

**Materials Used in Resin Bonded Fixed Partial Denture: A Review Article**

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**Abstract**

The resin bonded fixed partial denture serves to be a fantastic solution for replacing missing teeth particularly when minimal tooth preparation would be desired. When opting for a Resin bonded fixed partial denture, clinicians should consider the method of fabrication [direct or indirect], the design [cantilever or fixed-fixed], and the material to be used. These decisions are affected by various clinical and aesthetic factors such as connector

space, tooth position [anterior or posterior], patient preferences, and the dentists skills. Several materials can be used in the fabrication of resin bonded fixed partial denture such as metal alloys, all ceramic systems, fibre reinforced composites, and zirconia. This review article focuses on the different material choices available for resin bonded fixed partial denture fabrication, enumerating their properties ,advantages, limitations and clinical applications. <sup>1, 2, 6, 8, 10, 13</sup>

**Keywords:** resin bonded fixed partial denture, restorative treatment, material choice

## Introduction

Rochette introduced resin bonded fixed partial denture in early 1970s, providing a conservative treatment choice for replacing missing teeth with minimal or no preparation of abutment teeth<sup>1</sup>

The most commonly used materials used in resin-bonded fixed partial denture:

- Gold alloy (earlier)
- Base metal alloy
- Cobalt chromium alloy
- Nickel-chromium alloy
- All ceramic
- Fiber-reinforced composite
- Zirconia.<sup>2,4,6,8,10,13</sup>

Initially, gold alloys were being used, but newer advancements in dental materials have led to the adoption of base metal alloys, ceramics, and newer composite materials.<sup>2,4,6</sup> These advancements allow for improved aesthetics, bond strength, and clinical performance of the fixed partial denture.<sup>6,8,9,10</sup>

## Materials Used In Resin Bonded Fixed Partial Denture:

### Gold Alloy

Gold alloys are noble metals which were used historically in dentistry because of their excellent corrosion resistance, workability, and biocompatibility.<sup>4,6</sup>

Dental gold alloys can be categorized based on their hardness and composition and may also contain additions like palladium and platinum for improving strength and for reducing thermal expansion.<sup>6</sup>

Though they have been largely replaced by more affordable and stronger materials, gold alloys still offer a high precision and aesthetic outcomes when they are

used as substructures in resin bonded fixed partial dentures.<sup>2,6</sup>

Galvano forming is a newer technique that allows for the creation of very thin gold frameworks, preserving more natural tooth structure as much as possible.<sup>2</sup>

## Base Metal Alloy

### A. Cobalt Chromium Alloys

Cobalt chromium [Co-Cr] alloys have developed as a dependable alternative to gold due to their excellent mechanical properties, corrosion resistance, and affordability.<sup>5</sup> These alloys execute well under heavy masticatory forces, even in thin sections, making them desirable for resin bonded fixed partial dentures.<sup>5,6</sup>

CAD/CAM milling and laser sintering are modern manufacturing methods that have improved the accuracy and clinical applicability of the cobalt chromium alloys.<sup>5</sup>

Unlike nickel-based alloys, Cobalt-Chromium alloys pose a lower risk of allergic reactions.<sup>5,7</sup>

**B. Nickel Chromium Alloys:** Nickel chromium alloys had been used widely for decades because of their strength and favourable bonding characteristics with porcelain.<sup>4,6</sup>

They are cost friendly and mechanically strong, but their use has declined due to the rising concerns about nickel hypersensitivity in susceptible individuals who have allergies.<sup>7</sup> The shift towards Cobalt – Chromium alloys is getting more evident because of these biocompatibility issues.<sup>5,7</sup>

### All Ceramic

All ceramic resin bonded fixed partial dentures are highly preferred as they provide metal free option and also cater to the needs of the patients with high aesthetic demands.<sup>8,9</sup> All ceramics are particularly indicated for the replacement of anterior teeth in patients have stable occlusion and having healthy abutments.<sup>9</sup> The Benefits of all ceramic resin bonded fixed partial dentures include

excellent translucency, biocompatibility to the patients, and require conservative tooth preparation.<sup>6,8,9</sup>

However, all ceramic restorations tend to get fractured under high masticatory forces especially when used in posterior tooth and also tend to get fractured in patients having parafunctional habits such as night grinding, etc.<sup>8,14</sup> Cantilever designs are most commonly preferred because of their lower stress distribution.

### **Fiber Reinforced Composite**

Fibre reinforced composites have the excellent combination of aesthetics and functional benefits and are largely gaining popularity as a minimally invasive material.<sup>10,11,12</sup>

Fibre reinforced composites use glass, carbon, or polyethylene fibres which are embedded in a resin matrix which helps to provide strength and flexibility to the fixed partial denture.<sup>10,11</sup>

Fibre reinforced composite prosthesis can be fabricated chairside or in the laboratory and can be bonded directly to the enamel surfaces, that offers quick as well as cost-effective tooth replacement.<sup>10,11</sup> Despite having these many advantages, there are issues like wear resistance, water absorption, and technique sensitivity during cementation which may impact their long term success.<sup>11,12</sup>

These materials are ideal for being used as temporary or interim prosthesis and can be easily repaired if they tend to get damaged.<sup>10,11</sup>

### **Zirconia**

Zirconia, particularly 3Y-TZP [yttria stabilized tetragonal zirconia polycrystals], is recently one of the most durable ceramic materials that is being used in dentistry.<sup>13</sup> It reflects superior fracture toughness as well as flexural strength, that makes it suitable for being used for both anterior and posterior restorations. Earlier generations of zirconia were opaque and also required

veneering with porcelain, which increased the risk of chipping of the material.<sup>13,14</sup>

Newly introduced translucent monolithic zirconia variants provide with improvement of aesthetics and also eliminates the need for veneering. Also, occasional fracture of the veneers remain to be a concern in layered zirconia restorations and therefore a more long term clinical data is needed for further advancements.<sup>14,15</sup>

### **Discussion**

Treatment options for replacing missing teeth should be considered based on patient preferences, biological factors, and economical constraints of the patient.<sup>15,16</sup> Resin bonded fixed partial dentures provide a traditional and aesthetically attractive solution, especially for the patients who cannot undergo implant therapy or undergo a full coverage restorations.<sup>2,15</sup> The development of materials- from traditionally used gold and metal alloys to the high strength ceramics and fibre reinforced composites are expanding the scope and indications for resin bonded fixed partial dentures.<sup>2,6,10,13</sup> Zirconia and all ceramic systems do offer metal free alternatives and also provide excellent aesthetics but also require careful case selection due to possible fracture risks.<sup>8,13,14</sup> Ongoing research and development in material sciences continues to improve the long life and performance of these dental prosthesis.<sup>13,16</sup>

### **Conclusion**

Despite somewhat lower survival rates compared to the conventional fixed partial dentures, resin bonded fixed partial dentures remain a worthwhile treatment modality in the selected cases.<sup>8,15,17</sup>

Developments in dental materials particularly tooth coloured frameworks such as zirconia and fibre reinforced composite have increased the aesthetic potentials of the Resin bonded fixed partial dentures.<sup>10,13,14</sup>

However, long term clinical studies are required to establish their performance in relation to the available traditional metal based designs.<sup>15,17</sup>

Proper case selection, along with material centred considerations, is necessary for achieving predictable outcomes.<sup>15,17</sup>

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