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Light cured versus chemical cured resin composite for bonding orthodontic brackets: Can you tell the difference?

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Abstract

Light cured and chemical cured resin composite adhesives are both considered as valuable options for bonding of orthodontic brackets. However, some clinicians may get confused about which type of these adhesives is better. The aim of this review is to search in the available literature in an attempt to illustrate the advantages and limitations of each type of adhesive and to serve as a guide for the clinicians in their selection of the type of adhesive that can be efficiently utilized.

Introduction

An important feature for resin composite in order to be utilized in orthodontics is the ability to withstand forces of mastication and to be attached firmly to the teeth during the whole time of treatment. On the other hand, failure in bonding of the brackets will lead to increase in both time and cost of the treatment [(1, 2)].

Bond strength of the bracket is affected by many factors such as the type of adhesive, the design of the bracket base, the method of bonding, and the skills of the clinician. Although it is important to have the bond strength of the bracket high enough to avoid failure of the bond, it is also important to put into consideration the ease of removal after finishing the orthodontic treatment without causing any damage to the bonded surface of enamel [(3, 4)].

Light cure and chemical cure resin composite systems are the most commonly used types of orthodontic adhesives. In the chemical cure resin composite the polymerization reaction is initiated by benzoyl peroxide which start on the beginning of mixing. Despite the rapidity of this method in bonding brackets, its main disadvantage lies in the possible inaccuracy during positioning of the bracket. To overcome this problem a "no mix" chemical cure resin composite was developed. This type of resin composite was able to avoid many defects in the bonding of the brackets which is caused by improper mixing. Polymerization of the "no mix" chemical cure resin

composite was found to occur by the process of diffusion [3, 5].

On the other hand, light cured resin composite systems (also called command curing) enhances the accuracy of the bracket positioning. This will minimize the necessity for teeth realignment afterwards. Also, it allows for better removal of excess composite that surround the bracket after its attachment. However, this technique is considered more time consuming than chemical cure resin composite systems [5, 6].

Understanding the merits and limitations in both of the chemical cure and light cure resin composite systems will be beneficial to many clinicians to decide which type of system they will utilize.

Search strategy and selection of studies

An electronic search of articles from March 2020 to April 2020 was performed. All the articles written in English were identified in four international databases: Medline/PubMed, Scopus, Embase and Web of Science. The following terms were used in this search: composite* AND (light* OR chemical* OR self*) AND bracket*. The search items in the literature were de-duplicated by utilizing EndNote X10 software (Thomson Reuters, New York, USA).

Review of Literature

Omidkhoda et al. (2019) found that bond strength of the chemical cure resin composite (no mix chemical cure adhesive) in bonding stainless steel brackets was significantly higher than that of the light cure resin composite systems. Thus it was recommended to use the no mix chemical cure resin composite in patients who are found to have frequent deboning of the bracket [3]

Shaik et al. (2015) also compared the bond strength of two commercially available self-cured composites with three light-cured composites when bonding orthodontic brackets. The study was an in vitro study conducted on extracted premolars. Teeth were stored in distilled water for twenty four hours at room temperature then debonding was started. The results of the study showed higher bond strength values in the three types of light cure composites when compared with the chemical cure composite. However, it was also found that the chemical cure composite with the higher filler content showed significantly higher bond strength due to the positive effect of inorganic fillers on the mechanical properties of resin composite [6]

Newman et al. (2001) investigated the shear bond strength in self-cure resin composite in comparison with resin modified glass ionomer cements. The results of the study showed a high mean value of the shear bond strength in self-cure resin composite especially when combined with micro-etching [5].

Sanares et al. (2001) performed a study to investigate the effect of self-etch adhesives having different acidities on the bonding to both chemical and light cured resin composites. Bond strength of the chemical cure composite was much lower than that of the light cure composite when using different bonding techniques. The incorporation of small air bubbles during mixing of the chemical cure composite was one of the factors that significantly decreased the bond strength. Another important factor is the unwanted interaction between the monomers of the self-etch adhesive formed by the oxygen inhibited layer which prevent its curing and the initiator system inside the chemical cured composite [7].

Mandall et al. (2003) conducted a systematic review to evaluate the effects of orthodontic adhesives with its different types for bonding. Unfortunately, the analysis done by this review could not draw any conclusions that favours a specific type of adehesives to bond brackts [8].

O'brien et al. (1989) compared the light-cured adhesives with the chemically cured types in combination of two

types if brackets that differ the shape of its base. The study failed to find any significant differences between the two types of adhesives in terms of failure rates [9].

Bharathi et al. (2019) conducted a systematic review on the rate of failure in orthodontic brackets when they are bonded with the self-etch adhesives and compared it with the total etch technique. The results of the ten collected randomized controlled trials were conflicting due to the heterogeneity of the interventions and measurements between studies. However, most of the studies (eight out of ten) showed no statistically significant differences between the self-etch adhesive compared to the total etch adhesive. Only one study found a lower rate of bracket failure when using self-etch adhesives. Another study found the opposite showing a high rate of bracket failure when using self-etch adhesives. Based on these findings it was concluded that there is no difference in the rate of failure or the time of survival of the brackets that are bonded by either self-etch or total etch method [10].

Al-Saleh et al. (2019) measured the bond strength of both ceramic and metallic orthodontic brackets with a new self adhesive cements using a universal testing machine. After thermocycling the brackets were debonded by using a metal chisel in the universal testing machine having a cross head speed of one mm/minute. The load that caused the bracket to debond was recorded in every specimen [11].

Conclusion

Both chemical cured and light cured composite adhesives represent a valuable and efficient options for bonding orthodontic brackets. Although chemical cured composite adhesives may need less amount of time for bonding, this technique may not be recommended for the biggner orthodontists as the short working time of this adheisve may hinder proper postioning of the bracket. On the other hand, light cured composite adhesives have the advantage of controlled working time especially with the development of rapid curing light cure device which makes the procedure no longer time consuming.

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