A new system of adhesive fixed partial denture

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Resumo
A substituição de dentes ausentes pode ser alcançada de várias formas, tais como prótese parciais fixas convencionais cerâmicas ou metalocerâmicas, próteses sobre implantes ou prótese parciais fixas adesivas. Uma vez que as soluções existentes nem sempre são eficazes, descobrimos uma nova abordagem que assegura retenção adequada e estética satisfatória em um caso de prótese fixa adesiva de três elementos. Os autores apresentam um caso clínico realizado na Faculdade de Medicina Dentária do Porto – Portugal, que demonstra a reabilitação de um segundo pré-molar esquerdo com um novo sistema de prótese parcial fixa adesiva baseado na utilização de dois componentes protéticos segmentados entre si. A substituição de um dente posterior com este tipo de prótese parcial fixa adesiva possibilitou a restauração do dente perdido com preparos menos invasivos, restabelecendo a função e a estética ao paciente.

Palavras-chave: Prótese parcial fixa; prótese adesiva; prótese dentária.

Abstract
The replacement of missing teeth can be accomplished in different ways such as ceramic or metal-ceramic fixed partial dentures, dental implants or resin-bonded fixed partial dentures. Since the existing solutions are not always effective, a new approach is described to ensure adequate retention and satisfactory aesthetics for resin-bonded fixed partial denture with only one element. The authors present a clinical case of the Faculty of Dentistry of Porto – Portugal, showing the rehabilitation of a missing left second premolar with a new two-component system of resin-bonded fixed partial denture, which is bonded to the adjacent teeth. The replacement of one posterior tooth with this two component resin-bonded fixed partial denture may be more efficient and retentive than the classic ones.

Keywords: Denture partial fixed; resin-bonded; dental prosthesis.

INTRODUCTION

The replacement of a missing tooth can be accomplished with removable partial dentures (RPD), a dental implant, ceramic or metal-ceramic fixed partial dentures (FPD) or resin-bonded fixed partial dentures (RBFPD). When the adjacent teeth present perfect condition, adequate position, occlusion and aesthetics, dental implants or adhesive fixed partial dentures have been the most recommended treatment. However, FPDs are commonly used, owing to their considerable durability, aesthetics, cost effective, adequate retention and no need for a surgical procedure.

Retention has been critical for the success of conventional RBFPD. The conservative preparations, such as partial veneer crowns, are less retentive, difficult to manufacture and eventually unaesthetic, so they were replaced by metal ceramic crowns or complete ceramic restorations. These restorations have a tooth preparation that is more destructive and potentially iatrogenic (destruction of dental structures), and the occlusal ceramic may lead to excessive wear of antagonistic teeth1-4. However, these restorations can be more retentive and aesthetic than adhesive fixed partial dentures and even than dental implants in some cases5.

While dental implants are preferred by some clinicians, others choose adhesive partial dentures in order to minimize some of the above-referred inconvenient. Dental implants have been a proven, efficient and secure prosthetic rehabilitation, avoiding the post extraction bone resorption, but minimal surgery and a certain period to enable osseointegration are needed.

The use of RBFPD has become a popular treatment option when the abutments are relatively intact or when preservation of tooth structure is needed6-8.
RBFPD are extremely conservative and provide unparallel biological and aesthetic harmony\(^9\). These prostheses may also be preferable for young patients with big pulpal chambers\(^{10}\). In addition, the RBFPDs have been attractive for patients and dentists because of the minimal loss of tooth structure during tooth preparation\(^1\) and in some cases the produce of provisional restorations might be unnecessary. Anaesthesia can be avoided in some patients. RBFPDs also enable vitaliti tests and/or endodontic treatment of the abutments after its insertion\(^2\).

The minimal clinical chair time and cost effectiveness are another of the advantages of the RBFPDs\(^3\). However, their poor aesthetics (incisal enamel gets grey caused by metallic recovering of lingual or palatal surface of translucent abutments)\(^{12-15}\) and frequent loss of retention\(^{5,13}\) are the main drawbacks.

As Besimo et al.\(^9\) concluded in their study, the RBFPD technique can be currently considered as a clinically reliable treatment if the tooth preparation design provides suitable mechanical retention, and if the alloy and bonding agents are carefully selected and used.

Appropriate mechanical retention of the resin-bonded retainers with tooth enamel micropreparation is crucial; nevertheless, specific tooth preparation, better composite luting agents with improved bonding to metals and tooth structure allow a significant reduction in failures. According to Rochette\(^{16}\), these RBFPDs should be perforated to allow greater mechanical retention of composite cement to the metal. Currently, the new cementing materials and techniques for etching metal have increased the adhesive strength of the cement to the metal of the internal surface of retainers. Aluminium oxide blasting, electrochemical treatment, etching, silanization or tin plating (for precious alloy\(^{17-22}\)), ensure an efficient union to various materials, including enamel, dentine and metals. This fact enlarges the indications for RBFPDs.

Initial clinical studies reported a 25% failure rate because of loss of retention of these type of prosthesis, which was extremely high (Kerchbaum et al. cit. by Rammelsberg et al.\(^{23}\)). In 1993, Rammelsberg et al.\(^{23}\) reported in a six-year longitudinal study at the University of Munich-Germany the clinical factors that affect RBFPDs. A total of 82.9% were in function after six years. According to the same study, the success of RBFPDs was neither related with anterior or posterior quadrants, maxillary or mandibular arch, but was statistically connected with tooth preparation of the abutments. This was performed with 1.0 mm deep parallel grooves in the proximal and lingual surfaces of the abutments. The other independent structure is inserted in a perpendicular direction to the first structure (from occlusal to gingival surface). It consists in a pontic with two rest seats prepared in the abutments. The first independent structure, beyond retention permitted by grooves, is cemented with composite resin. This structure is made to provide the saddle pontic adequate anatomy without irregularities to allow acceptable finishing.

**THE TECHNIQUE**

- Study diagnostic casts;
- Mark the proximal and palatine grooves and the rest seats on the cast with a pen. Position the grooves between the gingival margin and contact point leaving enough tooth structure to separate it from the occlusal seat;
- Construct a plastic template on this cast (vacuumform);
- Perforate the template in areas that correspond to grooves and rest seats as evident in the translucency of the vacuumform;
- Prepare the grooves and rests on the casts;
- Perform local anaesthesia;
- Hold the reference template in the mouth;
- Mark with a diamond round bur (ISO 029) all the grooves extensions and rest seats areas, guided by template perforations;

The objective of this case report is to describe a new procedure of manufacturing a RBFPD that ensures a minimal preparation of teeth, adequate retention and satisfactory aesthetics.

**CASE DESCRIPTION**

This is a clinical case of the Faculty of Dentistry of Porto - Portugal, showing the rehabilitation of a missing left second premolar with a new two-component system of resin-bonded fixed partial denture, which is bonded to the adjacent teeth.

The system of two independent structures (Figure 1) are the goal for adequate retention. The first independent structure has an insertion transversal axis (from lingual to vestibular) that perfectly fits in two parallel grooves in the proximal and lingual surfaces of the abutments. The other independent structure is inserted in a perpendicular direction to the first structure (from occlusal to gingival surface). It consists in a pontic with two rest seats prepared in the abutments. The first independent structure, beyond retention permitted by grooves, is cemented with composite resin. This structure is made to provide the saddle pontic adequate anatomy without irregularities to allow acceptable finishing.

**TECHNIQUE**

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Figure 1. First and second structures.
• Prepare grooves accurately (1.0 mm deep with divergent walls); the occlusal surface must be expanded or bevelled (Figure 2);
• Prepare rest seats (Figure 2) with two diamond round burs, using the first one with a larger diameter (ISO 029), and then a similar bur with a smaller diameter (ISO 021)
35,36, as follows:
• prepare in a similar way to those recommended for RPDs, with a triangular form (the vertex directed to the centre of the tooth);
• 2 up to 2.5 mm in the buccal-lingual direction in premolars and molars;
• 1.5 mm mesiodistal;
• 1.0 mm deep;
• the ground rounded without sharp angles and a deeper central portion.
• Etch, prime and bond exposed dentine;
• Make an impression with monophasic addition silicones using a custom resin tray or with a double mixture technique. This is commonly a delicate phase because of enormous inertia during removal and can lead to rupture of the vinyl polysiloxane in the grooves;
• Set provisional cement without eugenol in the grooves as a temporary restoration.
• Trial seating of first (Figure 3) and second metal structures (Figure 4);
• Apply porcelain and finish the prosthesis (Figures 5, 6, 7, 8);
• Lute with a resin-based luting agent (Panavia EX; Kuraray Co. Ltd, Osaka, Japan). Etch, wash and dry enamel, and blasting the metal with a 50 µm aluminium oxide;
• Adjust occlusion, polish margins, evaluate RBFPD and demonstrate oral hygiene procedures.

DISCUSSION

The adhesive partial dentures are commonly selected, but the problems of poor retention have hindered its universal application. This type of prosthesis has become more popular because reliable resin-metal bonding can be achieved by electrolytic acid etching of cast base metal alloys
37.

In order to increase the adhesive strength of RBFPDs
30, the areas that support the metal on the lingual surfaces should be as wide as possible
38, which emphasize the need of tooth preparation with a correct convergence. This convergence in metal-ceramic crowns must not be exceeded. Sarafianou, Kafandaris
39 reported that when convergence is 10 up to 15 degrees, retention decreases between 15.4 and 17.4%, which is critical because
The innovative prosthetic technique presents some difficulties, both clinical and mechanical, that need to be understood for future investigation. Some of them can be related to the instruments required for tooth preparation: grooves in parallel forms, in areas where the access is hindered and the visibility is limited, and also the impression technique (without rupture or permanent deformation).

This technique has been recommended only in posterior teeth (second premolars or molars) with edentulous spaces that do not exceed one tooth because of technical and biomechanical factors.

After the improvements introduced by investigators, mechanical and clinical experiences show that this prosthesis will be less aggressive than conventional treatments, proving that RBFPDs may be an efficient prosthetic option. This will provide greater selection and a more effective method of treating patients.

CONCLUSION

The replacement of a missing tooth can be performed with several treatments. The new two-component resin-bonded fixed partial denture described overcomes the main drawbacks of the classic ones, providing better retention and aesthetics, which is well pointed out by the stability of the treatment after ten years follow-up.

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