

Case Report

Eleven-year clinical performance of a mandibular natural tooth pontic bonded with modified tri-*n*-butylborane initiated adhesive resin

Mitsuo Nakamura^{1,2)}, Hiroshi Nogawa²⁾, and Hideo Matsumura^{2,3)}

¹⁾Private Practice, Ichikawa, Japan

²⁾Department of Fixed Prosthodontics, Nihon University School of Dentistry, Tokyo, Japan

³⁾Division of Advanced Dental Treatment, Dental Research Center, Nihon University School of Dentistry, Tokyo, Japan

(Received June 15, 2015; Accepted July 29, 2015)

Abstract: This clinical report describes the bonding procedure and clinical course of a natural tooth pontic in a 65-year-old male patient. A mandibular lateral incisor was extracted due to severe marginal periodontitis. The root of the tooth was amputated and a pontic structure was formed by filling acrylic resin into the coronal pulp chamber space. The enamel surface of the pontic and the adjacent abutment teeth were etched with phosphoric acid gel. The pontic was bonded with a modified tri-*n*-butylborane initiated adhesive resin (Super-Bond Quick). The connectors fractured 11 years after bonding when the patient accidentally bit a metallic chopstick. Recurrence of the fracture, however, did not occur, and the re-seated pontic has been functioning for more than 1 year. Although proper maintenance of both the periodontal tissue and splinted dentition is required, this minimally invasive technique can be applied in selected patients suffering from periodontal diseases. (J Oral Sci 57, 385-388, 2015)

Keywords: adhesive; bonding; natural tooth; pontic; tri-*n*-butylborane.

Introduction

Patients usually find it difficult to accept the sudden loss of anterior teeth due to trauma or periodontal disease. Ibsen (1) reported the bonding of a natural tooth pontic to adjacent teeth with composite resin. The technique employed phosphoric acid for etching the enamel surface, a bonding agent, and a composite resin as an adhesive system. The direct bonded connector made of a composite resin, however, is susceptible to fracture due to the brittle characteristics of highly filled composite materials.

Rochette (2) used an acrylic resin adhesive for mechanically retaining a perforated splint. A tri-*n*-butylborane (TBB) initiated adhesive resin (Super-Bond, Sun Medical Co., Ltd., Moriyama, Japan) was thereafter introduced for bonding the pontic to adjacent teeth with (3,4) or without (5,6) application of additional reinforcing structure.

One of the problems associated with the TBB resin is the longer setting time compared with other adhesive resins. Monya et al. (5) used a silicone index for stabilizing the resin pontic during setting of the TBB resin adhesive. A resin splint has also been used to stabilize a pontic and align the incisal edges of dentition within an ideal position (7). A modified TBB resin with shortened setting time was developed in 2003, and the material is extensively used for fixing both anterior and posterior teeth. According to a report comparing the original and modified TBB resins, there was no apparent difference

Correspondence to Dr. Mitsuo Nakamura, Department of Fixed Prosthodontics, Nihon University School of Dentistry, 1-8-13 Kanda-Surugadai, Chiyoda-ku, Tokyo 101-8310, Japan
Fax: +81-3-3219-8145 E-mail: ndent@sea.plala.or.jp

doi.org/10.2334/josnusd.57.385

DN/JST.JSTAGE/josnusd/57.385



Fig. 1 Mandibular incisors and canines fixed with TBB resin.



Fig. 2 Fracture of connectors 3 years and 10 months after fixation.



Fig. 3 Extraction socket of the mandibular right lateral incisor.



Fig. 4 Natural tooth pontic formed immediately after extraction.



Fig. 5 Minimally reduced central incisor and canine.



Fig. 6 Enamel surfaces etched with 65% phosphoric acid gel.

in bonding characteristics between the two materials (8).

Other problems associated with the TBB resin and other acrylic resins are insufficient resistance to wear, discoloration, and interfacial staining (4). These problems have been overcome by application of tooth-colored material (6) as well as phosphoric acid etchant with an adequate concentration (4,9). This clinical report describes the long-term clinical performance of a natural tooth pontic bonded to adjacent teeth with modified TBB resin.

Case Report

A 65-year-old male patient presented with a chief complaint of masticatory disturbance due to mobility of his mandibular right lateral incisor. The patient reported that splinted resin connectors in his anterior tooth region had fractured two days before visiting the dental clinic.

The canine and four incisors had been fixed with Super-Bond resin (Fig. 1) and had functioned for 3 years and 10 months (Fig. 2). Inspection revealed that the resin adhesive had fractured (Fig. 2). The results of periodontal tissue examination for the lateral incisor were as follows: pocket depth, 7 mm; mobility, 3+; bleeding on probing, more than 20%; and plaque control record, more than 20%. Further radiographic examinations confirmed that extraction of the lateral incisor was indicated in this

case. Among the treatment options, the patient preferred transitional prosthodontic treatment with minimal tooth reduction. Direct bonding of a natural tooth pontic immediately after tooth extraction was proposed and consent was obtained from the patient.

The lateral incisor to be used as the natural tooth pontic was extracted under local anesthesia (Fig. 3) and the root was amputated with a high-speed diamond rotary cutting instrument under water coolant. The pulp was removed and the pulp chamber including the cut surface was filled and coated with a modified TBB resin (Super-Bond Quick, Teeth Color, Sun Medical Co., Ltd.) (Fig. 4). The monomer liquid of the Super-Bond Quick material contains 4-methacryloyloxyethyl trimellitate anhydride (4-META), glycerol dimethacrylate (GDMA), and methyl methacrylate (MMA). The fractured resin remnant was removed from the canine and central incisor, and the natural tooth pontic was prepared using a diamond rotary cutting instrument (Fig. 5).

When hemostasis was achieved, the enamel surfaces were etched with 65% phosphoric acid gel (Enamel Etchant Gel, Sun Medical Co., Ltd.) for 30 s, washed with water, and air-dried (Fig. 6). The etched pontic was bonded to the etched abutment teeth with TBB resin (Super-Bond Quick, Teeth Color) using a brush-dip technique (Fig. 7). The occlusion was adjusted after the



Fig. 7 Application of TBB resin (Super-Bond Quick) with a brush-dip technique.



Fig. 8 Seated natural tooth pontic.



Fig. 9 Facial view of the pontic 10 years after bonding.



Fig. 10 Detachment of the pontic 11 years after bonding.



Fig. 11 Detached pontic and fractured connectors.



Fig. 12 Re-seating the pontic with TBB resin.

adhesive had set, and the bonded area was polished (Fig. 8).

The patient entered into continuous maintenance program, and the bonded pontic survived for more than 10 years (Fig. 9). After a period of 11 years, the pontic detached when the patient unintentionally bit a metallic chopstick. The cohesively fractured resin connector was attached to both the pontic and the abutment teeth (Figs. 10,11). There was no fracture in the enamel structure of the abutments and the pontic. The detached pontic and adjacent teeth were ground, etched with phosphoric acid, treated with the Teeth Primer (Sun-Medical, Co., Ltd.), and bonded again with the Super-Bond Quick adhesive (Fig. 12). The re-seated pontic has been functioning for over 1 year and 7 months.

Discussion

Transparent or tooth-colored TBB resins are frequently applied in patients suffering from chronic marginal periodontitis to fix both anterior and posterior dentitions. Resistance to detachment has considerably improved with the use of appropriate enamel etching agents and bonding systems. One of the problems associated with the resin fixation technique is the probability of detachment of the adhesive as a result of masticatory peeling and flexural stresses. Although tooth reduction is required, applica-

tion of a reinforcing structure was proposed for bonding a pontic, and one of the cases survived for 20 years (4). Extracoronary reinforcing structures with minimal tooth reduction are of course options for splinting (2,3).

The present case did not receive any reinforcing structure for bonding the natural tooth pontic because fixation of the lateral incisor using TBB resin survived for more than three years without an additional splint. The bonded pontic and the connectors survived for 11 years. During these 11 years, regular check-ups for occlusion as well as plaque control had been continued. As shown in Fig. 8, connectors made of the resin adhesive expanded in thickness both bucco-lingually and mesio-distally. This type of connector can be fabricated intraorally using a transparent, translucent, and tooth-colored resin adhesive, although care should be taken to prepare sufficient space for cervical embrasures.

A modified TBB resin (Super-Bond Quick) was utilized in the present case. The material contains GDMA in the liquid component. Setting time of the material was somewhat shortened by the addition of the GDMA monomer, and this modification is especially useful for fixing multiple teeth within a single visit. According to a report (10) concerning bending strength of luting agents, the TBB resin specimens bent and did not fracture on application of flexural stress. This is probably due to the

addition of a large amount of TBB. It is easy to understand that the added TBB acts as a plasticizer, and that resistance to fracture increases with the addition of TBB. This resistance to fracture is indeed one of the advantages of the TBB resin over composite resins. However, another problem to be solved with the use of the TBB resin system is staining along the resin-enamel superficial interface (4). Staining can be largely eliminated using rounded steel burs or diamond and silicone rotary instruments with polishing paste.

Although care must be taken for the maintenance of both periodontal tissues and bonded area, this minimally invasive technique is applicable for selected patients, especially in the mandibular anterior dentition.

Acknowledgments

This report was supported in part by a Grant-in-Aid for Scientific Research C 24592934 (2012-2014) from the Japan Society for the Promotion of Science (JSPS).

Conflict of Interest

None of the authors had any conflict of interest regarding this case report.

References

- Ibsen RL (1973) One-appointment technic using an adhesive composite. *Dent Surv* 49(2), 30-32.
- Rochette AL (1973) Attachment of a splint to enamel of lower anterior teeth. *J Prosthet Dent* 30, 418-423.
- Minami H, Minesaki Y, Suzuki S, Tanaka T (2012) Twelve-year results of a direct-bonded partial prosthesis in a patient with advanced periodontitis: a clinical report. *J Prosthet Dent* 108, 69-73.
- Tanoue N, Tanaka T (2015) A direct bonded fixed partial dental prosthesis: a clinical report. *J Prosthet Dent* 113, 8-11.
- Monya Y, Matsumura H, Atsuta M (1998) A two-stage resin-bonded fixed partial denture seated in conjunction with postextraction healing of the alveolar socket: a clinical report. *J Prosthet Dent* 80, 4-8.
- Nakamura M, Koizumi H, Matsumura H (2012) Application to mandibular incisor fixation of an adhesive 4-META resin with sodium fluoride: a case report. *Asian Pac J Dent* 12, 17-19.
- Dimaczek B, Kern M (2008) Long-term provisional rehabilitation of function and esthetics using an extracted tooth with the immediate bonding technique. *Quintessence Int* 39, 283-288.
- Koishi Y, Tanoue N, Yanagida H, Atsuta M, Nakamura M, Matsumura H (2006) Evaluation of 2 thione primers and 3 resin adhesives for silver-palladium-copper-gold alloy bonding. *Quintessence Int* 37, 395-399.
- Nogawa H, Koizumi H, Saiki O, Hiraba H, Nakamura M, Matsumura H (2015) Effect of a self-etching primer and phosphoric acid etching on the bond strength of 4-META/MMA-TBB resin to human enamel. *Dent Mater J* 34, 219-226.
- Pace LL, Hummel SK, Marker VA, Bolouri A (2007) Comparison of the flexural strength of five adhesive resin cements. *J Prosthodont* 16, 18-24.