

# In vitro study of shear bond strength in direct bonding of orthodontic molar tubes

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## Abstract

**Objective:** Although direct bonding takes up less clinical time and ensures increased preservation of gingival health, the banding of molar teeth is still widespread nowadays. It would therefore be convenient to devise methods capable of increasing the efficiency of this procedure, notably for teeth subjected to substantial masticatory impact, such as molars. This study was conducted with the purpose of evaluating whether direct bonding would benefit from the application of an additional layer of resin to the occlusal surfaces of the tube/tooth interface. **Methods:** A sample of 40 mandibular third molars was selected and randomly divided into two groups: Group 1 - Conventional direct bonding, followed by the application of a layer of resin to the occlusal surfaces of the tube/tooth interface, and Group 2 - Conventional direct bonding. Shear bond strength was tested 24 hours after bonding with the aid of a universal testing machine operating at a speed of 0.5mm/min. The results were analyzed using the independent t-test. **Results:** The shear bond strength tests yielded the following mean values: 17.08 MPa for Group 1 and 12.60 MPa for Group 2. Group 1 showed higher statistically significant shear bond strength than Group 2. **Conclusions:** The application of an additional layer of resin to the occlusal surfaces of the tube/tooth interface was found to enhance bond strength quality of orthodontic buccal tubes bonded directly to molar teeth.

**Keywords:** Tooth bonding. Shear strength. Molar tooth.

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### Editor's summary

Direct bonding of tubes to posterior teeth has several advantages over the use of bands: shorter clinical time; greater preservation of periodontal tissues because of easier hygiene and preservation of biological distances; and no need of previous interdental separation. However, due to the incidence of greater masticatory forces in the posterior region, there is a relatively higher rate of bonding failures, which explains the greater prevalence of banding in posterior teeth in orthodontic practice. To increase the efficacy of tubes bonded to posterior teeth, this study evaluated whether the application of an additional resin layer in the tube/tooth occlusal interface might increase its adhesive resistance. Forty mandibular third molars were included in the study and divided into two groups: Group 1 – tubes bonded conventionally, using Transbond XT resin (3M Unitek, Monrovia, CA), light cured for 20 seconds, and

application of an additional composite resin layer in the tube/teeth occlusal interface, light cured for 10 seconds; Group 2 – conventional tube bonding using the same resin, light cured for 20 seconds at first and, 40 seconds later, light cured again for 10 seconds. The specimens were stored in distilled water at 37° C for 24 h. After that, shear bond tests were performed using a universal testing machine (Emic, São José dos Pinhais, Brazil). Adhesive strengths in each group were compared using an independent t test ( $p < 0.05$ ). In Group 1, where an additional composite resin was added to bond the tubes, shear strength was greater and statistically different than in Group 2, which underwent conventional tube bonding. Therefore, the authors concluded that an additional resin layer in the tube/tooth occlusal interface increases the adhesive resistance of tubes bonded to posterior teeth, probably due to the greater contact area between resin and tooth.

### Questions to the authors

**1) In this study, the addition of a composite resin layer resulted in an increase in adhesive resistance of tubes bonded to mandibular molars. Would the authors recommend the same procedure during bonding of tubes to maxillary molars? Why?**

Yes, we recommend the same procedure for maxillary molars. The recommendation of direct bonding of tubes to molars has been recently tested clinically by one of our students in the MS program in Orthodontics in Centro Universitário do Maranhão – Uniceuma, São Luís, Brazil. In this split-mouth trial, 84 maxillary and mandibular molars were selected and randomly divided into 2 groups: in one of the groups, a resin layer

was applied to the tube/tooth occlusal interface; in the other, only conventional bonding was used. Clinical performance was followed up for 1 year. Results showed that the application of an additional resin layer to the tube/tooth interface increased clinical stability of the bonded tube both in maxillary and mandibular molars.

**2) Laboratory tests provide a large amount of clinical information, but they often do not accurately reproduce the oral environment and, for example, its pH and temperature variations, as well as the different forces to which orthodontic appliances are exposed. Therefore, which factors should be taken into**

**consideration clinically when applying an additional resin layer to the tube/tooth occlusal interface, as recommended in your study?**

In clinical practice, several factors should be analyzed before making the decision of banding or bonding to molars: the quality of the adhesive material, the type of surface material (amalgam, resin, porcelain, enamel, metal alloys), the clinical needs (type of movement, height of clinical crown, need of anchorage use), as well as the patient's age. If the choice is direct bonding using the method described here, the amount of adhesive material should be calculated so that it does not affect the occlusal relation between maxillary and mandibular molars and does not obstruct the space for ligatures with archwires and elastic bands in the case of using convertible tubes. Clinically, we recommend that, after the application of this reinforcement, the patient should be asked to occlude several times before the resin is light cured to avoid the occurrence of occlusal interferences. This test may be repeated also after the procedure using articulating paper.

**3) Clinically, one of the greatest difficulties in bonding tubes to posterior teeth is the excessive accumulation of saliva in that region, which crucially affects the success of the procedure. What possible clinical solutions are there for this problem?**

We often bond tubes directly on molars and, honestly, we have not found any great differences in saliva accumulation in the molar region than in the region of second premolars, which are routinely bonded in orthodontic practice. In addition to adequate relative isolation, molars should be bonded one at a time, that is, the molar is first bonded on one side and then on the other, and tubes should only be bonded to other teeth after the procedure is completed. In other words, bonding should move from the posterior to the anterior region. Moreover, the procedure should be conducted with the help of a dental assistant and the use of an oral evacuator and vacuum suction. We usually ask the patient to move the head to the opposite side of the tooth to be bonded, which reduces the accumulation of saliva in the region.

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