IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 8 Ser. 6 (August. 2025), PP 32-37
www.iosrjournals.org

Resin Bonded Fixed Partial Denture: A Minimally Invasive Approach To Tooth Replacement

Arpitha Padmanabhan [1],Archana A C [2],Dr. Dipin P. P[3],
Dr. Unni Pympallil [4],Dr. Nirosha Vijayan[5],Dr. Ankitha Thejus[6]
1:Final year BDS, Mahe Institute of Dental Sciences and Hospital
2:Final year BDS, Mahe Institute of Dental sciences and Hospital
3:Senior Lecturer, Department of Prosthodontics Crown and Bridge, Mahe Institute of Dental Sciences and Hospital
4:Reader, Department of Prosthodontics Crown and Bridge, Mahe Institute of Dental Sciences and Hospital
5:Senior Lecturer, Department of Prosthodontics Crown and Bridge, Mahe Institute of Dental Sciences and Hospital
6:Senior Lecturer, Department of Prosthodontics Crown and Bridge, Mahe Institute of Dental Sciences and Hospital

Abstract:
Resin bonded fixed partial dentures (RBFPDs) represent a conservative and minimally invasive solution for the replacement of missing teeth, particularly suitable for single-tooth replacement in the anterior region. Despite their advantages, including preservation of tooth structure and relatively straightforward clinical procedures, their adoption remains limited among dental practitioners due to concerns regarding long-term retention and failure rates. This review discusses the key aspects of resin bonded bridges, including their indications, advantages, disadvantages, framework materials, bridge designs, and clinical protocols aimed at improving success rates. Special emphasis is placed on the advancements in all-ceramic resin bonded bridges and their role in contemporary prosthodontic practice.

Keywords: *Resin bonded FPD, Rochette bridge, conservative preparation, minimally invasive procedure.*

Date of Submission: 17-08-2025 Date of Acceptance: 27-08-2025

I. Introduction:

Resin-bonded fixed partial dentures (RBFPDs), also known as resin-bonded bridges (RBBs) or resin-retained bridges (RRBs), are minimally invasive prosthetic restorations that offer a conservative approach to tooth replacement. First introduced in the 1970s, the earliest design—known as the Rochette bridge—utilized a perforated metal framework to enhance micromechanical retention through resin cement tags[1]. However, this design suffered from limitations such as cement dissolution and debonding. Subsequent innovations, including electrochemical etching and surface modifications, led to the development of the Maryland bridge, significantly improving bond strength and longevity. Over the decades, advances in adhesive systems and resin cements have further increased the clinical success of these restorations. RBFPDs are especially advantageous due to their tooth-preserving nature, reduced pulpal morbidity, and cost-effectiveness, making them suitable for younger patients, medically compromised individuals, or those unable to undergo more invasive treatments[2]. Despite certain limitations—such as esthetic concerns with metal frameworks and contraindications in cases of insufficient interocclusal space or

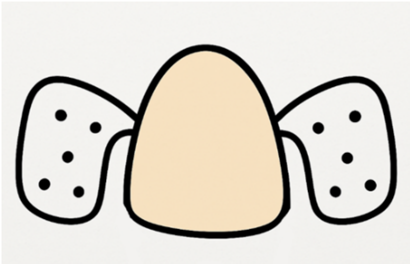
parafunctional habits—the evolution of non-metallic materials like zirconia and lithium disilicate has expanded their indications. This review aims to evaluate the survival rates, complications, material options, and bonding protocols associated with RBFPDs, highlighting their viability as an alternative to conventional fixed prostheses and implant-supported restorations.

II. Types Of Resin Bonded FPD

○ **Rochette Bridge**

○ **Maryland Bridge**
○ **Cast Mesh FPD**
○ **Virginia Bridge**
○ **Rochette Bridge:**

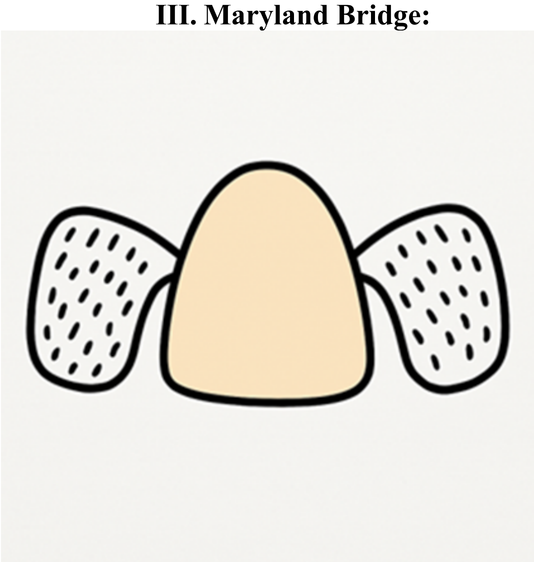
Rochette in 1973 combined mechanical retention with a silane coupling agent to produce adhesion to the metal. It is a wing like retainer with funnel shaped perforation through then to enhance resin retention.



Tooth preparation: In Rochette bridges, little to no tooth preparation is done, as retention is achieved through mechanical interlocking of resin into perforations in a metal wing that rests on the lingual surface; this design is often used as a provisional option due to its bulk and lower strength

Procedure:
1. Abutment tooth preparation
a. Patient assessment: Evaluation of occlusion, inter arch space and periodontal surface and status of the abutment tooth is done
b. Surface cleaning is done using non fluoridated water and pumice and isolation is done
c. Minimal enamel preparation:
   i. Roughening the lingual surface of abutment tooth using fine grit diamond bur or using air abrasion {aluminium oxide particle} and ensuring smooth adaptation of the metal wing without occlusal interference.
2. Cementation
a. Trial fitting is done to confirm the passive fit and proper wing adaptation.
b. Metal wing: Ensuring that the metal wing has countersunk holes and are clean from debris
c. Resin cement selection:
   i. Non adhesive, chemically or dual cure resin luting cement like: Nexus (Kerr/SDS)
d. Cementing: filling the perforation in the metal wing with the resin cement ,only a thin layer is applied on the prepared lingual enamel surface
e. Bridge placement and adjustment: the bridge is seated with minimal pressure and the resin is allowed to cure according to manufacturer's instructions. Excess cement is removed, and margins are checked. Occlusion is verified and adjusted, ensuring the bridge and pontic are not in direct contact in centric or excursive movement
f. Post cementation instruction is given [5]

III. Maryland Bridge:



The Maryland bridge involves etching the inner surface of a metal retainer using either electrochemical or chemical methods to enhance adhesion. This etched metal prosthesis design was first introduced by Livaditis and Thompson.

Tooth preparation: The Maryland bridge involves light lingual reduction (0.3–0.5 mm) and may include proximal grooves, pinholes, or rest seats to improve resistance and retention. Retention here is primarily micromechanical and adhesive, relying on etched enamel and resin cement without perforations.

Procedure and techniques:
1. Electrochemical etching technique
a. Non-Beryllium Nickel-Chromium Alloys
b. Beryllium-Containing Alloys

Parameter	*Non-Beryllium Ni-Cr Alloys*	*Beryllium-Containing Ni-Cr Alloys (Thompson et al.)*
Etching Solution	35% Nitric Acid	10% Sulfuric Acid
Current Density	250 mA/cm²	300 mA/cm²
Etching Time	5 minutes	Not specified (same during current application)
Post-Etching Treatment	Rinse thoroughly	Rinse thoroughly
Ultrasonic Cleaning	18% Hydrochloric Acid for 10 minutes	18% Hydrochloric Acid for 10 minutes
Ultrasonic Bath Use	Yes	Yes

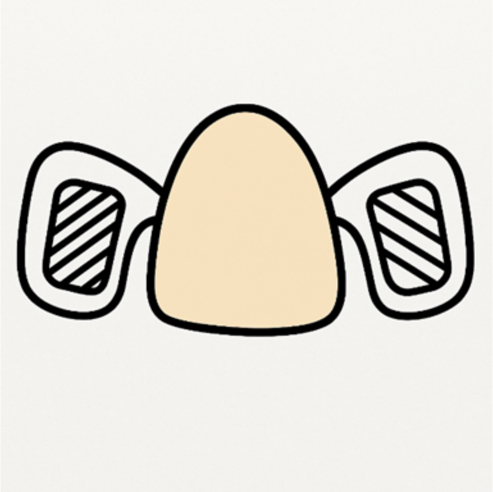
Thermal chemical etching technique:

To reduce the technique sensitivity associated with electrochemical etching, Livaditis later introduced a simplified chemical etching method that did not require the use of electrical current. In this approach, the same acidic etchant—chosen based on the specific alloy type—is used. The metal framework is immersed in the etching solution and placed in a water bath maintained at 70°C for a duration of one hour. This thermal chemical etching technique produces a comparable micro-retentive surface on the metal, eliminating the need for electrochemical equipment while still enhancing resin adhesion effectively.

Pyrolyzed silane coating:

In addition to surface etching, retention of Maryland bridges can be significantly enhanced by applying a pyrolyzed silane coating to the inner surface of the metal retainer. This coating is applied after the etching process and serves to further improve the bond between the metal and resin cement. In vitro studies have demonstrated that the use of pyrolyzed silane can increase retention strength by approximately 47% to 104% compared to etching alone, making it a valuable adjunct in improving the long-term stability of resin-bonded prostheses.[6]

IV. Cast Mesh FPD:



This technique involves creating surface roughness prior to alloy casting by incorporating a nylon mesh over the lingual surfaces of the abutment teeth on the working cast.

Tooth preparation: The Cast Mesh bridge uses a woven metal screen or mesh on the retainer surface to enhance mechanical bonding, and like the Rochette, it usually involves minimal or no tooth preparation but offers slightly better strength and retention.

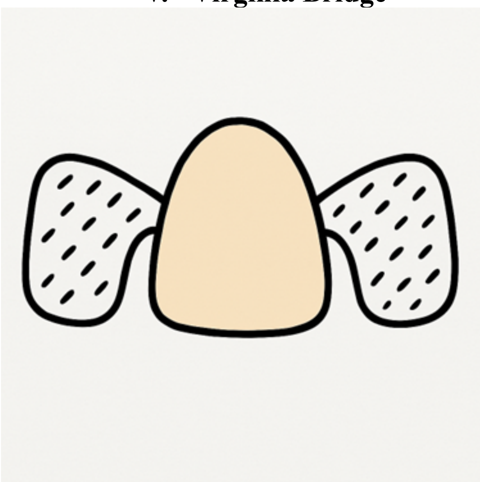
Procedure:
Laboratory Procedure:

Fabrication of a precise working cast of the patient's arch, followed by identification of the lingual surfaces of the abutment teeth where the metal wings will contact. A suitable nylon mesh is then cut and carefully adapted to these designated areas on the working cast. The next step involves building the wax pattern of the retainer wings directly over the mesh, ensuring that the mesh is fully embedded within the wax to maintain close adaptation. Once the wax pattern is completed, it is invested and cast using a metal alloy—typically a noble metal alloy, which is generally incompatible with traditional acid etching methods. Upon casting, the inner surface of the retainer displays a mesh-like texture that offers effective micromechanical retention, eliminating the need for chemical or electrochemical surface treatments.

Cementation:

During the clinical phase, the cast framework is first tried intraorally to confirm proper fit and adaptation to the abutment teeth. The inner mesh-textured metal surface of the retainer should be thoroughly cleaned to eliminate any residual debris or contaminants that may interfere with bonding. The abutment teeth are then cleaned using non-fluoridated pumice, and the operative field is isolated using a rubber dam or cotton rolls to maintain moisture control. Importantly, this technique typically does not require enamel preparation or acid etching, making it minimally invasive. For cementation, a **chemically or dual-cure resin luting cement**, specifically one that is compatible with metal bonding is applied to both the mesh-textured inner surface of the retainer and the cleaned tooth surface. The bridge is then seated under gentle pressure, which is maintained until the cement has fully polymerized. After setting, all excess resin cement is carefully removed from the margins and interproximal spaces, and the occlusion is checked to ensure there are no premature contacts or interferences.[7]

V. Virginia Bridge



It was developed by Moon and Hudgins at the University of Virginia in 1983. It uses a technique called lost salt technique. Virginia bridge is an early form of resin-bonded fixed partial denture (RBFPD) that utilizes a perforated metal retainer for micromechanical bonding. Similar in concept to the Rochette bridge, the Virginia bridge differs in that the **perforations are smaller and more numerous**, providing a more uniform distribution of **retentive resin plugs**.

Tooth preparation: The Virginia bridge, an earlier form of RBFPD, incorporates electrolytically etched metal retainers bonded to enamel with resin cement; it also typically involves little or no preparation, though mild enamel roughening may be done to improve bonding.

Procedure:

The die is lubricated and sieved using cubic salt 150-250 microns is sprinkled on the surface leaving out the margins. A resin pattern is then constructed over the salt allowing it to get incorporated in the resin. The salt is then dissolved by placing the set pattern in an ultrasonic cleaner, which leaves behind the voids in the pattern which are reproduced in the cast , this provides retention. [8]

VI. Cementation Protocol

Successful bonding of resin-bonded fixed partial dentures (RBFPDs) relies on a multi-layer attachment complex, involving the bond between enamel and resin, the cohesive strength of the resin itself, and the bond between resin and the metal framework. Early RBFPD designs utilized perforated frameworks to achieve mechanical retention, but this method compromised the structural integrity of the framework and increased susceptibility to resin degradation from oral fluids.

- Modern cementation protocols emphasize chemical bonding, utilizing materials such as ***Panavia EX and 4-META-based adhesives*** (e.g., C&B Metabond). Panavia EX, introduced in 1984, is a bis-GMA-based resin cement containing MDP (10-methacryloyloxydecyl dihydrogen phosphate), which effectively bonds cobalt-chromium alloys to enamel. Clinical studies have shown Panavia EX to offer superior bond durability compared to older cements like Comspan, with lower debonding rates (16% vs. 45%).[9]
- **Surface preparation of the metal framework** is critical. Air abrasion with ***50 µm alumina particles*** creates a rough surface and deposits an alumina layer that facilitates bonding with phosphate-based cements. Additionally, the oxidation of base metals, such as nickel and chromium, enhances the bond's durability. For example, nitric acid can be used to generate an oxide film on nickel-chromium alloys, improving adhesion when using 4-META systems.[10]
- **Cement film thickness** also plays a role in retention. A thickness of approximately ***80 µm*** has been found to yield optimal metal-to-resin bond strength, while ensuring complete seating of the prosthesis and minimizing internal flaws.[11]
- In cases where resin remnants need to be removed from the framework before bonding, heating the prosthesis in a ***porcelain furnace at 480°C for three minutes*** can clean the surface without damaging porcelain glaze.[12]
- **Moisture control** during cementation is essential. While the rubber dam offers the most effective isolation, it may not always be feasible, especially when it impedes access to the margins or causes fluid pooling. In such cases, cotton roll isolation may be used as a practical alternative.

VII. Choice Of Material: [13]

The following material can be 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.

VIII. Indication And Contraindications

Indications	***Contraindications***
*Replacement of **single missing** anterior or posterior tooth*	Replacing ***multiple teeth*** with more than one pontic
Young patients where conservative treatment is preferred	Use of multiple retainers or pier abutments
*Cases requiring **minimal** or no tooth preparation*	***Replacing canines*** (due to increased functional load and unfavourable angulation)
***Medically compromised** or elderly patients unsuitable for implants or surgery*	Patients with ***bruxism*** or other parafunctional habits
***Interim esthetic** replacement before implant placement (e.g., Carolina bridge)*	***Inadequate*** enamel bonding surface or insufficient crown height
Favourable occlusal and periodontal conditions	Patients with poor oral hygiene or poor isolation capability during bonding

Advantage:

Resin-bonded fixed partial dentures (RBFPDs) provide a ***conservative and minimally invasive*** alternative to conventional fixed prostheses. One of their most significant advantages is the preservation of natural tooth structure, as minimal or no preparation is needed for abutment teeth. This not only ***reduces the risk of pulpal damage*** but also makes the procedure reversible. RBFPDs are particularly suitable for younger patients, medically compromised individuals, or those seeking interim solutions before implant therapy. They are associated with shorter clinical appointments, ***reduced cost***, and less postoperative discomfort. ***Esthetic improvements*** have also been achieved with the use of all-ceramic materials and fiber-reinforced composites, which mimic the translucency of natural teeth. Furthermore, they are relatively easy to fabricate and place, and they allow for multiple bonding techniques and materials, enhancing their versatility in clinical practice.

Disadvantage:

Despite their many benefits, RBFPDs have several disadvantages that must be carefully considered. The most ***common issue is debonding***, particularly in posterior regions where occlusal forces are greater. This can cause patient dissatisfaction and may necessitate frequent re-bonding, which in turn reduces long-term bond strength and increases failure rates. RBFPDs are ***contraindicated in cases involving multiple missing teeth, pier abutments, or bruxism, as these conditions compromise retention and longevity***. Their success is highly technique-sensitive, requiring strict isolation during cementation and precise metal surface treatment. Additionally, esthetic concerns may arise when metal frameworks are visible through translucent anterior teeth. Challenges in achieving proper seating or adaptation—especially in techniques like the cast mesh or lost salt method—can further reduce their effectiveness. Therefore, while RBFPDs offer a conservative solution, their long-term success depends heavily on careful patient selection, proper case planning, and clinical expertise.[14]

IX. Conclusion:

Resin-bonded fixed partial dentures (RBFPDs) represent a conservative and effective alternative to conventional fixed partial dentures. Their minimally invasive nature, combined with advancements in retentive design and bonding protocols, has significantly improved their longevity and clinical success. These factors have contributed to the frequent inclusion of RBFPDs in treatment planning, especially when cost-effective and tissue-preserving options are desired. While the popularity of dental implants has led to a decline in the routine use of RBFPDs, they continue to hold relevance in cases where implant therapy is contraindicated due to poor bone quality, systemic health issues, or financial constraints. RBFPDs are particularly useful as transitional restorations in patients with periodontal involvement, or after orthodontic treatment where long-term implant placement may be delayed. Their minimal preparation requirements make them ideal for medically compromised or elderly patients who may not tolerate extensive dental procedures. Despite the availability of more advanced restorative options, the simplicity, affordability, and predictability of RBFPDs maintain their value as both semi-permanent and long-term treatment solutions in carefully selected clinical scenarios

Reference

[1] Pjetursson BE, Tan WC, Tan K, Brägger U, Zwahlen M, Lang NP. A Systematic Review Of The Survival And Complication Rates Of Resin-Bonded Bridges After An Observation Period Of At Least 5 Years. Clin Oral Implants Res. 2008 Feb;19(2):131–41

[2] Siddique R, Sureshbabu NM, Somasundaram J, Jacob B, Selvam D. Qualitative And Quantitative Analysis Of Precipitate Formation Following Interaction Of Chlorhexidine With Sodium Hypochlorite, Neem, And Tulsi. J Conserv Dent. 2019 Jan-Feb;22(1):40–7.

[3] Van Heumen CCM, Tanner J, Van Dijken JWV, Pikaar R, Lassila LVJ, Creugers NHJ, Et Al. Fiveyear Survival Of 3-Unit Fiber-Reinforced Composite Fixed Partial Dentures In The Posterior Area. Dent Mater. 2010 Oct;26(10):954–60.

[4] Kern M. Rbfdps: Resin-Bonded Fixed Dental Prostheses: Minimally Invasive - Esthetic - Reliable. 2017. 254 P.

[5] Shillingburg HT. Fundamentals Of Fixed Prosthodontics. 3rd Ed. Chicago: Quintessencepub; 1997

[6] A REVIEW ON RESIN BONDED PROSTHESIS Dr. Tanmay Biswas, Dr. Anindita Majumder, Dr. (Prof) T.K Giri, Dr. (Prof) S. Mukharjee

[7] Abd Alraheam I, Nguyen Ngoc C, Oliveira G, Donovan T. Clinical Performance Of A Modified Resin Bonded Fixed Partial Denture (Carolina Bridge): A Retrospective Study. J Esthet Restor Dent. 2020;1–7

[8] Livaditis G.A. Chemical Etching System For Creating Micromechanical Retention In Resin- Bonded =Retainers. J Prosthet Dent 1987; 56, 181

[9] Hussey, D.L., Pagni, C., Linden, G.J. Performance Of 400 Adhesive Bridges Fitted In A Restorative Dentistry Department. J Dent 1991; 19: 221-225

[10] El-Guindy, J., Selim, M., El-Agroudi, M. Alternative Pre-Treatment Modalities With A Self-Adhesive System To Promote Dentin/Alloy Shear Bond Strength. J Prosth 2010; 19: 205-211

[11] Tanaka, T., Nagata, K., Takeyama, M., Atsuta, M., Nakabayashi, N., Masuhara, E. 4-META Opaque Resin – A New Resin Strongly Adhesive To Nickel-Chromium Alloy. J Dent Res 1981; 60: 1697-1706

[12] Flood, A.M. Resin-Bonded Prostheses: Clinical Guidelines. Aust Dent J 1989; 34: 209-218

[13] Lally D U. "Resin-Bonded Fixed Partial Dentures Past And Present–An Overview". Journal Of The Irish Dental Association 58.6 (2013): 294-300

[14] Dr. JAYAPRIYA P ,CRRI, Et. Al. "Longevity Of Resin Bonded FPD-A Review." IOSR Journal Of Dental And Medical Sciences (IOSR-JDMS), 22(3), 2023, Pp. 36-39.