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Flowable Composite in Orthodontics

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Abstract
Flowable composite resin is a type of dental composite resin that has a low viscosity and can flow on a surface. As a result, they are simply applied using a syringe. Despite their popularity in operative dentistry, these materials have yet to find a place in the field of orthodontics. Some orthodontists also use flowable composite resins for the temporary opening of the patient's bite and have recently been used as an adhesive for orthodontic brackets and fixed orthodontic retainers. An updated literature review on the application of flowable composite resins in orthodontics is the objective of this research.

Keywords
Flowable composite resin, Orthodontics, Bracket bonding, Fixed retainers, Bite opening, Dental materials.

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INTRODUCTION
Composite resins have been widely used in dentistry since the early 1990s. Composite resins are proven to absorb a considerable amount of water but do not cause serious changes in mechanical properties (Park & Kang, 2020; Zaidan & Rafeeq, 2021). Based on the amount and type of filler used, they are categorized as either nano-filled, micro-filled, hybrid, packable, or flowable (Burgess *et al.,* 2002). Flowable composite resins are a kind of conventional composite resins that contain a lower concentration of filler (between 37 and 53%) than conventional composite resins (between 50 and 70%) in addition to the greater monomer proportion this increases flowability and allow them to be packed in syringes and dispensed by needle (Salih and Al-Janabi, 2014). Due to the significantly reduced viscosity of this group of restorative materials, they can now be injected with a syringe into difficult-to-reach areas of the oral cavity (Aminian *et al.,* 2019).

Flowable composites have recently become more popular than conventional Trans bond XT because they are less time-consuming, lower the likelihood of errors that can lead to bonding contamination, decrease dental chair side time, and improve aesthetics, other than bonding orthodontic brackets, flowable composite resins have a variety of applications in dentistry, a number of low viscosity composite resins have been on the market in the recent years (Deeksheetha & Naveen, 2021). Although flowable composite showed increased microleakage (AL-Shimmary & Hassan, 2019), increasing the physical, mechanical, and biological properties of this material may lead to increased orthodontic applications in the future by increasing strength and decreasing microleakage (Nahidh *et al.,* 2021).

USES OF FLOWABLE COMPOSITE IN ORTHODONTICS
Bonding of Orthodontic Bracket
As an alternative to conventional bonding methods, flowable composite resins have been proposed for use with orthodontic brackets. Shear bond strength, adhesive remnant index (ARI) after bracket debonding and microscopic analysis of enamel surfaces after bracket debonding are all significant factors, according to several in vitro studies evaluating the properties of flowable composite resins as a bonding agent for orthodontic brackets (D'Attilio *et al.,* 2005; Park *et al.,* 2009; Cantekin *et al.,* 2014). Flowable composites are able to be applied directly to acid-etched enamel without the need for intermediate bonding resins due to their low filler loading and increased flowability (Ryou *et al.,* 2008). Flowable composites may be a good option for bonding orthodontic brackets, but this must be determined through clinical trials.

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Bonding of Fixed Retainer

Recently, it has been proposed to use flowable composites for bonding fixed lingual retainers. Flowable composites are said to be a good alternative for composite resin bonding agents, especially for lingual retainers, because they can be easily placed with needle tips in places that have restricted access, are not sticky, and tend to flow toward the bulk of the material rather than away from it (Elaut *et al.,* 2002). Flowable composites typically experience a volume polymerization shrinkage rate of 5% (Radz, 2006), which can lead to mechanical failure at the composite/tooth interface, de-bonding, microleakage, secondary caries, and enamel fractures (Millar & Nicholson, 2001). This has cast some doubt on their use as a bonding agent for fixed retainers, so more investigation into this area is required (Uysal *et al.,* 2008).

Bite opening

During orthodontic treatment we need sometimes to open the bite like patients with deep bites, several appliances have been employed to achieve this goal, such as removable bite plates, cement, adhesive agents, and so on (Zachrisson *et al.,* 2016).

Using flowable composite resin at occlusal contact locations localized to one or more areas of occlusal contact is a simple and quick technique; the benefits associated with this procedure include the possibility of quick and safe removal of the material with equipment like the Weingart plier and the speed and ease with which the material can be applied using needle tips, especially in posterior areas with restricted access (Baroudi and Rodrigues, 2015).

Reactivation and Deactivation of Coil Springs

In order to make space for a tooth that is being pushed out buccally or lingually/palatally, open coil springs are frequently used, but they must be reactivated as the space opens up. Many methods have been developed to reactivate the open coil spring, including crimping a C-Ring over the arch wire or placing a tiny segment of closed coil spring across the arch wire. After retracting the inactive coil spring to one side with a wire tucker, a simple and inexpensive solution is to apply light cure flowable composite to the base arch wire. This composite acts as a stopper, preventing tooth movement in one direction while allowing movement in the opposite direction (Yadav **&** Yadav, 2012). After using an open coil to create space during fixed orthodontic treatment, it may be necessary to disable the coil so that it no longer exerts force on the teeth nearby. An alternative would be to apply a small amount of flowable composite resin to the open coil and cure it using light (Aminian et al., 2019).

Attachments in Clear Aligner Therapy

Clear aligner-based orthodontic movement approaches have shown limits in creating complicated force systems like central incisor extrusion, canine rotation and inclination, and bodily tooth movement. Composite attachments bonded to the dental surface were created to overcome these restrictions. These applications enable aligners to create more complex force systems, such as couples or pairs (Gomez et al., 2015).

Although flowable composite resins have lower shear bond strength than packable composite (Chen et al., 2021), some clinicians prefer them for this use because they can be injected into a plastic template, applied to the tooth, and light cured.

Reactivation of Twin Block

One of the most important myofunctional appliances is the twin block which is used to treat adolescent patients with cl II with mandibular deficiency by decreasing the overjet (Sattarzadeh & Lee, 2010).

When preparing the construction bite, the jaw is directed forward to achieve normal overjet if the sagittal discrepancy is less than 6 mm. However, in patients with more severe discrepancy (overjet >6 mm), most clinicians prefer to advance the mandible relative to its original position in several steps to keep the controlling muscles active, reducing mandibular incisor protrusion. Patient compliance with this technique is higher than complete activation in one step (Banks *et al.,* 2004).

Abrading occlusal ramps and applying a time-consuming fast-curing methacrylate acrylic resin to activate twin block appliances takes several sessions. The monomer left in the newly set acrylic rein is cytotoxic and may irritate the patient's mucosa. A flowable composite resin can be light-cured after abrasion, acid etching, and irrigation of the appliance's occlusal ramps. Since monomer-free flowable composite resin cures faster than methacrylate acrylic resin and doesn't irritate the patient's mucosa, the appliance can be reactivated faster (Aminian *et al.,* 2019).

Crossbite correction

To correct an anterior crossbite, reverse stainless-steel crowns, fixed acrylic planes, tongue blades, and removable plates with Z-spring are all able to be used. Instead, flowable composite slopes with an inclined plane can be used to deal with such a problem (Baroudi & Rodrigues, 2015).

Protection of the Patient's Mucosa from Irritation by Orthodontic Appliances

Tongue cribs are highly efficient in stopping the behavior of tongue thrusting, they work as a reminder appliance, causing irritation to the tongue when it comes into contact, making it noncompliant, especially in little children, to avoid this trauma, the crib's tip surface is covered with flowable composite (Bharti, 2017).

Ligature ties should be used to secure cantilever arches to the teeth; these ties tend to come loosened over time, causing mucosal ulceration. The ligature ties are tucked in and a small amount of flowable composite is injected to prevent this (Bharti, 2017).

Brackets, archwires, TADs, and closing loops may become traumatic and cause ulceration, a little amount of flowable composite could be applied to prevent this (Aminian *et al.,* 2019).

Molar stopper

Mulligan, Bennet, and Treveisi recommend using expanded heavy archwire or Begg's molar stops anterior to the molar tube when orthodontic expansion is needed in the upper arch, this can be done with flowable composite by placing two composite beads anterior to the molar tube according to the amount of expansion required (Bharti, 2017).

Increasing the Retention of Removable Appliance

To improve patient compliance and retention of removable appliances like the labial bow and C-clasp, a small amount of flowable composite resin can be applied to the facial surface of the first mandibular deciduous or permanent tooth to come into contact with the retentive features (Aminian *et al.,* 2019).

Constructing a Button-Like Attachment

After etching, rinsing, drying, and priming the tooth surface, use an elastic separator as a mold. If there is no button or the button is often de-bonded, an adequate amount of flowable composite can be injected and cured as an elastic attachment (Nahidh *et al.,* 2022).

Direct Pontic Fabrication

A previous study reported using flowable composite for constructing immediate pontic in fixed orthodontic treatment and then securing with ligature wire to arch wire with a bracket that bonded to the pontic, the ligature wire extends to the adjacent tooth to prevent rotation (Kravitz, 2016).

DISCUSSION

Several flowable resins have reached the commercial market, and their non-stickiness and adaptability make them ideal for placing restorative materials in cavities with limited access (Frankenberger *et al.,* 1999). Flowable resins, on the other hand, might create marginal overhangs because the flowability is attained by lowering the filler loading but flowable resins are intended to improve mechanical retention (Park *et al.,* 2009). While some flowable composites may not be suitable for orthodontic use so clinicians must be careful when selecting the materials (Turgut *et al.,* 2011). Without an intermediate bonding resin on the etched enamel, flowable composites can bond orthodontic brackets, eliminating this step will save chairside time as well as the risk of saliva contamination (Shinwari *et al.,* 2017).

CONCLUSION

The increased demand for orthodontic treatments and other cosmetic treatments has resulted in the development of newer composite. Flowable composites, which are now used in orthodontics, have proven to be useful in a variety of operations, and they are expected to have several applications in this field in the future.

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