Top tips for resin-retained bridge construction in primary care

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Introduction

In the rush to consider dental implants as replacements for missing teeth, resin-retained bridges (RRBs) are often overlooked, but in the correct circumstances they are often the treatment of choice. In this short paper, we will consider pre-operative considerations, site preparation, fit, cementation, and post-operative care and maintenance. These tried and tested top tips will hopefully facilitate successful outcomes for primary care practitioners utilising this effective treatment modality.

Pre-operative considerations

For any fixed prosthesis to be deemed successful, it should firstly be able to replicate the appearance of a natural tooth in relation to the gingival tissues and secondly it must obviously remain attached to its abutments. Addressing this second point, since RRBs rely exclusively on the adhesive bond between the retainer and the abutment rather than traditional concepts of retention/resistance form, the primary concern when planning an RRB is protection of this adhesive joint. Protection of the adhesive joint can be achieved by paying close attention to the following factors:

1. Bonding substrate

a. The abutment side of the joint should ideally be completely in enamel as the bond strength to etched enamel is superior to the bond to dentine. Where restorations are present in the part of the tooth to be covered by the retainer, it is advisable to replace these with new resin composite restorations, ideally placed under rubber dam

b. The retainer side of the joint should be to a material that can be roughened to provide micro-mechanical retention and one that forms a strong oxide layer (such as non-precious metal alloys) capable of forming a chemical bond to MDP, found in adhesive luting resin cements, notably Panavia.

2. Framework design

a. To prevent flexure that could cause fracture of the resin cement, the metal framework must be of sufficient thickness (ideally at least 1 mm) to be completely rigid. Connectors should be sufficiently thick to resist flexure in the direction that they will be loaded. In practical terms, this means bucco-palatally in the anterior region and occluso-gingivally in the posterior region

b. To increase the surface area for bonding, the retainer wing should cover all available enamel without unduly compromising the aesthetics through labial show of the metal framework. This should involve extending the retainer wing into proximal areas, to the CEJ palatally and up to (and, if the patient is willing, over) the incisal edge/cusp tip.

3. Loading

Compressive loading of the retainer-cement-abutment complex will not result in damage to the resin cement. Indeed, RRBs are routinely cemented in high, utilising the Dahl principle with no adverse effects. However, subjecting RRBs to excessive flexural loads will increase the risk of failure of the resin cement joint. To avoid this, eccentric occlusal contacts on pontics should be identified and removed, whilst maintaining occlusal stops that prevent passive eruption of opposing teeth, which could lead to later unplanned eccentric contacts. Designing occlusal guidance on the wings, however, is perfectly acceptable, so long as the incline is not too steep, which can be said to equally apply to conventional crown and bridgework design.

4. Abutment stability

When a fixed-fixed design is selected over a cantilever design, any differential movement will increase the strain on the resin cement joint, increasing the risk of luting failure. This risk will increase with the increasing mobility of the abutments. Wherever possible, cantilever designs should be chosen, and this is evidenced by improved survival in studies on RRBs. Paradoxically, when teeth are very mobile, fixed-fixed designs are often selected to provide periodontal splinting, but one needs to be especially vigilant of debonds in such cases.

Revisiting the aesthetic considerations of successful RRBs, they should in theory be as able to replicate the natural appearance of teeth as any other porcelain fused to metal (PFM) restoration, perhaps even more so, since there is no limit to the space available for the porcelain, unlike PFM crowns. Where RRBs do tend to fall short compared to implants is at the gum interface. Whereas implant supported crowns emerge through the gum, mimicking a natural tooth, RRB pontics often appear to float above the gum, casting a tell-tale shadow. This problem can be overcome in several ways ranging from immediate placement at extraction, sculpting of the soft tissues using ovate pontics on removable appliances, or by surgical methods, such as electrothermy (Fig. 1).

Optimising preparation of the site prior to impressions

The shade should be selected at the start of the impression appointment to avoid lightening of teeth due to dehydration. Since thin anterior teeth can result in a blue/grey appearance due to metal shining through translucent resin cements, opaque cements are usually advocated. However, this can come at the expense of incisal translucency, so it is sensible to mimic the opacity when selecting the shade. This can be achieved by holding a cotton wool roll palatal to the tooth, or even painting TempBond on the palatal surface (Fig. 2).

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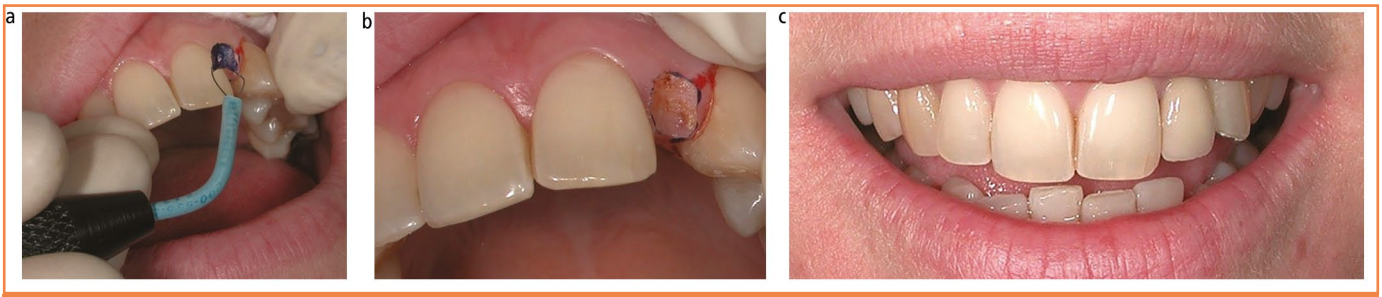

Fig. 1 a, b, c) Soft tissue sculpting of the gingiva with electrothermy

Fig. 2 Utilising temp bond during shade taking

Fig. 3 Sandblasted fit surface prior to cementation

Since successful RRBs require an enamel substrate to bond to, tooth preparation is generally contraindicated. The only indication for preparing an RRB abutment is to increase the available surface area for bonding, such as the removal of a bulbosity that may limit the path of insertion of the framework. Occlusal reduction is unnecessary, since RRBs are routinely cemented in supra-occlusion. This results in intrusion of the abutment and opposing teeth and passive eruption of the remaining teeth. To increase the available bonding area further, the authors suggest packing two retraction cords and removing the most superficial one just prior to making the elastomeric impressions. Sometimes, more radical retraction may be indicated, such as electrothermy, to uncover more enamel in cases of delayed gingival maturation.

Fit and cementation

One example of a resin composite adhesive cementation system is Panavia V5 (Kuraray Noritake, Osaka, Japan), which is widely used for the cementation of RRBs and indeed for other restorations which require to be bonded to dental hard tissue, such as lithium disilicate ceramics. Prior to its clinical use, it is essential to lay out the product and follow the instruction card, explaining to the patient that this is a highly technical cementation process. Asking your dental nurse to read out the instructions can act as a valuable checklist; good communication is key throughout. This material is often not used to its full potential, and it is important to remember that five distinct shades are available: white, brown, universal, clear and opaque. In the aesthetic zone, although an opaque resin cement is frequently selected, it is advisable to utilise the try-in pastes which are included in the kit to assess the effect of metal 'shine-through' prior to final bonding. This stage is one that can pay dividends, as the aesthetics of the definitive restoration can often be enhanced. Resin cements are often refrigerated to improve shelf-life, so it is important to allow them to reach room temperature before use or the set will be retarded. Prior to cementation, the surface of the tooth can be prepared by ultrasonic scaling, followed by application of a pumice slurry on a bristle brush or, even better, sandblasting. If the tooth surface has previously supported a RBB retainer, or has been restored with resin composite, then sandblasting is essential. The surface should be particle air abraded with 50 µm alumina under rubber dam isolation prior to undertaking the bonding stages.

Because the bonding surface will have been contaminated with saliva during try-in, it is advisable to also sandblast the fit surface of the retainer wings immediately prior to cementation (Fig. 3).

Once mixed, the resin cement should be applied thinly to both the tooth and fit surface of the retainer wings to prevent air inclusions. Once seated, it is essential that the framework is loaded firmly so that it cannot move during the setting period, which can be as long as five minutes. Opaque cements are generally not dual cure, so immobility is crucial. To ensure complete curing, thew oxygen barrier, often supplied in the cement kit, should be used. To facilitate excess cement removal post-bonding, it is wise to place polytetrafluoroethylene (PTFE) tape interproximally between the abutment tooth and adjacent teeth and below the pontic.

Rotary instruments generate heat and vibrational movement which can disrupt the bond, so adjustment should be avoided at the fit visit.

Post-operative care and maintenance are key

Most RRBs will be bonded-in high, so there will be a period of several months before pre-operative occlusal contacts are re-established. During this period, orthodontic retainers and occlusal splints should not be worn, as this will prevent relative axial movement of the teeth. Since the interface with RRBs is generally in enamel, they tend to have less issues with microleakage and caries than conventional bridgework, where the preparation is into dentine. That said, the general advice on diet and oral hygiene measures still applies. Where fixed-fixed designs are used, the potential for partial debond poses a risk of caries beneath the retainer wings. Patients should be advised to attend regular recall appointments to check

that all retainers are still completely bonded to tooth, and to re-attend if they sense any increased movement of the bridge that might denote a partial debond. Should this occur, the pragmatic approach is usually to remove the debonded wing to convert the bridge to a cantilever. Should the bond fail on a cantilever RRB, it will be all too evident to the patient! Thankfully, resolving this is often very straightforward, simply requiring sandblasting of the tooth and retainer, and then rebonding. However, if the cause of the debond is diagnosed to be a flexible retainer wing or connector, remaking the bridge after addressing the design faults is advisable.

Conclusions

RRBs are the ultimate in minimally invasive dentistry, where an entire tooth can be replaced with no removal of tooth tissue or the need to resort to surgery, as is the case for dental implants. They are less expensive, less biologically invasive and less time consuming than either conventional bridges or dental implants. They are more resistant to caries than conventional bridges, and less problematic than implants in periodontally susceptible patients, or those at risk of osteonecrosis. However, even though there are many reasons to recommend RRBs, they are the epitome of a technique-sensitive treatment. Designed and fitted poorly, they are a source of huge frustration for the dentist and patient alike. Executed correctly however, RRBs provide an excellent solution to tooth loss from all causes, have predictable clinical survival, and perhaps most importantly, have few negative effects should they fail. ■

CLINICAL PUZZLE

Painful red gums

A 61-year-old otherwise well male patient presented with painful, red, increasingly swollen gingivae and occasional gingival bleeding with tooth cleaning that has been worsening over the past 6–7 months. There has been some superficial ulceration of the lower left gingivae. There is no identifiable initiating factor. The clinical symptoms and signs have persisted despite assessment by a specialist in periodontology, debridement of calculus and the patient maintaining a fair level of oral hygiene. A recent full blood cell count undertaken by his general medical practitioner revealed no abnormalities. The patient is single, employed as a concierge, does not smoke tobacco or other preparations, rarely drinks alcohol, and has a history of contact dermatitis for which he occasionally takes fexofenadine.

Can you identify or diagnose what is shown in the image? Send your answers to k.quinlan@nature.com by 9 February 2023. The answer will be revealed in an upcoming issue.

If you would like to send a clinical puzzle, view the details here: https://www.nature.com/articles/s41415-022-5392-2.

First dentist to give the Calman Lecture

Professor Barry F. A. Quinn of the University of Liverpool, School of Dentistry delivered the Calman Lecture on 14 December 2022 at the Academy of Medical Educators (AoME).

The prestigious annual Calman Lecture is given in honour of Sir Kenneth Calman HonFAcadMEd, one of the founders of AoME.

As a tribute to Sir Ken's own enormous involvement, leadership and contribution to teaching, learning and the organisation of medical training, the general theme for the Calman Lectures is reflections on the education of doctors. Professor Quinn is the first dentist to be given the honour to present the Calman Lecture; past recipients have included Sir Peter Rubin, Past Chair of the General Medical Council and Professor Cees van der Vleuten, a Professor of Education in The Netherlands.

The title of Professor Quinn's lecture was 'Haptically enabled virtual reality simulation: is this the future for surgical skills training?'

https://www.medicaleducators.org/Calman-Lecture-Presidents-Evening