Three Patient Reports Illustrating the Use of Dentin Adhesives to Cement Crowns to Severely Worn Teeth

David W. Bartlett, BDS, PhD, MRD, FDS RCS[a]

Purpose: Severely worn and broken down teeth present clinical treatment planning dilemmas. Extreme examples of worn teeth present in patients suffering from bulimia nervosa and dentinogenesis imperfecta. Bulimia nervosa typically presents early in adult life with a myriad of clinical features and a most important dental sign of eroded palatal surfaces on the maxillary teeth. Dentinogenesis imperfecta is a relatively uncommon disorder that presents with varying severity of unsupported enamel and results in teeth more susceptible to wear. ***Materials and Methods:*** Dental treatment for both conditions when wear has resulted in the complete loss of the tooth can either be directed toward restoring remaining tooth tissue or extraction and replacement with implants or dentures. This article presents the clinical management of three case histories, each with one or more severely broken down teeth, which were restored with adhesively retained crowns. ***Results:*** Treatment lasted nearly 10 years in one patient and failed after 6 years in another. The third patient was treated more recently. ***Conclusion:*** All three case histories serve as examples of using adhesive cements to retain indirect restorations as a possible prosthodontic management strategy. *Int J Prosthodont 2005;18:214–218.*

Management of extensively broken down teeth presents many clinical problems, particularly retention of restorations. Traditional treatment options have included elective root treatment to provide support for a core followed by major coronal restorations. The concept of a restorative cycle for single/multiple dental restorations has highlighted the need to prescribe teeth treatment in the context of the fact that most restorations do not last a lifetime. Consequently, a certain degree of planning for failure should be considered every time a tooth is restored.[1]

Dentinogenesis imperfecta is a hereditary disorder with dental implications. The most common dental sequelae are multiple pulpless teeth, teeth with an opalescent bluish dentin, and teeth susceptible to wear. The dentin has wide, irregular tubules with areas of atubular dentin, but there is little guidance as to whether this will affect the bond strength of modern dentin adhesives. The difficulty in restoring teeth without identifiable pulps or root canals is that once the main body of the tooth is worn away, little else is left to retain a restoration, and placing posts is a hazardous process because there is no opportunity to place a root filling.

One relatively common problem is tooth wear caused by the eating disorder bulimia nervosa. The condition affects a similar group of subjects to anorexia nervosa, namely white, middle-class females with a college education. Bulimics have low self-esteem but present as a slightly older age group than anorexics (20 to 30 years old).[2–4] Unlike anorexic patients, a typical bulimic patient is usually a more outgoing, heterosexual individual and is more amenable to therapy.[3] Estimates of the prevalence of bulimia vary in a similar manner to anorexia; it may also be on the increase, but there are no definitive studies to substantiate this.[4] The dental manifestations are well-known. Typically, the palatal surfaces of the maxillary incisors are eroded by expul-

[a]*Division of Conservative Dentistry, Guy's, King's and St Thomas' Dental Institute, King's College, London, England.*

Correspondence to: *Dr David Bartlett, Floor 25, Division of Conservative Dentistry, Guy's, King's and St Thomas' Dental Institute, Guy's Tower, London Bridge SE1 9RT, United Kingdom. Fax: + 0207 955 4935. e-mail: david.bartlett@kcl.ac.uk*

Fig 1a *(left)* Maxillary first molar is severely worn and characterized by failure of a pin-retained amalgam core. The predisposing factor was dentinogenesis imperfecta.

Fig 1b *(below)* Nine years later. The metal onlays remain, apart from the maxillary right first premolar, but the conventional crowns on the maxillary anterior teeth are failing.

sion of gastric contents during vomiting.[5,6] When more generalized damage occurs, the erosion causes flattening of the palatal surfaces of maxillary molars; in extreme circumstances, complete obliteration of the palatal cusps can occur.

The use of adhesive luting cements to restore worn or broken down teeth has been reported.[7–9] One early case report suggests using indirect metal onlays to restore worn teeth in patients with dentinogenesis imperfecta.[10] The advantage of using cast-metal onlays luted to the tooth is that there is no need to search for a root canal in situations in which it is unlikely to be found; this is particularly relevant to dentinogenesis imperfecta. Since the early 1990s, adhesive luting cements have evolved to produce clinically acceptable results, especially when bonding to dentin. The variety of studies reporting the success of this type of restoration has made them a potential choice in the restoration of broken down teeth. Chana et al[9] report the results of 158 cast-metal veneers bonded to dentin on the palatal surfaces of maxillary incisors, with nearly a 90% success rate over 5 years. Burke et al[8] propose using dentin-bonded crowns routinely for restoring teeth. Others have suggested adapting crown design to take into account the properties of adhesive cements.[11,12] There is, then, some support for using dentin adhesives to link the dentin to metals in the restoration of severely broken down teeth.

This article reports on three patients with severe tooth wear to highlight the challenge and possibility of prosthodontic management with dentin adhesives used as the major retentive feature to support coronal restorations.

Case Histories

Case 1

A 20-year-old man with dentinogenesis imperfecta presented in 1994 with a previously failed restored permanent first molar. Initial attempts using conventional amalgam restoration aided by friction-gripped pins had failed (Fig 1a). Overeruption of the opposing teeth had subsequently complicated the restoration of the now severely morphologically compromised tooth. A diagnostic wax-up on a semiadjustable articulator was used to make metal onlays for both premolars and the first permanent molar. The onlays were made in a high-palladium alloy (Pd 79%, Cu 9.5%, Ga 9%, Au 2%, Ge 0.5%; Simadur 32, Wieland) and cemented onto the teeth using Panavia 21 (Kuraray), using cotton wool rolls for isolation (Fig 1b). The restorations were cemented at an increased vertical dimension of occlusion so that the short clinical crowns on the anterior teeth could also be restored with conventional metal-ceramic crowns. Within 6 months, the onlay on the maxillary right first premolar had decemented twice, and the restoration was replaced with direct resin composite using Herculite XRV (Kerr). Apart from routine reviews at yearly intervals, no further treatment was required.

Nine years later, the metal onlays and single direct resin composite restoration remained in place, the teeth remained fully functional, and there was no evidence of caries. Unfortunately, the conventionally retained crowns on the maxillary incisors failed and are

Fig 2a Single missing crown on the first molar. The situation is the same on the contralateral side.

Fig 2b Metal onlay used to restore the tooth. It lasted nearly 6 years and eventually failed due to recurrent caries.

in the process of being replaced with implant-supported crowns. In 2004, the onlays on both molars debonded; caries was detected in the maxillary left first molar but not the contralateral side. The restorations will be replaced using the same technique.

Case 2

In 1998, a 30-year-old patient, also with dentinogenesis imperfecta, presented with a similar problem associated with the mandibular first molars in an otherwise intact dentition. No overeruption of the opposing teeth had occurred, and the vertical dimension of occlusion remained unchanged (Fig 2a). An impression of the worn tooth was taken in Impregum (3M/EPSE), the model was cast in die stone, and a coronal wax pattern was formed and cast in the same metal (Simadur 32). The restorations were luted to the teeth with Panavia 21 (Fig 2b), and the patient was reviewed at yearly intervals. The restorations did not debond; however, 6 years later, both teeth developed caries and were extracted. The teeth have since been replaced with minimal-preparation fixed partial dentures (FPD). This logically poses the question regarding an FPD treatment decision in the first place.

Case 3

Unlike the previous two case histories, the 25-year-old patient suffered from ongoing bulimia nervosa. The destruction of the clinical crowns was similar in severity to the previous examples, but the cause of the tooth wear was erosion from vomited gastric acid (Fig 3a). The management of this patient differed in that the problem was far more extensive than the previous examples, but the treatment planning protocol was similar, and the teeth were restored with bonded metal-ceramic crowns. An alternative treatment plan could have been an overdenture, but the patient declined this choice of treatment. A diagnostic wax-up was used to produce crowns with occlusal rest seats so that a Stellite alloy (Deloro Stellite) removable partial denture (RPD) could be used to restore the missing teeth. The crowns were cemented with Panavia 21 and were in place 3 years later (Fig 3b). The maxillary left lateral incisor and canine required root treatments 2 years after cementation; direct posts (Parapost, Coltène/Whaledent) were used to support a resin composite core, and the original crowns were retrofitted and recemented back into place. The RPD is still used routinely by the patient.

Discussion

Although each of the described case histories differs somewhat, the underlying problem is a common one in that the teeth in question offered little support for conventional restorations. The first two case histories highlight the problem of absent root canals with dentinogenesis imperfecta. This makes a post-retained crown difficult to justify because of perforation risk. In the third patient, it was theoretically possible to prescribe endodontic treatment and an overdenture, but the merits of the adhesive crown approach seemed compelling. All three case histories highlight the feasibility of using dentin adhesives to support severely broken down teeth.

The case histories were specifically selected to highlight the planning difficulty confronting the clinician

Fig 3a Preoperative status of case 3.

Fig 3b Postoperative status, 2 years after restoration placement.

when severely broken down teeth are present. While elective root treatment can be considered, the acceptability of bonding directly to the tooth without the need for a core buildup presents an attractive option. The use of dental pins to retain restorations is generally considered unnecessary when using resin composite restorations[13] and increasingly uncommon for amalgam alloy restorations. In the two dentinogenesis imperfecta patients, there was no potential for using a post and core because the root canal could not be seen on the radiograph, thereby increasing the risk for perforation if a post hole was attempted. In the third example, posts were possible and in fact became necessary for two teeth, but the end result may have been a greater risk of individual tooth morbidity. Although both molars were eventually lost after 9 years, it could be argued that the longevity of the restorations was reasonable and probably cost-effective.

The use of dentin adhesives has become more widespread since they became dependable in the mid-1990s. Furthermore, the reliability and strength of the bond of dentin to metal has become more closely matched to that of enamel to metal. Consequently, this type of restoration could be considered for situations in which conventional treatment might compromise teeth longevity. There are clear risks involved, particularly with decementation of these resin-retained crowns; however, the potential to delay the need to treat endodontically must be regarded as advantageous.

Arguably, all teeth involved had poor prognosis and could have been replaced earlier with implants. While this may remain a possibility, not all patients want to consider the expense of implant-supported crowns when they can have their own, albeit severely compromised, teeth restored, at least in the short term. The available evidence to justify employing this technique

Table 1 Papers Used to Support the Principle of Using Dentin Adhesives to Retain Different Types of Restorations

Study	Year	Study type	Brief description	No. of restorations/samples	Maximum length of study
Harley and Ibbetson[10]	1993	Case report	Cementing onlays onto flat tooth surfaces	64	4 y
Nohl et al[14]	1997	Clinical	Gold palatal veneers used for anterior tooth wear	210	4 y
Gough and Setchell[15]	1999	Clinical	Assessment of success of Dahl appliances	50	NA
Hemmings et al[7]	2000	Clinical	Composites bonded to worn anterior teeth	52	30 mo
Burke and Qualtrough[16]	2000	Clinical	Assessment of dentin-bonded crowns	60	4 y
Burke et al[17]	2001	Clinical	Case report	4	1 y
Lang et al[18]	2003	Laboratory based	Fracture resistance of premolars restored with dentin-bonded crowns	40	NA

on a routine basis is quite limited, and only a few studies support its concept. The main validation and the original article stimulating the advocacy of the technique was the Harley and Ibbetson[10] case reports publication in 1993. Regrettably, controlled studies are unavailable; they would help support the technique with more substantial evidence, but the infrequent nature of this severity of tooth wear makes a traditional research approach somewhat problematic. The list of papers in Table 1 is a guide for information on the use of dentin adhesives to retain crowns. It does not refer to the technique used in this specific article given the different types of restorations reported on.

A relevant question is the time and cost of long-term maintenance for this type of restoration, particularly when compared to alternative modalities. All three presented examples relied on the dentin bonding agents exclusively to retain the restorations, and the patients did not require any more than routine appointments to check their restorative status. Therefore, the maintenance issue might be considered to be comparable to other restorations, including overdentures and implants.

Three case histories are described to illustrate a technique for restoring almost flat tooth surfaces using cast crowns and dentin adhesives. Although this type of restoration is currently of limited application, it is certainly a treatment option for those few patients presenting with extensive tooth wear caused by eating disorders and dentinogenesis imperfecta.

References

1. Elderton RJ. The prevalence of failure of restorations: A literature review. J Dent 1976;4:207–210.
2. Knewitz JL, Drisko CL. Anorexia nervosa and bulimia: A review. Compendium 1992;11:244–247.
3. Herzog DB, Copeland PM. Eating disorders. N Engl J Med 1985;313:295–303.
4. Spigset O. Oral symptoms in bulimia nervosa. Acta Odontol Scand 1991;49:335–339.
5. Hellström I. Oral complications in anorexia nervosa. Scand J Dent Res 1977;85:71–86.
6. Jones RH, Cleaton-Jones P. Depth and area of dental erosions, and dental caries, in bulimic women. J Dent Res 1989;68:1275–1278.
7. Hemmings KW, Darbar UR, Vaughan S. Tooth wear treated with direct composite restorations at an increased vertical dimension: Results at 30 months. J Prosthet Dent 2000;83:287–293.
8. Burke FJ, Qualtrough AJ, Hale RW. Dentin-bonded all-ceramic crowns: Current status. J Am Dent Assoc 1998;129:455–460.
9. Chana H, Kelleher M, Briggs P, Hooper R. Clinical evaluation of resin bonded gold alloy veneers. J Prosthet Dent 2000;83:294–300.
10. Harley KE, Ibbetson RJ. Dental anomalies—Are adhesive castings the solution? Br Dent J. 1993;174:15–22.
11. Bartlett DW, Ricketts DNJ, Fisher NL. Management of the Short clinical crown by indirect restorations. Dent Update 1997;24:431–436.
12. Bartlett DW. Adapting crown preparations to adhesive materials. Dent Update 2000;27:460–463.
13. Muhlbauer JA, Dunn WJ, Roberts HW, Murchison DF. The effect of resin composite pins on the retention of Class IV restorations. Oper Dent 2002;27:284–288.
14. Nohl FS, King PA, Harley KE, Ibbetson RJ. Retrospective survey of resin-retained cast-metal palatal veneers for the treatment of anterior palatal tooth wear. Quintessence Int 1997;28:7–14.
15. Gough MB, Setchell D. A retrospective study of 50 treatments using an appliance to produce localised occlusal space by relative axial tooth movement. Br Dent J 1999;187:134–139.
16. Burke FJ, Qualtrough AJ. Follow-up evaluation of a series of dentin-bonded ceramic restorations. J Esthet Dent 2000;12:16–22.
17. Burke FJ, Hussey DL, McCaughey AD. Evaluation of the 1-year clinical performance of dentin-bonded ceramic crowns and four case reports. Quintessence Int 2001;32:593–601.
18. Lang M, McHugh S, Burke FJ. In vitro fracture resistance of teeth with dentin-bonded ceramic crowns and core build-ups. Am J Dent 2003;16:88A–96A.