative material that is directly bonded to the remaining tooth structure. With adhesive materials, it is no longer necessary to prepare the cavity to provide mechanical retention through such features as dovetails, grooves, undercuts, sharp internal angles in order to retain the filling. Since 1955, with Buonocore’s introduction of the concept of treating enamel to chemically change its surface and hence facilitate the adhesion of filling materials to enamel surfaces, adhesion dentistry has rapidly changed and evolved from no-etch to total-etch (4th and 5th generation) to self-etch (6th, 7th and 8th generation) systems. Currently, bonding to dental substrates is based on three different strategies: 1) etch-and-rinse, 2) self-etch and 3) resin-modified glass-ionomer approach as possessing the unique properties of self-adherence to the tooth tissue. More recently, a new family of dentin adhesives has been introduced (universal or multi-mode adhesives), which may be used either as etch-and-rinse or as self-etch adhesives. [1, 2]

Classification by clinical steps:

1) 3-Step Adhesives
They require acid etching (enamel and dentin), rinse and dry, use of a priming agent and adhesive as steps to follow before placing the composite. Once the tissues are demineralized, primers must transform the hydrophilic tooth surface into hydrophobic, so that the bonding of adhesive resin is achieved. To do so, agents contain monomers that can be polymerized with hydrophilic properties, dissolved in acetone, water and/or ethanol. These agents carry monomers through the etched tissue. Adhesive systems that have volatile organic compounds such as ethanol and acetone are based on their capacity to remove the remaining water. This makes it possible for the monomers to penetrate the micro porosities caused by the acid etching on the enamel, within the open dentinal tubules and through the nano-spaces in the collagen network of the dentin. Hence full tissue infiltration would be achieved if such tissues have been previously wetted. The priming procedure ends with dispersion, using a light air stream to remove the solvent and leave a shiny and homogeneous layer on the surface. In the third step, the hydrophobic bonding agent is applied, which will chemically bond with the composite resin, applied afterwards. The main advantage of three-step system is their capacity to achieve the necessary bond strength to enamel and dentin. However, there are some drawbacks, for example, the technique is very sensitive given the many clinical steps to follow for their application, and the risk of over-wetting or over-drying the dentin during rinsing and drying after the etching acid has been applied. [3]

2) 2-Step Adhesives
The primer and the adhesive come together in one package, and the acid etching agent comes separately. The adhesion mechanism of these systems is the same as that of their three-step predecessors but they are more technique-sensitive. These systems require the application of a wet adhesion technique as the priming step does not take place independently. The main drawback is that the acid must be rinsed with water and then dried. The tissue must remain wet in the case of dentin to prevent the demineralized collagen from collapsing. However, it is very difficult for the clinician to reach the optimal degree of moisture. Additionally, the primer now has monomers with acid groups that can act as the acid etching agent, and hence prepare the dental tissue for adhesion. The advantages of these systems are that the rinse stage is eliminated, and that the dentin surface is already prepared to receive the adhesive agent. [4]

3) 1-Step (all-in-one) Adhesives
These systems combine the three functions: acid etching, priming and adhesion in one stage. Their main advantage is that they are easy to apply and that it is not necessary to rinse the surface: only drying is necessary to uniformly spread the product before photo polymerization. In these adhesive systems, the technique has been simplified, thus making it possible to keep hydrophilic acid monomers, organic solvents and water in one solution. These components are essential to activate the process of dentin demineralization and the operation of the system. Solvents like acetone or alcohol are kept in the solution, but once dispensed, solvent evaporation begins. This evaporation triggers a separation phase, with the formation of multiple droplets and oxygen inhibition. [5]

Conclusion
Dental adhesives have dramatically changed since their introduction many years ago. Initially, these required a long etching time and were only recommended for etching and bonding of the enamel. Today, dentists have a big variety of aesthetic and functional materials to choose from in restorative dentistry.

References: