

Providing Support for the Pontic of Natural Tooth Adhesive Bridges: A Clinical Report.

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Abstract - Resin bonded bridges have become established as a treatment option for replacing missing teeth. Their development can be traced to the work of Rochette who used a macro mechanically bonded metal framework to stabilize mobile teeth. Adaptations of Rochette's concept, using natural teeth as pontics, have been presented. The use of a natural tooth has aesthetic and psychological advantages for the patient. The high failure rate of natural tooth pontics may be explained by a lack of support for the tooth on the metal framework. A clinical report is presented to illustrate a previously unreported technique to improve pontic support.

KEY WORDS: Resin bonded, adhesive bridge, adhesive fixed partial denture, natural tooth pontic

INTRODUCTION

Rochette¹ described the use of a cast metal splint to stabilize periodontally mobile teeth. The addition of a porcelain tooth to the framework gave rise to the first adhesively bonded fixed partial denture²; the "Rochette Bridge". The macro mechanical retention of these adhesive bridges was adequate but its longevity could not be guaranteed. Techniques for increasing the macro mechanical retention have been investigated, examples of which include the lost salt procedure³, or cast mesh⁴ on the fitting surface. Micro mechanical retention has been investigated using electrolytic^{5,6} or chemical etching⁷, alloy surface treatment by tin plating⁸, or silica coating⁹. The electrolytic etching of a non precious metal framework in this context became known as the "Maryland Bridge".

In parallel with novel forms of micro mechanical retention there was the development of chemically active luting cements^{10, 11, 12, 13, 14} that chemically bond to both tooth tissue and the metal alloys of the framework. These became known as "resin-bonded fixed partial dentures" or "resin-bonded bridges" (RBB). Clinical de-bonding of one wing of the fixed-fixed design of resin-bonded partial dentures design still remained a concern, and led to the concept of using a single wing as a direct cantilevered design¹⁵. Botelho¹⁶ in a review paper in 2000 showed that cantilevered resin-bonded bridges had quoted retention rates of between 72-97%, over a mean service life span ranging from 27 months-10 years. The resin bonded bridge offers a minimally invasive technique for the replacement of a single tooth.

Laboratory investigation into resin-bonded bridge failure^{21, 22, 23} has suggested that a peeling force is generated at the margin interface of metal wing and the adhesive cement.

The placement of grooves¹⁶ within enamel has been found to increase the resistance of wings to de-bonding. This reinforcement reduces its tendency to flex under occlusal loading, and thereby reduces the tensile peeling forces.

Subsequently, in conventional resin-bonded bridges the bond strength and longevity of the adhesion between the metal of the framework, and the abutment tooth has improved through research, improving the clinical outcome²⁴. This increase has now led the authors to reappraise the option of using a natural tooth as the pontic for a fixed partial denture. The aim is to apply these technical improvements that have proved effective for framework/abutment bonding, into the framework/pontic bonding.

The use of a natural tooth as a bridge pontic can be traced back to Sinclair²⁵. The literature describes two methods of attaching a pontic; in the first method a natural tooth is bonded to the abutment teeth using composite resin^{26, 27, 28, 29}, whereas the second method uses a bonded metal framework, to attach the pontic to the abutment teeth^{30, 31, 32}. The studies that use a metal framework use the same technique for bonding metal to the natural tooth pontic as they do for bonding the metal to the abutment teeth. However there are important differences between the two bonds; the occlusal forces act in opposite directions. Occlusal forces on the pontic push the pontic apically away from the metal framework; whereas the same occlusal forces, transferred to the retainer push the metal framework apically towards the abutment tooth (see figure 1). When a patient occludes, the natural tooth pontic is pushed away from the metal whereas the metal is pushed toward the abutment. In removable prosthodontic terms the natural tooth pontic lacks support.

This lack of pontic support was solved in this clinical report by the preparation of a ledge in the pontic which was engaged by the metal framework; support being gained from the metal framework. The preparation creates a ledge in the tooth surface, perpendicular to the direction of the occlusal force (figure 1), and is analogous to the cingulum rest preparation on the abutment tooth, but providing resistance in the opposite direction.

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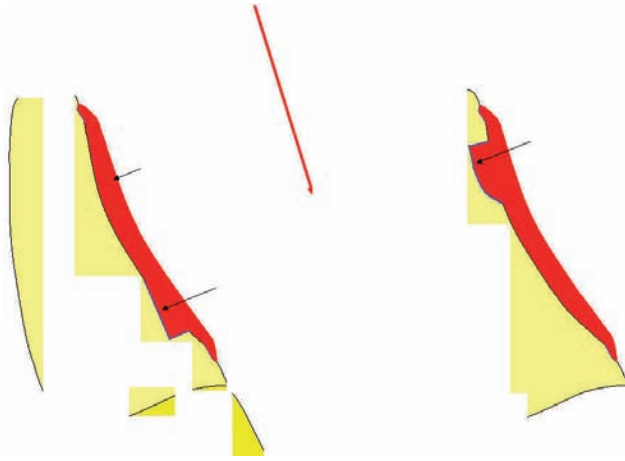


Figure 1. Demonstrates the contrasting tooth preparation of abutment and pontic to gain support.



Figure 2. Anterior teeth at presentation



Figure 3. Crowded mandibular anterior teeth at presentation

CLINICAL REPORT

A 74 year old female presented with pain from the mandibular anterior region described as a 'sore ache' in her chin, affecting both lingual and labial sulci. On questioning it was found that the patient had sustained trauma to the anterior teeth at the age of thirteen; although no teeth had been avulsed. Intra-orally the soft tissues around the mandibular incisors were red, painful and swollen on the labial side. The patient was partially dentate with a restored dentition. Four natural anterior teeth were present in the

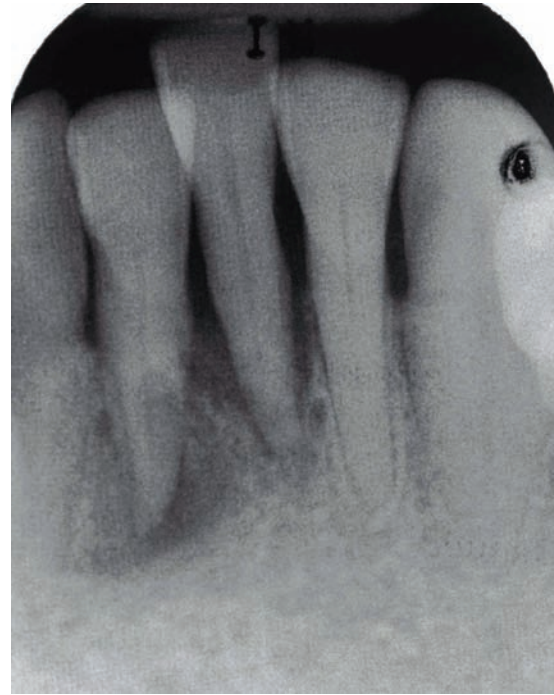


Figure 4. Radiograph of lower anteriors at presentation

maxilla with a removable prosthesis restoring aesthetics and function. There was mandibular incisor crowding, with periodontal pockets of six and seven millimetres around the mandibular central incisors. The mandibular left central incisor was grade II mobile. Thermal response testing with ethyl chloride showed that mandibular central incisors were unresponsive; however both mandibular lateral incisors were responsive. The appearance of the anterior teeth at presentation is seen in figure 2 & 3.

Periapical radiographs showed a periapical radiolucency and a mottled radiolucency within the root canal of the mandibular right central incisor. There was eighty percent bone loss on the mandibular left central incisor (figure 4). A diagnosis of internal root resorption of mandibular central incisors was made. Treatment options were considered; and a decision to replace the mandibular central incisors with immediate natural tooth bridges was reached with the patient. Consent was obtained and treatment commenced.

The crowding of the mandibular incisors may have interfered with the framework for the bridge; therefore a Kessling³³ diagnostic set up was created to assess the availability of space for re-aligning the mandibular incisors. The set up enabled interproximal stripping of all four incisors to provide the space to reduce the crowding. This facilitated both tooth preparation and bridge placement, and enhanced aesthetics by minimising crowding.

The treatment plan called for two separate, direct cantilever resin bonded bridges, each with a natural tooth pontic, and the adjacent lateral as the abutment. Each abutment was prepared, with a cingulum rest cut into enamel perpendicular to the long axis of the tooth. The pontics were then prepared with a horizontal slot, 3mm below the incisal edge and perpendicular to the long axis of the tooth (figure 1). The mandibular impression was taken in an acrylic special tray using light and medium bodied vinyl polysiloxane (Express; 3M ESPE, St Paul, Minn).

In the dental laboratory, both central incisors on the master casts were removed at gingival level and then realigned using the Kessling set up. Once completed the casts were mounted on a semi adjustable articulator and the position of the mandibular central incisors was adjusted to conform to the existing occlusion. The Kessling set up was duplicated and two separate metal frameworks each with incisal locating pins were constructed on the duplicate cast, and sandblasted. At the clinical visit, mandibular left and right central incisors were extracted under local analgesia, and the roots amputated allowing the crowns to be positioned over the residual ridge. The pulps were extirpated, the canals widened with Gates Glidden burs, irrigated with sodium hypochlorite and dried with paper points. The canal space was then obturated with glass ionomer cement (GC Fuji II LC Capsule, GC Corporation, Tokyo, Japan) and sealed radicularly with an etched and bonded composite resin (Ceram X duo, Dentsply, De Trey, Konstanz, Germany). Rubber dam was applied to gain good moisture control and each fixed partial denture was then placed separately. The right abutment was etched and primed (Panavia 21, Kuraray Medical Inc, Japan) and the metal framework bonded to the abutment with an adhesive, chemically-activated luting cement. (Panavia 21 Kuraray Medical Inc, Japan). An alloy primer (Panavia 21, Kuraray Medical Inc, Japan) was used on the metal surface under the pontic. The right pontic was then etched, primed and bonded onto the metal framework with the same luting cement (Panavia 21). The bonding procedure was repeated for the left bridge. The incisal locating pins were removed and the occlusion checked and adjusted as required.

Minor occlusal adjustments were needed at one the first review 1 week later. At 8 weeks the patient reported no problems with function or discomfort and was pleased with the result. These results are depicted in figures 5 and 6; (photographs at 8 weeks post extraction). 1year after the placement of the restorations a review appointment was arranged and the bridges continued to function satisfactorily.

DISCUSSION

The use of natural teeth as the pontic for a bridge has potential aesthetic and psychological advantages for the patient, although the high failure rate of natural tooth pontics has led to a poor reputation, and restricted their use in clinical practice. The failure is primarily a problem of prosthodontic support for the natural tooth pontic by the metal framework. The term 'support' as defined by Davenport³⁴ means 'resistance to a vertical force directed toward the mucosa'. It is a common misconception that the failure of natural tooth pontics (and of resin bonded bridges in general) is a problem of prosthodontic retention. The major force on the pontic is generated by the occlusal forces, and resistance to these heavy forces, is by providing adequate prosthodontic support. When a natural tooth pontic is used, additional consideration should be given to the design of support for the pontic on the framework. This clinical report demonstrates a method of providing support for the pontic, by the preparation of a ledge on the lingual aspect of the pontic, perpendicular to the direction of occlusal force. This ledge is then directly engaged by the adhesive metal framework. Further research is required to validate this technique as a long term option for the replacement of teeth.



Figure 5. Anterior teeth 8 weeks post treatment



Figure 6. Mandibular anterior teeth 8 weeks post treatment

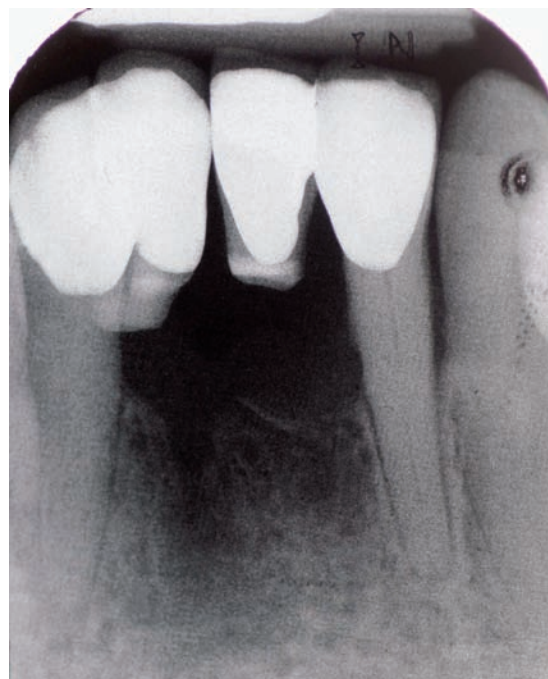


Figure 7. Mandibular anterior radiograph 14 weeks post treatment.

SUMMARY

A clinical report is presented which demonstrates enhanced support for an immediate replacement, natural pontic, resin bonded bridge by the incorporation of a horizontal groove in the lingual aspect of the pontic.

ACKNOWLEDGEMENTS

The authors would like to thank the photographic department of Leeds Dental Institute (LDI) for the production of the illustrations and Miss Sarah Beddall of LDI for the technical work. The treatment presented here was completed as part of the clinical portfolio of a pre-doctoral dental student at Leeds Dental Institute, UK.

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