Effect of matrix compatibility and type of adhesive on the repair bond strength to aged composite.

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تأثير توافق القالب ونوع اللاصق على قوة رابطة الترميم لمادة الراتنج المركب المتقادم

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Introduction

Total replacement of defective old composite restorations is considered a challenging decision that faces dentists during their daily practice. It is frequently accompanied with the removal of sound tooth structure. Besides widening of the prepared cavity, more of sound tooth structure is unnecessarily compromised. Repeated insults to the pulp, misuse of chair time, resources and patient's tolerance to accept interventive dental care is inevitable. It has been estimated that half a general practitioner's time is spent on 'replacement' dentistry [(1)].

Consistent with the philosophy of 'minimum intervention' , defective restorations should be first evaluated for the possibility of repair, rather than being routinely replaced [(1)]. There is now accumulating evidence that repair of composite can be a viable clinical procedure. However, all composite manufacturers recommended repair of their materials, but more than half of them do not supply any repair instructions. Although some of them give guidance on repair using the same type and brand of composite as the original [(2)].

The dilemma for the clinician, however, is that the type and brand of original composite may not be known, and now that composite monomers other than dimethacrylates are being used regularly in clinical practice. However, it is likely that these different materials may react differently to various repair techniques [3]. Moreover, the great diversity of the adhesive systems available nowadays, among these many adhesives are recommended by their manufacturers to be used during repair procedures. Furthermore, until now, an optimal universally applicable technique to repair various types of composite restorations has not been described.

From that point of view, it was found beneficial to study the repair bond strength to aged composite when repair is being done, using similar and different resin matrix materials and various adhesive systems.

I- The concept of resin composite repair :

The goals pursued by each restorative treatment in dentistry include, restoring the tooth to a long-term condition of health, function, and aesthetic appearance as well as preventing caries recurrence [4]. An invasive approach to caries management has prevailed in the past decades, and sound tooth structure has been often sacrificed to make up for the limitations of the available operative techniques and filling materials [5,6].

The synthesis of the first adhesive resin and the enamel acid-etching have marked the start of a major revolution in dentistry. Non-invasive pit and fissure sealing and preventive resin restorations have been the earliest precursors of minimally invasive treatments [7]. The increased understanding of the caries process and the advances in adhesive dentistry have promoted a gradual shift in the operative philosophy from the "extension for prevention" proposed by GV Black [5,6] toward "prevention of extension". As a result, the traditional surgical approach to caries lesions has been steadily superseded by a biological approach, focused on the individual caries risk assessment, the disease control, the healing potential of early carious lesions and the selective removal of cavitated lesions [8].

These aspects characterize a refined model of care known in daily practice as "Minimal Intervention Dentistry" [9]. Minimal intervention also provides for a conservative treatment of failed restorations [10]. For many years, traditional taught considered as necessary to completely remake restorations not satisfying strict quality requirements. Replacement of failed restorations accounted for about 60% of the operative activity in general dental practice [11]. Laboratory and clinical studies have shown that replacing a resin based composite restoration inevitably increases the size of the new cavity preparation, which may extends to areas remote from the original site of failure [12].

Due to the aesthetic quality of resin composites, with shade matching and light-transmitting properties similar to the surrounding dental tissues, the visual and tactile identification of the bonded resin tooth interface may be impaired [13]. Either over- or under-treatment are likely to occur and finally result, respectively, in unnecessary loss of tooth structure or in incomplete removal of resin remnants from the substrate [14]. As resin residues may affect the bonding potential of the new restoration, the cavity preparation is often extended beyond the resin-impregnated, beveled margins at the time of replacement [12]. Conversely, the optical contrast to the tooth substance and the purely mechanical retention of amalgam restorations, make their replacement more conservative as compared to the removal of failed resin restorations [15].

There is consensus in dental literature that replacement of resin composites is a technically-demanding and time-consuming procedure, likely to result in weakening of the tooth and renewed insult to the pulp tissue[16]. Considering these concerns, the repair of an existing restoration may be conceived as a viable and minimally invasive alternative to total replacement, providing that the repaired restoration is clinically acceptable.

II- Longevity of direct composite restoration :

The Dictionary of Dentistry described a permanent restoration as "a restoration designed to remain in service for not less than 20 to 30 years.."[17]. Based on this definition, a resin composite restoration cannot be regarded as permanent restoration, on account of significantly lower survival times reported in the literature. The need of placing effective long-lasting restorations has stimulated a continuous research in the field of adhesive resins, with the aim of achieving a reliable adhesion of the composite restoration to enamel and dentin.

The long-term survival of direct composite restorations has interested a great number of researchers in the last decades. In spite of the wide variation in longevity reported, median survival time has been calculated to range between six and eight years, and it has been evaluated by retrospective and prospective studies.