

## Flowable Composite Resins in Orthodontics

**Amin Aminian, Seyed Sajad Hoseini Musa\*, Fatemeh Abdi**

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### Abstract

Flowable composite resins are defined as a group of dental composite resins which their low viscosity allows them to flow on a surface, so they can easily be applied with the help of a syringe. These materials have been used as filling and sealant agents for almost three decades; but despite of their popularity in the operative dentistry, to this day they have not found a place in the field of Orthodontics. Recently a few studies successfully used flowable composite resins as an adhesive for orthodontic brackets and fixed orthodontic retainers; also some orthodontists prefer to use these materials for temporary opening of the patient's bite. The purpose of this literature review is to present an update on the use of flowable composite resins in the orthodontic treatments.

**Key words:** Flowable composite resins; Orthodontics; Bonding; Appliance reactivation.

### Introduction

Composite resins have been in widespread use in dentistry since the early 1990s. They are divided into the following categories based on their filler content and type as follows: Nanofilled, Microfilled, Hybrid, Packable and Flowable (Burgess, Walker and Davidson, 2002). Flowable composite resins are a group of conventional composite resins, whose filler content is 37–53% compared to conventional composite resins with a filler content of 50–70%. This decrease in filler content has decreased the viscosity of this group of restorative materials significantly, so that they can be injected with the use of a syringe into areas in the oral cavity with difficult access (Murchison, Charlton and Moore, 1999).

These materials have been introduced as universal adhesives in different dental procedures for some reasons, including their easy application with no need for a specific applicator, low viscosity, micromechanical bonding capacity to different surfaces such as tooth and acrylic resin surfaces, mechanical contact with the surfaces of orthodontic wires and retentive features. The present study is a review of four common uses of flowable composite resins and five uncommon and sometimes innovative uses of these materials in orthodontic treatment.

### Common uses

#### *Bonding of orthodontic brackets*

Recently, flowable composite resins have been advocated as an alternative for adhesive bonding of orthodontic brackets. Several in vitro studies have evaluated the properties of flowable composite resins as a bonding agent for orthodontic brackets, concluding that considering favorable shear bond strength, the amount of adhesive remaining (adhesive remnant index, ARI) after debonding of brackets, bond failure values and also microscopic analysis of enamel surfaces after debonding of brackets. In addition, this material exhibited a minor decrease in unexpected debonding of brackets during a one-year clinical follow-up (Ryou et al., 2008; D'Attilio et al., 2005).

#### *Boning of fixed lingual retainers*

Recently, use of flowable composites has been suggested for bonding of fixed lingual retainers. Since these composite resins can be

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#### **Amin Aminian**

Associate Professor, Department of Orthodontics, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran.

#### **Seyed Sajad Hoseini Musa\*, Fatemeh Abdi**

DDS, Post-graduate student, Department of Orthodontics, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran.

\*Email: sajad\_musa88@yahoo.com

easily placed with needle tips in areas with difficult access, are not sticky and tend to flow toward the bulk of the material, rather than in the opposite direction, and because they do not require polishing and trimming, it is claimed that they can be a good alternative for composite resin bonding agents, especially for lingual retainers (Elaut et al., 2002). One of studies in this respect showed that flowable composite resins exhibit shear bond and wire pull-out strengths similar to standard orthodontic resins; therefore, they can replace these materials in the bonding of lingual retainers (Tabrizi, Salemis and Usumez, 2010).

However, higher microleakage values at adhesive–wire interface and their unspecified resistance to wear has cast doubts on their use of as a bonding agent for fixed retainers, necessitating further studies in this respect (Uysal et al., 2008).

#### *Bite opening*

In many cases during orthodontic treatment, it is necessary to temporarily open the patient's bite to avoid traumatic occlusal contacts, eliminate bracket interferences, eliminate crossbite of anterior or posterior teeth and to facilitate various tooth movements in patients with deep interdigitation such deep bite patients. To date, different appliances have been used to this end, including removable bite plates, cements, adhesive agents, etc (Zachrisson, Usumez and Büyükyılmaz, 2016).

A fast and easier technique is the use of flowable composite resin at occlusal contact areas after acid etching and irrigation that is confined to one or several areas of occlusal contacts. One of the advantages of this technique is the fast and easy application of the material with needle tips, especially in posterior areas with difficult access and also the possibility of the fast and safe removal of the material with tools such as Weingart plier.

#### *Attachments in Clear Aligner Therapy*

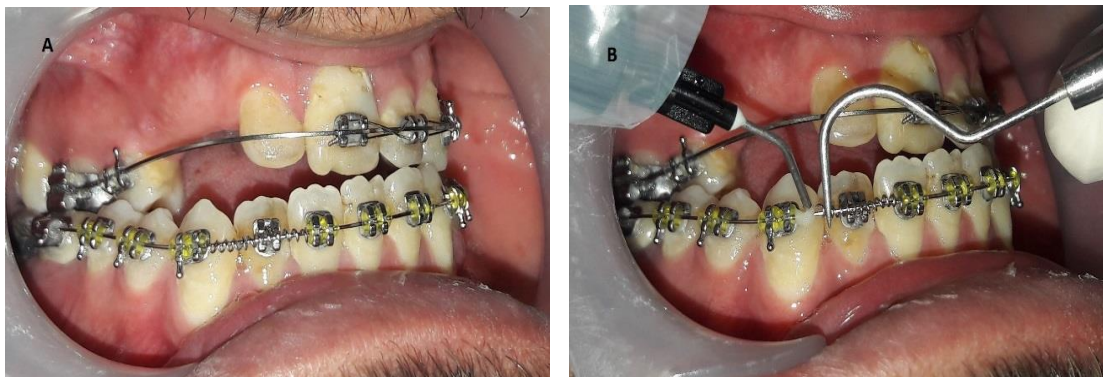
Clear aligner–based orthodontic movement techniques have demonstrated limitations in the configuration of complex force systems, such as extrusion of central incisors and rotation and inclination of the canines, as well as bodily tooth movement. The need to overcome these limitations has led to the development of biomechanically “enhancing” composite attachments bonded to the dental surface. These applications increase the aligners' biomechanical capabilities by enabling the construction of more complex force systems, usually including couples or pairs (Gomez et al., 2015). Some clinicians prefer to use Flowable composite resins for this purpose, because it can easily be injected inside the plastic template and be placed on the surface of the tooth and cured using light.

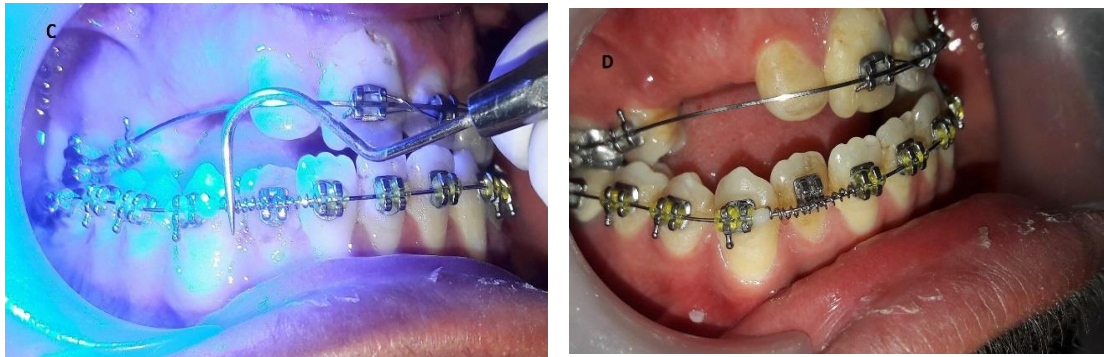
### **Uncommon uses**

#### *Open coil spring reactivation*

During fixed orthodontic treatment, in many cases open coil springs are used on the main archwire in order to open spaces. In such cases, conventionally in each visit the clinician has to remove the archwire and place a new segment of the open coil in place with a slightly longer length. This increases the patient's chairtime.

Alternatively, it is possible to inject a small amount of flowable composite resin on the archwire next to the open coil with the use of a special syringe while the open coil is compressed with the finger pressure or with the use of an explorer so that it can be cured (Fig 1). This way it is not necessary to remove the main archwire in consecutive visits and it is possible in the following sessions to increase the reactivation of the open coil by adding some flowable composite resin. Another advantage of this technique is the precise control of the amount of reactivation of the open coil.





**Fig 1. (A-D)** Open coil spring reactivation

#### *Twin-block appliance reactivation*

One of the most commonly used functional appliances in contemporary orthodontic treatment is the twin-block appliance which is usually used to treat adolescents with CI II malocclusion with mandibular deficiency and decreased facial height (Clark, 2002).

Conventionally, if the sagittal discrepancy is not excessive (an overjet around 6 mm) at the time the construction bite is prepared, the mandible is guided forwards up to the amount necessary in order to achieve normal overjet. However, in patients with more severe discrepancy (overjet >6 mm), the majority of clinicians prefer to advance the mandible relative to its original position in several steps so that they can maintain the controlling muscles in an active state, resulting in a decrease in the protrusion of mandibular incisors; in addition, the patient's compliance with the use of this technique is more probable than complete activation in one step (TM, 1997).

In relation to the twin-block appliance, conventionally reactivation is carried out in consecutive sessions by abrading occlusal ramps and adding some fast-curing methacrylate acrylic resin, which is very time-consuming; in addition, the methacrylate monomer remaining in the newly set acrylic resin is cytotoxic and might irritate the patient's mucosa. As an alternative technique, after abrasion, acid etching and irrigation of the contact area of the occlusal ramps of the appliance, it is possible to add some flowable composite resin, followed by light-curing (Fig 2). Therefore, a shorter time is required for reactivation of the appliance because flowable composite resin is cured at a much shorter time compared to methacrylate acrylic resin and does not irritate the patient's mucosa since it does not have any monomer in its structure.



**Fig 2. (A-D)** Reactivation of Twin-Block functional appliance

### *Protection of the patient's mucosa against irritation resulting from orthodontic appliances*

In many cases, the oral mucosa in orthodontic patients is irritated by traumas from the orthodontic appliance components such as arch wires, brackets, closing loops, etc. Such irritations might result in ulcers and sometimes mucosal hyperplasia. In cases in which the arch wire has irritated the mucosa, especially when the free part of the arch wire is long, elastic tubes, referred to as shrink tubing, are usually used around the part of the arch wire that has irritated the mucosa. Alternatively, in such cases it is possible to place a small amount of flowable composite resin on the appliance part involved in irritation and light-cure it, to prevent direct contact between the mucosa and the arch wire or any other component of the appliance (Fig 3).

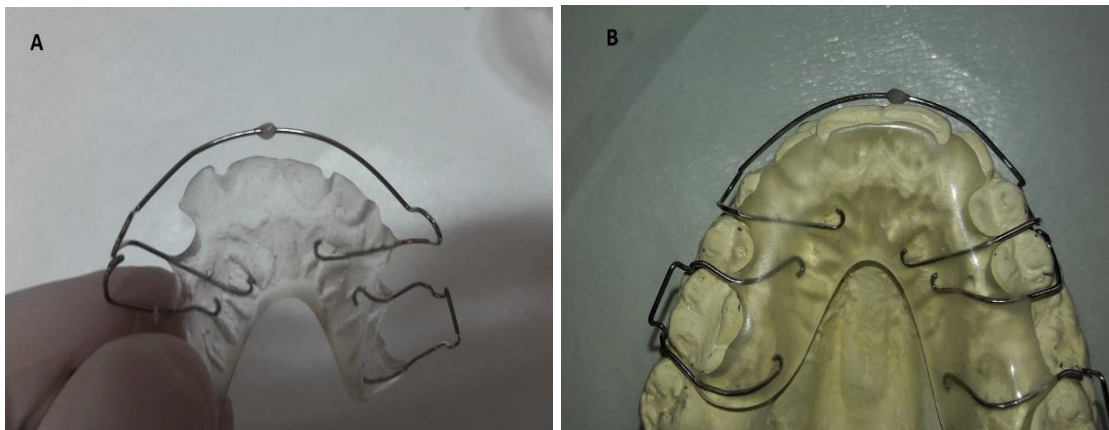
The advantage of this technique over the use of shrink tubing is a lack of need for removing the arch wire for its placement. In addition, in cases in which the closing loops have irritated the patient's mucosa, it is possible to place a small amount of flowable composite resin in the area and light-cure it.



**Fig 3.** An amount of Flowable Composite has been placed on the Closing-Loop to prevent mucosal irritation.

### *Increasing the retention of removable orthodontic appliances*

It is possible to place a small amount of flowable composite resin on the facial surface of the first mandibular deciduous or permanent tooth in contact with the retentive features of a removal plaque in order to increase the retention of removable appliances such as the labial bow and even a C-clasp and to increase patient compliance. Similar attachments, too, are used during clear aligner therapies in order to prevent aligner displacement and improve and facilitate specific tooth movements. In addition, it is possible to use flowable composite resins in order to reactivate labial bow of removable appliances e.g. Hawley, in cases in which minor lingual tipping of teeth is necessary (Fig 4).







**Fig 4. (A-B):** Activation of the Labial Bow to apply a lingual force on the Maxillary left central incisor, **(C):** Activation of Lingual Arch to apply a labial force on the Mandibular right lateral incisor.

#### *Freezing (deactivation) of the open coil*

Sometimes during fixed orthodontic treatment, after a space being opened using an open coil, it may be crucial to inactivate the open coil to make sure that any unnecessary force from the open coil would not be applied to the adjacent teeth. In this situation, a possible solution is to apply an amount of Flowable composite resin on the open coil and light-cure it (Fig 5).



**Fig 5.** Freezing (deactivation) of the open coil.

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