Revista de Odontologia da UNESP. 2007; 36(2): 189-192

A technique for fabrication specimens for shear bond test using an embedded machine

Debora Barros BARBOSA[a], *Valentim Adelino Ricardo BARÃO*[b], *Douglas Roberto MONTEIRO*[b], *Juliê MARRA*[c], *Ana Carolina PERO*[c], *Marco Antonio COMPAGNONI*[d]

[a]*Department of Dental Materials and Prosthodontics, Araçatuba Dental School, UNESP, 16015-050 Araçatuba - SP, Brazil*
[b]*Postgraduate Student, Department of Dental Materials and Prosthodontics, Araçatuba Dental School, UNESP, 16015-050 Araçatuba - SP, Brazil*
[c]*Postgraduate Student, Department of Dental Materials and Prosthodontics, Araraquara Dental School, UNESP, 14801-903 Araraquara - SP, Brazil*
[d]*Department of Dental Materials and Prosthodontics, Araraquara Dental School, UNESP, 14801-903 Araraquara - SP, Brazil*

Barbosa DB, Barão VAR, Monteiro DR, Marra J, Pero AC, Compagnoni MA. Técnica para confecção de espécimes para teste de cisalhamento utilizando uma embutidora. Rev Odontol UNESP. 2007; 36(2): 189-192.

Abstract: This article describes an alternative technique for fabricating a specimen for shear bond testing between acrylic resin and artificial teeth. The technique involves a special machine to embed the artificial tooth on which the acrylic resin is processed.

Keywords: *Acrylic resins; bonding; shear strength; denture bases; tooth, artificial.*

Resumo: Este artigo descreve uma técnica alternativa para confecção de um espécime para teste de cisalhamento entre resina acrílica e dente artificial.

Palavras-chave: *Resinas acrílicas; união; resistência ao cisalhamento; bases protéticas; dente artificial.*

Introduction

The failure rate of acrylic resin dentures due to fracture has been reported to be unacceptably high[1] and the most common type of failure encountered was the debonding or fracture of the teeth[2] Most attempts to improve the bond strength of denture teeth to an acrylic resin denture base have involved chemical treatment or mechanical modification of the ridge laps portion of the denture tooth[3-6]. The experimental techniques used by various researchers have been varied. The size and the shape of the specimens, the varying preparation of the specimens, and the satisfactory bond strength limits used for the tests also varied among the studies[7]. Depending on the study, the load mode was tensile[8,9], compressive[6,10], shear[4,7,11,12], peel[13], and transverse three-point[5,14], or four-points bending[3].

Teeth for bond strength testing according to American National Standards/American Dental Association Specification number 15[15] are grounded to a plug shape and inserted into the center of a cylindrical shaft of unpolymerized resin and then processed. The polymerized specimen is tested in tensile load mode. The specification for synthetic resin teeth in the International Organization for Standardization[16], describes a technique to establish tooth bond strength. A group of ground anterior teeth is processed against acrylic resin held in a metal form. The bond strength is determined by submitting the teeth to peeling load. However, the International Organization for Standardization, in the specification for polymer-based crown and bridge materials[17] describes another method for determining tooth bond strength. Based on that specification, this article describes the technique to fabricate the specimens for shear bond testing between denture base resin and acrylic resin teeth.

Technique

1 Ground flat the ridge lap surface of the acrylic resin tooth with 320, 400 and 600-grit wet/dry sandpaper (Norton; Saint-Gobain Abrasivos Ltd, Vinhedo, SP, Brazil) in a polishing machine (Arotec Ind. e Com. Ltd, Cotia, SP, Brazil) at 300 rpm.

2 Use a special machine to embed the tooth (Arotec Ind. e Com. Ltd, Cotia, SP, Brazil) (Figure 1):

Figure 1. Embedded machine: a) upper cover; b) lock screw; c) handspike; d) metal piston cylinder; e) cylinder cover; f) heating bottom; g) pressure pointer; h) cooling bottom.

2.1 Open the upper cover, close the lock screw, and pump the handspike to rise the metal piston cylinder.

2.2 Fix onto the center of the piston cilynder the flat surface tooth with instantaneous adhesive (Super Bonder, Loctite Henkel Ltd, Diadema, SP, Brazil) (Figure 2a and b).

2.3 Lower the metal piston cylinder and pour in 7.0 gram of the polymer of autopolymerizing acrylic resin (PMMA) (Jet, Artigos Odontológicos Clássico Ltd, São Paulo, SP, Brazil) (Figure 2c).

2.4 Push the cylinder cover (Figure 2d), and screw the embedding machine cover (Figure 2e). Start heating the machine and induce pressure to 150 kgf.cm^{-2}. Keep for 7 minutes. Start cooling the bottom and keep for more 7 minutes.

2.5 Turn off the machine, and take off the pressure by opening the lock screw. Open the cover, close the lock screw and pump the handspike to rise the piston. Remove cylinder cover and the embedded tooth. (Figure 2f). The embedded tooth is ready (Figure 3).

3 Ground the projecting ridge-lap surface of the embedded denture tooth using of 400, 600, and 1200-grit wet/dry sandpaper (Norton; Saint-Gobain Abrasivos Ltd) in a polishing machine (Arotec Ind. e Com. Ltd) at 300 rpm (Figure 4).

4 Shape a cylindric hard silicone mold (Zetalabor, Zhermack S.p.A. Rovigo, Italy) with the same

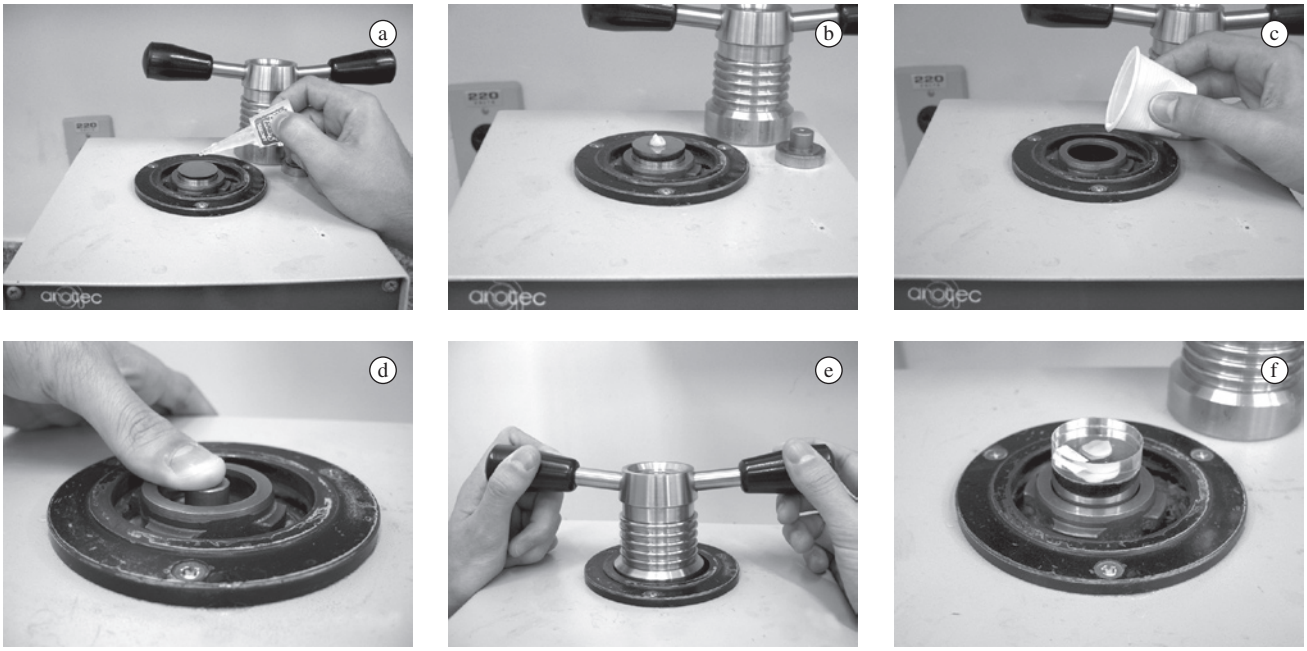

Figure 2. Embedding denture tooth procedure.

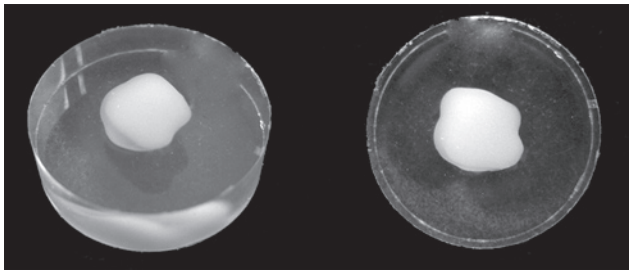

Figure 3. Embedded tooth.

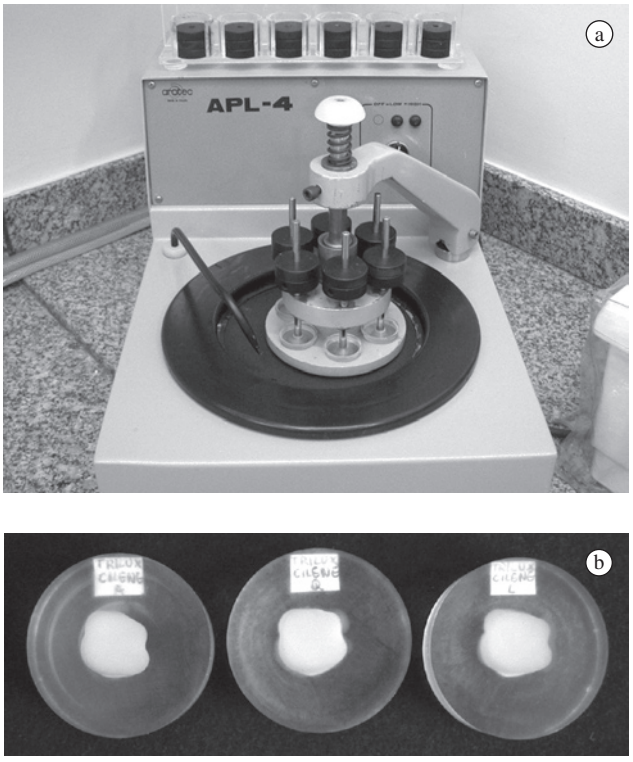

Figure 4. Polishing of the embedded tooth: a) Embedded teeth in the polishing machine; b) Embedded tooth polished.

diameter of the embedded PMMA opening in its center (Figure 5a and b). Fix the mold on the top of the embedded tooth using instantaneous adhesive (Super Bonder, Loctite Henkel Ltd) (Figure 5c). The wider end of the opening, which would come into contact with the tooth, was 5.0 ± 0.1 mm, and the narrow end was 4.9 ± 0.1 mm in diameter and 2.50 ± 0.05 mm in height [7,17] (Figure 5d).

5 Process denture base resin into the opening of the silicone mold. The specimen is ready to shear bond test (Figure 6).

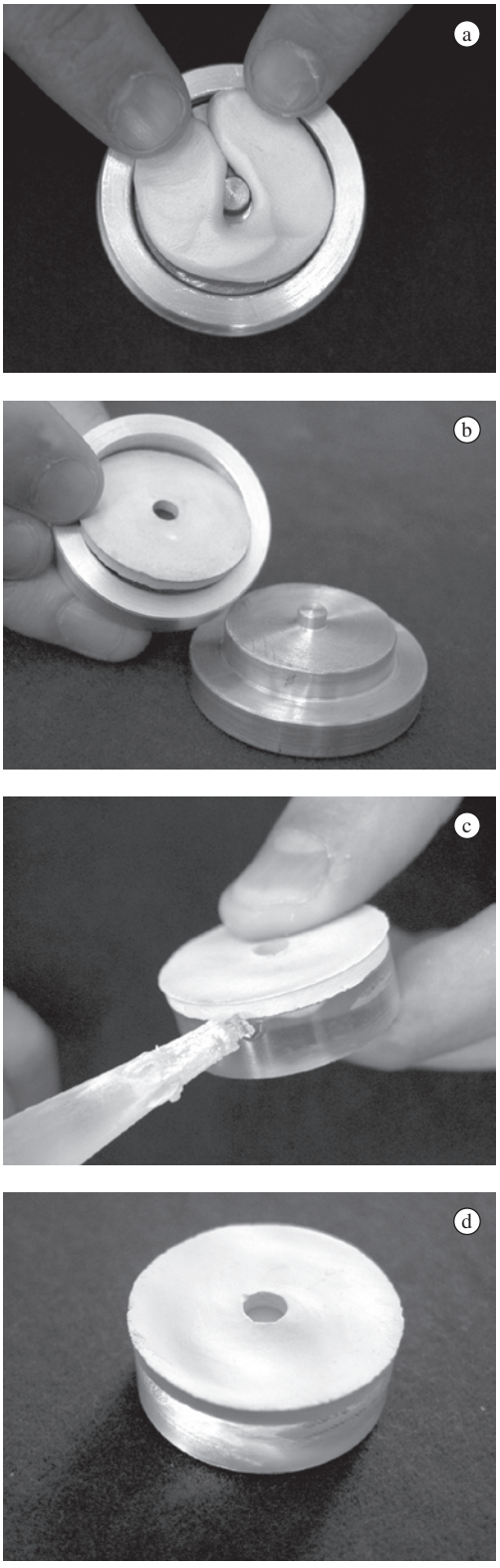

Figure 5. a and b) Fabrication of the silicone mold; c) Fixing the mold on the embedded tooth; d) Set of silicone mold and embedded tooth.

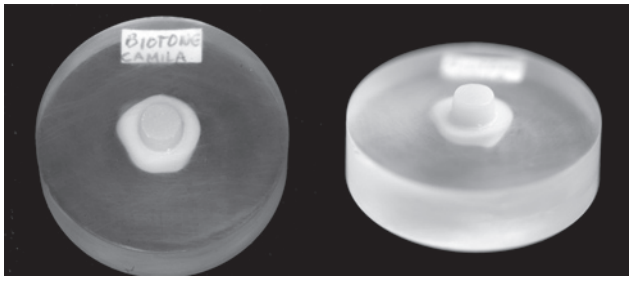

Figure 6. Specimen to shear bond test.

Conclusion

This article describes a simple, practical and effective technique for fabricating specimens to shear bond test between denture base resin and acrylic resin teeth. The embedding technique can also allow testing the bond between different materials, like implants, alloys, teeth, and dental resins.

References

1. Cunningham JL. Bond strength of denture teeth to acrylic base. J Dent. 1993;21:274-80.
2. Darbar UR, Hugett R, Harrison A. Denture fracture – a survey. Br Dent J. 1994;176:342-5.
3. Kawara M, Carter JM, Ogle RE, Johnson RR. Bonding of plastic teeth to denture base resins. J Prosthet Dent. 1991;66:566-71.
4. Geerts G, Jooste CH. A comparison of the bond strengths of microwave- and water bath-cured denture material. J Prosthet Dent. 1993;70:406-9.
5. Vallittu PK. Bonding of resin teeth to the polymethyl methacrylate denture base material. Acta Odontol Scand. 1995;53:99-104.
6. Takahashi Y, Chai J, Takahashi T, Habu T. Bond strength of denture teeth to denture base resins. Int J Prosthodont. 2000;13:59-65.
7. Büyükyilmaz S, Ruyter IE. Curing temperature effects acrylic denture base-tooth bond. Int J Prosthodont. 1997;10:49-54.
8. Cunningham JL, Benington IC. Bond strength variation of synthetic resin teeth in dentures. Int J Prosthodont. 1995;8:69-72.
9. Schneider RL, Curtis ER, Clancy JMS. Tensile bond strength of acrylic resin denture teeth to a microwave- or heat-processed denture base. J Prosthet Dent. 2002;88:145-50.
10. Spratley MH. An investigation of the adhesion of acrylic resin to dentures. J Prosthet Dent. 1987;58:389-92.
11. Cunningham JL. Shear bond strength of resin teeth to heat-cured and light-cured denture base resin. J Oral Rehabil. 2000;27:312-6.
12. Lagouvardos PE, Polyzois GL. Shear bond strength between composite resin and denture teeth: effect of tooth type and surface treatments. Int J Prosthodont. 2003;16:499-504.
13. Polyzois GL, Dahal JE. Bonding of synthetic resin teeth to microwave or heat activated denture base resin. Eur J Prosthodont Restor Dent. 1993;2:41-4.
14. Orchard NA, Howlett JA, Davies EH, Pearson GJ. Adhesive composite resins for artificial teeth: a laboratory investigation of bond strength to a cobalt-chromium alloy. Biomaterials, 1997; 18: 935-8.
15. American National Standards Institute. Revised American National Standards/American Dental Association Specification no. 15 for synthetic resin teeth. New York:ANSI; 2000.
16. International Organization for Standardization. Dentistry – synthetic polymer teeth. ISO 3336. Geneva: ISSO; 1993.
17. International Organization for Standardization. Dentistry: polymer-based crown and bridge materials. ISO 10477: 1992 DAM 1 Draft Amendment. ISO/IC 106/SC 2. Geneva: ISSO; 1995.