A discussion on how to apply resin-modified glass ionomers

Resin-modified glass ionomers (RMGIs) have been introduced to dentistry as materials which have the advantages of composite resins and glass ionomers at the same time. These materials have an acid–base reaction due to their glass ionomer nature and can form a chemical bond with the substrate.[1] They have the advantage of releasing fluoride and are recommended for use on the gingival floor of deep Cl II and Cl V cavities in which there is proximity to dentinal and cemental substrates in the bonded base technique.[2] RMGLs might decrease the incidence of recurrent caries and polymerization shrinkage stress of composite resins.[2-4] On the other hand, these materials have adequate strength as a base material beneath composite resins and amalgam due to their resin nature and in some cases, such as conservative cavities, they can be used to restore the whole cavity.[1,3]

In relation to polymerization, the resin component of these materials can exhibit two types of polymerization: Photoinitiated and chemical; if both types of polymerization are involved, the curing process will be three-fold by taking account of the acid–base reaction.[1,4] The majority of these materials exhibit photoinitiated polymerization in addition to the acid–base reaction; in such cases, the curing will be dual because self-curing properties do not exist. The curing rate of some of these materials has been promoted by incorporating calcium aluminate into their chemical structure, and in the self-cured versions which have a high curing rate such a process has been used in the curing process.[4] Therefore, the operator should know that not all the RMGI's have a light-curing mechanism for polymerization. In some commercial products, these materials exhibit shrinkage up to 3% and in some cases, shrinkage rates more than those of composite resins have been reported.[5] In recent years, in some studies, a kind of network competition has been reported during curing processes, i.e., a delay in light-curing might increase the rate of acid–base reaction; on the contrary, light curing of these materials immediately after their placement in the cavity might limit the formation of resin chains of the acid–base reaction.[6]

From a clinical point of view, some of these materials have special conditioners or primers used before their placement in the cavity to modify the smear layer and prepare the surface of the substrate for bonding. However, some others are used without conditioning the tooth surface.[5] Recently, some studies have reported that the use of an adhesive, especially self-etch adhesives, results in an improvement in marginal integrity and bond strength of these materials in deep cervical cavities.[7-9] However, these adhesives might prevent or limit the release of fluoride in the substrate beneath the resin.[5]

On the other hand, current light curing units convey a wide range of spectral emissions and irradiance levels. These differences among the different units are often not perceivable by the eye nor accurately by a radiometer; however, they can affect the polymerization of the resin based materials.[10] The best and most efficient range of wavelengths of light, intensity, and exposure time with each of the light curing device is unknown, particularly for RMGIs.

The question is whether it is advisable for manufacturers to provide users with more information about the commercial products to achieve more favorable clinical results so that the clinical behaviors will be adjusted to the nature of the materials and the dentists will resolve ambiguities and will avoid carrying out some procedures

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through trial and error to achieve more favorable clinical results. Since such materials have the dual resin/glass ionomer nature, it appears each of these two natures affects their behaviors and physico-mechanical properties, including shrinkage. Isn't it high time the users received more explanations about these materials, the rate of their resin and glass ionomer components and the amount of fluoride released by them? Moreover, isn't it high time the manufacturers provided the clinicians with information on such matters?

When the clinician uses these materials in the clinic, he/she should ask him/herself these questions: Does the material have adequate glass ionomer properties so that a delay in photoinitiated polymerization can increase the rate of acid–base reaction with the underlying substrate? Can the substrate benefit sufficiently from the release of fluoride? Does the material have adequate resin nature so that a higher bond strength and more appropriate marginal integrity can be achieved with the use of an adhesive instead of the conventional conditioning or simple irrigation, the choice depending on the manufacture's recommendation? Is the resin nature of the commercial product used adequate so that the effect of the use of dental adhesive on the release of fluoride can be ignored in favor of less microleakage? How much polymerization shrinkage will the material exhibit with self-curing or photoinitiated curing? Does the amount of shrinkage necessitate measures on the gingival floor, such as the use of composite resins similar to that with the incremental technique? It appears there are more questions in this respect, which should be answered by purposeful studies and at least information should be provided in the instruction manuals of commercial products so that they can serve as good guides for the proper clinical use of these materials.

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