An Effective Technique to Modify Weldable Buccal Tube for Bonding.

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Early orthodontics involved fixing attachments to teeth with the help of crude clamps. Individual tooth banding was in vogue in the medieval period. Securing of bands to teeth was facilitated with Zinc oxy-chloride cement, recommended by Feichtinger in 1858 as dental cement.[1]

For the first time in 1955, Michael G Buonocore paid attention to the surface conditioning done for industrial bonding. He postulated the use of acids for surface treatment before application of resins.[2] He subsequently found that etching enamel with 85% Phosphoric acid increased the duration of adhesion under water[2, 3]. In 1960's, he demonstrated the formation of resin tags that caused the adhesion of resins to acid etched enamel. The introduction of acid etching proved to be a simple method of increasing the adhesive capabilities of enamel surfaces that led to a new era in orthodontics [4]. Within a decade, a lot of research on surface conditioning and adhesion was done [3].

Newman [5, 6] first reported direct bonding of brackets in 1965 and later done by Mitchell [7, 6] in 1967, has currently become an inseparable part of day-to-day orthodontics. Banding of first molars is generally a protocol, but nowadays many orthodontists also prefer to bond the second molars mainly due to anchorage considerations.

Banding is not only time consuming, but it also requires considerable skill. Banding is difficult on partially erupted or tilted molars, causes gingival irritation, and is esthetically not superior. Bonding gives better precision in positioning of the attachment. Banding also leaves an undesirable band space after removal, which needs closure with active retainers[3].

The orthodontic adhesives and attachments should be capable of withstanding normal forces of mastication, loads exerted by arch wires and even some abuse by the patient [6]. Reynolds in 1975 has recommended the minimum acceptable bond strength to be 5.88 – 7.85 MPa [6, 8]. The maximum bond strength should be less than the fracture resistance of enamel, i.e., 16MPa to avoid damage during debonding[6, 9]. Reports of higher bond failures in molars are mostly attributable to the larger masticatory forces and difficulty in obtaining adequate isolation posteriorly in the mouth [10].

TECHNIQUE TO MODIFY WELDABLE BUCCAL TUBES FOR BONDING.

1. Seven to nine criss-cross grooves are made on the base of a weldable buccal tube with a 0.20mm ceramic disc mounted on a motor hand-piece.
2. Sandblast the grooved surface for 15-20 sec from a distance of 3mm with 50μ Aluminum Oxide powder.
3. Check for the adaptation of the base of the buccal tube to the tooth surface.
4. Bond the modified attachment as a bondable buccal tube.

MATERIAL AND METHODS.

Thirty-two intact molars with no caries and wasting diseases were included in the study. All teeth were stored in formalin for not more than 2 weeks. Helmut and Brigitte showed that the ideal bond strength was closest to the bond strength achieved experimentally with teeth freshly extracted and stored in formaldehyde[11]. Teeth were mounted on an acrylic base and stored in normal saline for a day. Scaling was done using piezoelectric ultrasonic scaler to remove calculus, and polished using oil free pumice paste. Teeth were stored in normal saline to avoid dehydration until bonding. (Fig 1)

Fig 1. Sample teeth used for shear bond testing.

Weldable second molar buccal tubes with .022 Slot- Roth prescription were used in the study. Seven to nine criss-cross grooves were made on the weldable surface and were sandblasted for 15-20 sec at a distance of 3mm to achieve a surface suitable for bonding. (Fig 2), (Fig 3) Buccal tubes were selected according to the tooth number. The bases of the buccal tubes were adapted to the buccal surfaces of the teeth (fig 4). After acid etching using 35% Phosphoric Acid for 30 sec, the teeth were dried using a jet of oil free compressed air. Bonding was done using Rely-a-bond, self cure composite from Reliance Orthodontics (Fig 5). All sample teeth were immersed in normal saline at room temperature for 24 hours before shear bond testing. Instron Universal Testing Machine was used to measure the debonding force in Kilograms (Fig 6). Most of the bond failure was at the enamel-composite interface.

Fig 2. Modification of weldable buccal tube base.

a. Base of weldable buccal tube before modification.
b. Making seven to nine oblique grooves on the base.
c. Making criss cross grooves
d. Sand blasting the grooved surface using 50μ Aluminium oxide particles for 15-20sec at distance of 3mm.

Fig. 2-A Base of weldable buccal tube before modification.

Fig 2-B Making seven to nine oblique grooves on the base.

Fig 2-C Making criss cross grooves

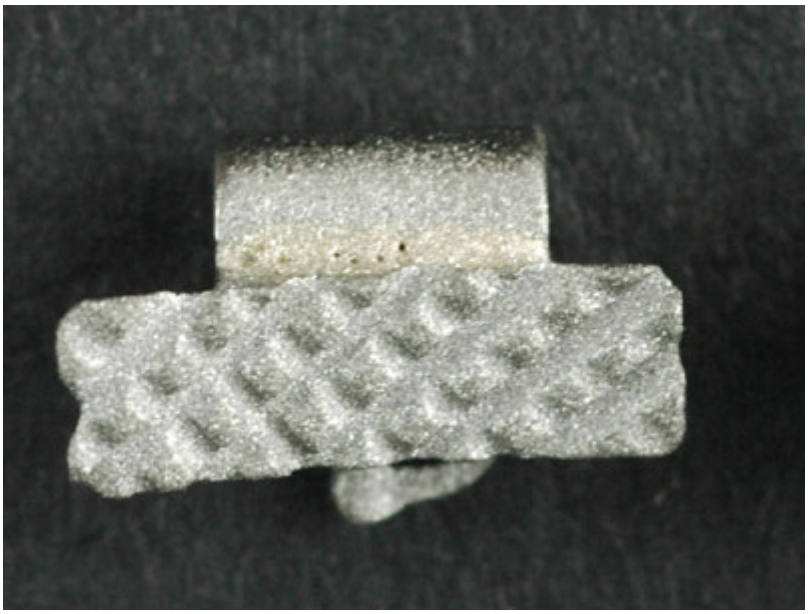

Fig 2-D Sand blasting the grooved surface using 50µ Aluminium oxide particles for 15-20sec at distance of 3mm.

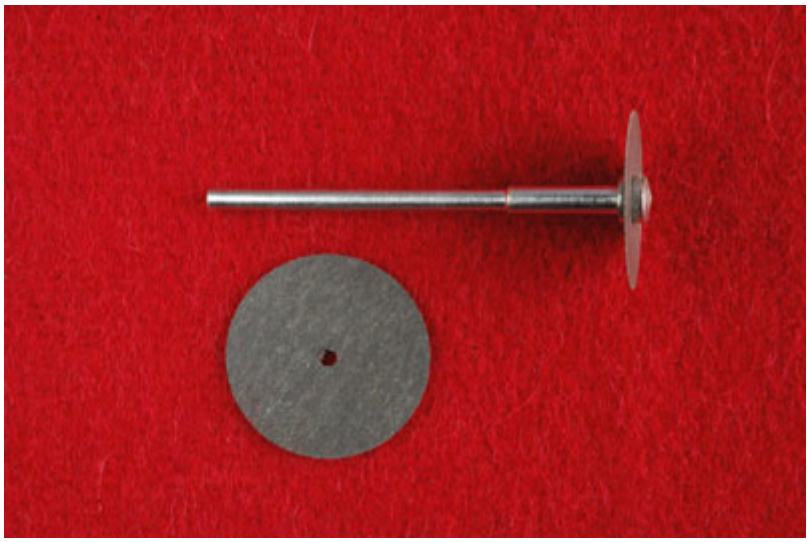

Fig 3. 0.2mm Ceramic discs mounted of a disc mandrel used for making grooves.

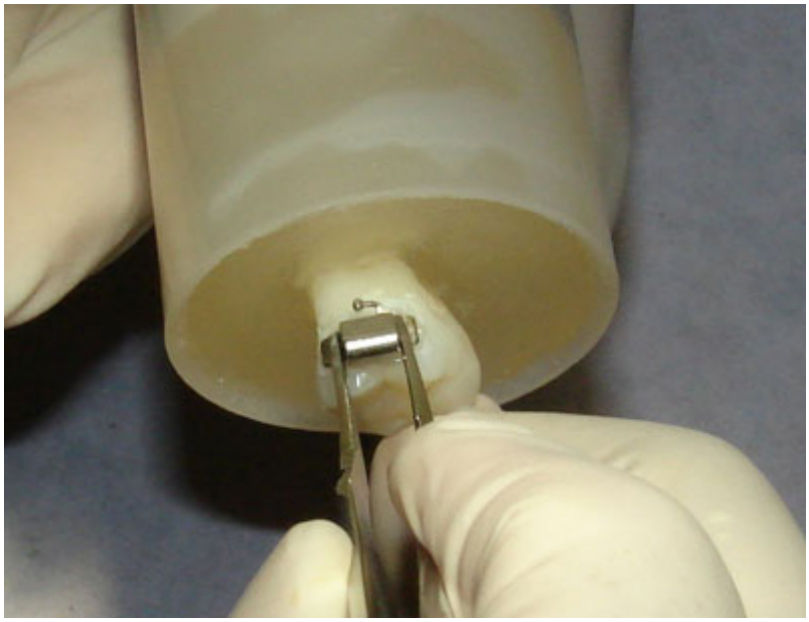

Fig 4. Checking the adaptation of the buccal tube to the tooth surface before bonding.

Fig 5. Armamentarium used for bonding the modified buccal tubes.

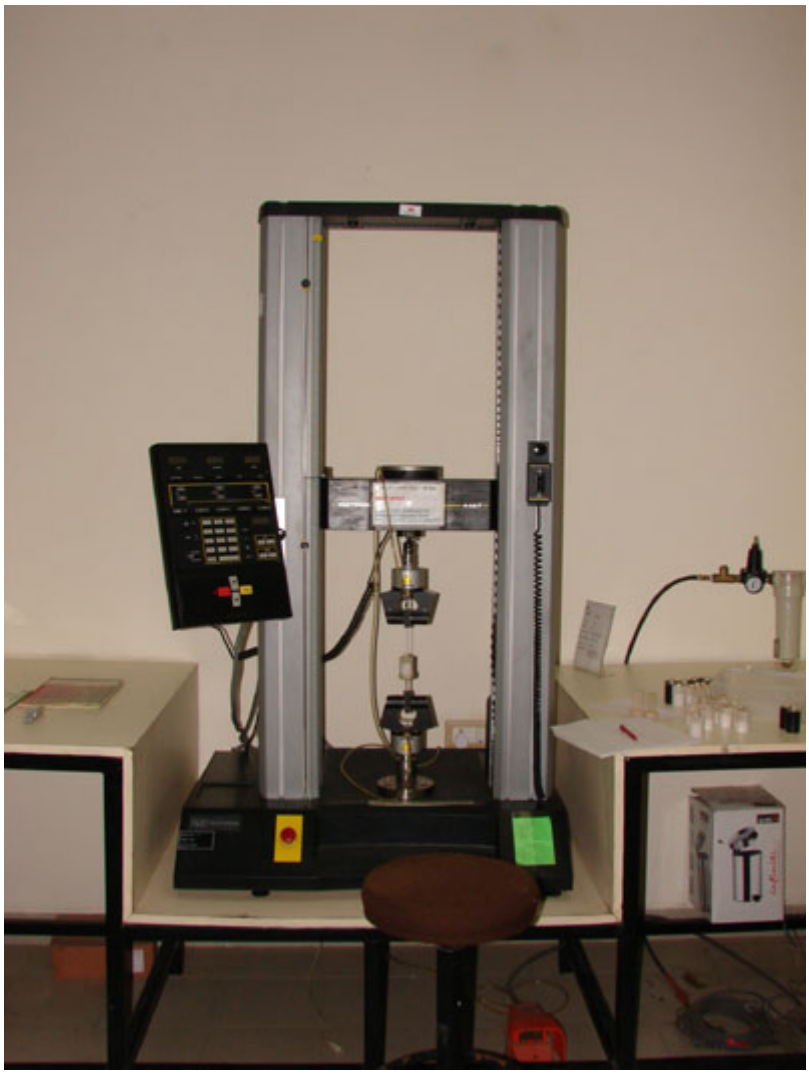

Fig 6. Instron universal testing machine, model 4467 at 3M India Innovations Center, where the testing of samples was done.

Fig 7. A 16 year old male patient on whom the modified buccal tube was bonded using Transbond XT, light cure flowable composite. The attachment is intact since 3 months.

Surface area of the buccal tube base was measured using digital Caliper with an accuracy of 0.01mm. Shear bond strength of individual tooth was calculated in Mega-Pascal (MPa). The maxillary and mandibular base had surface area of (7.00 * 2.25) 15.75mm^2 and (7.15 * 2.10) 15.015mm^2 respectively. The debonding strength of individual tooth was calculated. Three samples experienced premature bond failures and were eliminated from statistical analysis. Reason for failure could be attributed to improper adaptation of the buccal tube base that increased the thickness of composite.

The debonding strength for the modified buccal tube calculated was equal to 8.644 ± 0.716 MPa that correlates with the recommendations of Reynolds. (Table 1)

Table 1.

IN MPa	MAXILLARY	MANDIBULAR
1	9.16	7.663
2	9.18	9.683
3	8.439	8.828
4	9.118	9.848
5	10.185	8.541
6	9.185	9.102
7	8.703	8.564
8	8.051	9.498
9	9.328	8.628
10	9.034	9.528
11	9.146	7.713
12	8.337	8.456
13	9.238	-----
14	9.06	-----
15	8.998	-----
16	8.757	-----
17	9.428	-----
MEAN:	**8.644**	
STD DEV:	**±0.716**	

This is an easy, convenient and emergency technique to convert the weldable buccal tube for bonding.

References:

1. Alan D. Wilson Dental Silicate Cements: VII. Alternative Liquid- Cement Formers. J Dent Res November-December 1968. p1133-1136.

2. Gerard Kugel, Marco Ferrari.: The science of bonding: From first to sixth generation. Jr. Am. Dent. Assoc, 131: 20-25, 2000.

3. Bjorn U Zachrisson: Bonding in orthodontics, in Orthodontics- Current principles and techniques, Thomas M. Graber.; Brainerd F. Swain, The C.V. Mosby Co., St Louis, Missouri, 1985, p.485.

4. Buonocore, M.G.: A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces, J. Dent. Res. 34: 849-853, 1955.

5. Newman G.V.: Epoxy adhesives for orthodontic attachments: progress report, Am. J.Ortho. 51: 901-912, 1965.

6. Jose C. De Castro: Areas requiring further research in testing of orthodontic shear bond strengths, JCO, XLI, 3: 135-137, 2007.

7. Mitchel: Bandless orthodontic brackets, Jr. Am. Dent. Assoc, 71: 103-110, 1967.

8. Reynolds: A review of direct bonding orthodontics, Br. J.Orthod, 2: 171-178, 1975

9. Korbmacher, H.M.; Huck, L; and Kahl-Nieke,B: Fluoride releasing adhesive and anti-microbial self- etching primer effects on shear bond strength of orthodontic brackets, Angle Orthod. 76: 843-848, 2006.

10. Chris D. Johnston.; Donald J. Burden.; David L. Hussey and Christina A. Mitchell: Bonding to molars—the effect of etch time (an in vitro study), Eur J. Ortho, 20: 195-199, 1998.

11. Helmut H. Droschl.; Brigette Wendl.: Comparison of bond strength using various fixation methods, World J. Orth. 8: 153-156, 2007.

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