Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2023.30.10.033

Resin Bonded Bridges - A Review of the Literature

Ojasvini Arora[1*], Vinay Sivaswamy[2]

[1]Post Graduate Student, Department of Prosthodontics and Implantology, Saveetha Dental College And Hospitals, Saveetha Institute Of Medical And Technical Sciences, Saveetha University, Chennai-600077, Tamil Nadu,India

[2]Associate Professor, Department of Prosthodontics and Implantology, Saveetha Dental College & Hospitals, Saveetha Institute of Medical & Technical Sciences, Saveetha University, Chennai-600077, Tamil Nadu, India

***Corresponding author:** Ojasvini Arora, Post Graduate Student, Department of Prosthodontics and Implantology, Saveetha Dental College And Hospitals, Saveetha Institute Of Medical And Technical Sciences, Saveetha University, Chennai-600077, Tamil Nadu,India,
Email: ojasviniarora8@yahoo.com

Submitted: 20 March 2023; Accepted: 19 April 2023; Published: 03 May 2023

ABSTRACT

In the 1970s, dentists began using resin-bonded fixed partial dentures (RBFPDs). Ever since then, there have been various advancements in the same. This review was done to assess the survival rates, complications and bonding options of resin bonded bridges. A MEDLINE search was completed till June 2021, along with a manual search, to locate related articles on the topic. It was found that resin bonded bridges are a conservative and viable treatment option for tooth replacement with comparable survival rates as fixed dental prostheses and implant supported restorations for upto 5 years. However, careful case selection, material selection and bonding protocol are essential to ensure success of the restoration.

Keywords: *resin bonded , fixed partial denture, resin cement*

INTRODUCTION

In the 1970s, dentists began using resin-bonded fixed partial dentures (RBFPDs). (1) The first design of RBFPDs was given by Rochette in 1973. The framework was made of metal and perforations were integrated in his design. At hat time, they were designed to splint periodontally compromised teeth.(2) The disadvantage of this design was that the dissolution of luting cement through the perforations, leading to leakage, secondary caries or debonding To overcome the disadvantages of the Rochette design, newer designs such as electrochemical etching and pitting corrosion of the metal framework were introduced.(3,4)

Howe and Denehy, in 1977, presented a method for fabricating and attaching a fixed partial denture in the anterior region on the lingual surface without the need for tooth preparation, wherein composite resin was used on the abutment tooth surface and on acid etched enamel.(5) Livaditis and Thompson incorporated guide planes on the lingual and interproximal surfaces and rest seats on the occlusal surface to gain mechanical advantage for posterior resin bonded bridges.(6) Ever since then, there have been various developments in the bonding mechanism using resin cements, which has led to greater survival of resin bonded bridges.(7)

This article is distributed under the terms of the Creative Commons Attribution-Non Commercial 4.0 International License. ©2021 Muslim OT et al.

RBFPD failures are typically less devastating than standard FPD failures.(8) The key benefits of RBFPDs include tooth preservation, less pulpal morbidity, and the utilisation of supragingival margins. RBFPDs are more economical and more conservative than implant restorations.(9) They are specially suitable for patients who are growing and have lost anterior teeth or in patients who cannot undergo more aggressive treatments because of various factors like old age, medical condition, financial situation or poor oral hygiene.(10)(11)

Since the metal can show through when abutment teeth are particularly transparent or in cases of large interdental spaces, RBFPDs are not recommended in such cases. When a metal framework is employed, it can also cause tooth decay. RBFPDs can also not be used in patients with inadequate interocclusal space, short clinical crowns on abutment teeth or with parafunctional habits.(12)(13)

The application of RBFPDs with non-metallic frameworks has expanded dramatically since the development of ceramic and non-ceramic materials.(14) Clinicians have employed lithium disilicate, zirconia, glass ceramic and fiber-reinforced composite as frameworks for RBFPDs, also known as Maryland bridges.(15–18) However, in comparison to metal RBFPDs, there is scarce long term data on nonmetal RBFPDs.

Survival Rates

The 5-year survival rates of RBBs were quite high. However, the survival rates varied according to the framework material used. It was seen that RBB framework made from In-Ceram alumina VITA had the highest survival rate 94.26%, followed by zirconia (92.07%), metal (88.1%) and then fiber reinforced composite (84.83%) at the end of 5 years.(19) In a systematic review (20), the overall 5-year survival rate of resin bonded bridges was 91.4% compared with 87.7% survival rate reported in another systematic review (1). The difference between the 2 reviews was the inclusion of newer studies in the 2017 systematic review, wherein the new studies were done on non-metal RBBs which presented better survival rates. Similarly, in another systematic review (21) the predicted survival rates at the end of 5 years and 10 years were 83.6% and 64.9% respectively. But the majority of the included studies were conducted till the year 2000, and thus were on metal RBBs. The overall 10-year survival rate of RBBs was reported to be 82.9%. Survival rate here refers to the prosthesis being the mouth without any debonding or other complications like abutment tooth caries or periodontal trauma, or fracture of the prosthesis framework.

There were higher survival rates for single retainer RBBs as compared to 2-retainer RBBs.(22)(23) However, metal-ceramic RBBs showed similar survival rates for single and double retainer RBBs.(24) In one study (25), there was a 100% success rate at the end of 5 years for the single retainer group and 75% for the double retainer group. There was debonding of 80% of the RBFPDs in the double retainer group. There was a success rate of 97.5% for single retainer RBBs made from In-Ceram alumina and 88.3% for double retainer RBBs.(26) The two abutment teeth move differently, specially during protrusion and laterotrusion of the mandible when contact with antagonist is present. This has been touted to be the major factor responsible for the failure of 2-retainer RBBs. On the other hand, in a cantilever RBB, the pontic is free to move along with the single abutment tooth and is not sandwiched between 2 differently moving abutment teeth, because of which shear and torquing forces during eccentric movements are very limited.

RBBs in the maxilla have a higher survival rate than in the mandible, however, the difference is not statistically significant. Anterior resin bonded bridges survive longer than posterior RBBs, and the difference is marginally significant. The 1-year failure rate of anterior RBBs was 1.20% and that posterior RBBs was 3.65%.(20)

Complications

Technical and biological complications of RBBs have been reported. Of the two, technical complications are the major cause of failure.(27) The most prevalent is debonding, seen in 82% cases and the second most common is fracture of the retainer part of the RBB framework, with an

This article is distributed under the terms of the Creative Commons Attribution-Non Commercial 4.0 International License. ©2021 Muslim OT et al.

incidence of 15%.The main biological complications were caries and periodontal disease, with a prevalence of 1.7% and 0.6% respectively. Other complications occurred very minimally, like pulpal pathology, poor esthetics etc. In 2 studies it was found that RBBs with two retainers debonded more frequently than one-retainer RBBs.(25,26) It was reported that debonding was the major complication seen in RBBs, with a frequency of 19.2% in 5 years time.(1)

Annual debonding rate in ascending order was 0% for glass-infiltrated and glass-reinforced ceramic frameworks, 1.42% for zirconia frameworks, 1.72% for fiber reinforced composite and 2.8% for metal ceramic RBBs.(20) Fractures could be of either the veneering matial or more catastrophic framework fractures.(28) Different materials showed different fracture rates. No fractures were observed for reinforced glass ceramic, metal–ceramic and zirconia RBBs, whereas fiber-reinforced composite and glass infiltrated ceramic showed significantly higher fracture rates. As for chipping, the annual incidence rate in ascending order was 1.42% for fiber-reinforced composite, 1.04% for glass-infiltrated ceramic, 0.95% for reinforced glass ceramic, 0.29% for metal ceramic and 0% for zirconia RBBs. Considering metal-ceramic RBBs as the base material, zirconia RBBs showed significantly less chipping and all the other materials showed significantly higher chipping rates. These results were obtained based on 16 studies evaluating 1345 RBBs.(29–35)

Cementation

Resin bonded bridges appear to be more likely to survive due to the resin bond than to any additional mechanical retention.(36) Within the first five years, there was no difference in the clinical outcomes with RBBs when utilising either the Multilink Automix resin cement by Ivoclar Vivadent, Schaan, Liechtenstein or Panavia 21 TC by Kuraray, Japan.(10) Comparison of luting with with Super-Bond C&B and Panavia F Kuraray, Japan) also showed similar results in the case of metal-ceramic RBB (Sun medical, Japan). (29) So, it's possible that the resin cement used does not have a major role in the failure of resin bonded bridges.((37)

The usage of a rubber dam is advised to provide a dry working space. For preventing saliva contamination, two trials used rubber-dam, one used cotton rolls, and one used both rubber-dam and cotton rolls.(20,31–34) Less debonding was noted in cases where rubber-dam was used than in cases where cotton rolls were the main application method.(32) Consequently, it seems that the use of rubber-dams and RBB survival are favourably connected.(35) Metal-framework RBBs had greater retention if air-particle abrasion was done prior to cementation.(34) Similarly, surface treatment had a significant impact on investigations of long term bond strength to glass infiltrated ceramics.(36) Silanization and tribochemical silica coating of the alumina ceramic are the recommended surface treatment techniques, after which a composite resin comprising phosphate monomer is applied. (37) Air-particle abrasion with 50 microns alumina particles at 1.0-2.5 bar and use of resin cements containing phosphate monomer is a popular bonding technique. (38,39)

Resin cement having 10-MDP(10-methacryloyloxydecyldihydrogenphosphate) as one of its constituents is a preferred option for the cementation of zirconia prostheses because it produces a bond with zirconia that is water-resistant. (40)(38) MDP-containing priming agent has also been demonstrated to dramatically improve the bond strength of resin cements to zirconia when the zirconia surface in contact with the luting agent has been air-particle abraded. (41,42)

CONCLUSION

Resin bonded bridges are a conservative and viable treatment option for tooth replacement with comparable survival rates as fixed dental prostheses and implant supported restorations for upto 5 years. However, careful case selection, material selection and bonding protocol are essential to ensure success of the restoration.

REFERENCES

J Popul Ther Clin Pharmacol Vol 30(10):e287–e291; 03 May 2023.
This article is distributed under the terms of the Creative Commons Attribution-Non Commercial 4.0 International License. ©2021 Muslim OT et al.

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. Rochette AL. Attachment of a splint to enamel of lower anterior teeth [Internet]. Vol. 30, The Journal of Prosthetic Dentistry. 1973. p. 418–23. Available from: http://dx.doi.org/10.1016/0022-3913(73)90163-7
3. Tanaka T, Atsuta M, Uchiyama Y, Kawashima I. Pitting corrosion for retaining acrylic resin facings. J Prosthet Dent. 1979 Sep;42(3):282–91.
4. Dunn B, Levy MN, Reisbick MH. Improving the fracture resistance of dental ceramic. J Dent Res. 1977 Oct;56(10):1209–13.
5. Howe DF, Denehy GE. Anterior fixed partial dentures utilizing the acid-etch technique and a cast metal framework [Internet]. Vol. 37, The Journal of Prosthetic Dentistry. 1977. p. 28–31. Available from: http://dx.doi.org/10.1016/0022-3913(77)90187-1
6. Thompson VP, Del Castillo E, Livaditis GJ. Resin-bonded retainers. Part I: Resin bond to electrolytically etched nonprecious alloys [Internet]. Vol. 50, The Journal of Prosthetic Dentistry. 1983. p. 771–9. Available from: http://dx.doi.org/10.1016/0022-3913(83)90088-4
7. Ramesh A, Varghese S, Jayakumar ND, Malaiappan S. Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study. J Periodontol. 2018 Oct;89(10):1241–8.
8. Miettinen M, Millar BJ. A review of the success and failure characteristics of resin-bonded bridges. Br Dent J. 2013 Jul;215(2):E3.
9. 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.
10. Oesterle LJ, Cronin RJ Jr, Ranly DM. Maxillary implants and the growing patient. Int J Oral Maxillofac Implants. 1993;8(4):377–87.
11. Vijayashree Priyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. J Periodontol. 2019 Dec;90(12):1441–8.
12. Manohar J, Ashok V, Dinesh SPS, Subhashree R. A Retrospective Study on Implant Prosthesis in Missing Maxillary Anteriors among Middle Aged Adults. J Long Term Eff Med Implants. 2021;31(4):33–7.
13. Samuel SR. Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life? Int J Paediatr Dent. 2021 Mar;31(2):285–6.
14. Duraisamy R, Krishnan CS, Ramasubramanian H, Sampathkumar J, Mariappan S, Navarasampatti Sivaprakasam A. Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments. Implant Dent. 2019 Jun;28(3):289–95.
15. van Heumen CCM, Tanner J, van Dijken JWV, Pikaar R, Lassila LVJ, Creugers NHJ, et al. Five-year survival of 3-unit fiber-reinforced composite fixed partial dentures in the posterior area. Dent Mater. 2010 Oct;26(10):954–60.
16. Kern M. RBFDPs: Resin-Bonded Fixed Dental Prostheses: Minimally Invasive - Esthetic - Reliable. 2017. 254 p.
17. Cenci MS, Rodolpho PA da R, Pereira-Cenci T, Del Bel Cury AA, Demarco FF. Fixed partial dentures in an up to 8-year follow-up. J Appl Oral Sci. 2010 Jul;18(4):364–71.
18. Sasse M, Kern M. CAD/CAM single retainer zirconia-ceramic resin-bonded fixed dental prostheses: clinical outcome after 5 years. Int J Comput Dent. 2013;16(2):109–18.
19. Alraheam IA, Ngoc CN, Wiesen CA, Donovan TE. Five-year success rate of resin-bonded fixed partial dentures: A systematic review. J Esthet Restor Dent. 2019 Jan;31(1):40–50.
20. Thoma DS, Sailer I, Ioannidis A, Zwahlen M, Makarov N, Pjetursson BE. A systematic review of the survival and complication rates of resin-bonded fixed dental prostheses after a mean observation period of at least 5 years. Clin Oral Implants Res. 2017 Nov;28(11):1421–32.
21. Balasubramaniam GR. Predictability of resin bonded bridges – a systematic review [Internet]. Vol. 222, British Dental Journal. 2017. p. 849–58. Available from: http://dx.doi.org/10.1038/sj.bdj.2017.497
22. Mourshed B, Samran A, Alfagih A, Samran A, Abdulrab S, Kern M. Anterior Cantilever Resin-Bonded Fixed Dental Prostheses: A Review of the Literature. J Prosthodont. 2018 Mar;27(3):266–75.
23. Tezulas E, Yildiz C, Evren B, Ozkan Y. Clinical procedures, designs, and survival rates of all-ceramic resin-bonded fixed dental prostheses in the anterior region: A systematic review. J Esthet Restor Dent. 2018 Jul;30(4):307–18.
24. Wei YR, Wang XD, Zhang Q, Li XX, Blatz MB, Jian YT, et al. Clinical performance of anterior resin-bonded fixed dental prostheses with

This article is distributed under the terms of the Creative Commons Attribution-Non Commercial 4.0 International License. ©2021 Muslim OT et al.

different framework designs: A systematic review and meta-analysis. J Dent. 2016 Apr;47:1–7.
25. Botelho MG, Chan AWK, Leung NCH, Lam WYH. Long-term evaluation of cantilevered versus fixed–fixed resin-bonded fixed partial dentures for missing maxillary incisors [Internet]. Vol. 45, Journal of Dentistry. 2016. p. 59–66. Available from: http://dx.doi.org/10.1016/j.jdent.2015.12.006
26. Kern M, Sasse M. Ten-year survival of anterior all-ceramic resin-bonded fixed dental prostheses. J Adhes Dent. 2011 Oct;13(5):407–10.
27. Varghese SS, Ramesh A, Veeraiyan DN. Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students. J Dent Educ. 2019 Apr;83(4):445–50.
28. Hussainy SN, Nasim I, Thomas T, Ranjan M. Clinical performance of resin-modified glass ionomer cement, flowable composite, and polyacid-modified resin composite in noncarious cervical lesions: One-year follow-up. J Conserv Dent. 2018 Sep-Oct;21(5):510–5.
29. Kumbuloglu O, Özcan M. Clinical survival of indirect, anterior 3-unit surface-retained fibre-reinforced composite fixed dental prosthesis: Up to 7.5-years follow-up [Internet]. Vol. 43, Journal of Dentistry. 2015. p. 656–63. Available from: http://dx.doi.org/10.1016/j.jdent.2015.04.006
30. Sailer I, Bonani T, Brodbeck U, Hämmerle CHF. Retrospective clinical study of single-retainer cantilever anterior and posterior glass-ceramic resin-bonded fixed dental prostheses at a mean follow-up of 6 years. Int J Prosthodont. 2013 Sep;26(5):443–50.
31. van Heumen CCM, van Dijken JWV, Tanner J, Pikaar R, Lassila LVJ, Creugers NHJ, et al. Five-year survival of 3-unit fiber-reinforced composite fixed partial dentures in the anterior area. Dent Mater. 2009 Jun;25(6):820–7.
32. Zalkind M, Ever-Hadani P, Hochman N. Resin-bonded fixed partial denture retention: a retrospective 13-year follow-up [Internet]. Vol. 30, Journal of Oral Rehabilitation. 2003. p. 971–7. Available from: http://dx.doi.org/10.1046/j.1365-2842.2003.01165.x
33. Kanter RJAMD, De Kanter RJAM, Creugers NHJ, Verzijden CWGJ, Van't Hof MA. A Five-year Multi-practice Clinical Study on Posterior Resin-bonded Bridges [Internet]. Vol. 77, Journal of Dental Research. 1998. p. 609–14. Available from: http://dx.doi.org/10.1177/00220345980770041401
34. Creugers NHJ, Käyser AF. An analysis of multiple failures of resin-bonded bridges [Internet]. Vol. 20, Journal of Dentistry. 1992. p. 348–51. Available from: http://dx.doi.org/10.1016/0300-5712(92)90023-6
35. Creugers NHJ, Snoek PA, Van't Hof MA, Käuyser AF. Clinical performance of resin-bonded bridges: a 5-year prospective study. Part III: failure characteristics and survival after rebonding [Internet]. Vol. 17, Journal of Oral Rehabilitation. 1990. p. 179–86. Available from: http://dx.doi.org/10.1111/j.1365-2842.1990.tb01408.x
36. Chaturvedula BB, Muthukrishnan A, Bhuvaraghan A, Sandler J, Thiruvenkatachari B. Dens invaginatus: a review and orthodontic implications. Br Dent J. 2021 Mar;230(6):345–50.
37. Hussey DL, Linden GJ. The clinical performance of cantilevered resin-bonded bridgework. J Dent. 1996 Jul;24(4):251–6.
38. Princeton B, Santhakumar P, Prathap L. Awareness on Preventive Measures taken by Health Care Professionals Attending COVID-19 Patients among Dental Students. Eur J Dent. 2020 Dec;14(S 01):S105–9.

This article is distributed under the terms of the Creative Commons Attribution-Non Commercial 4.0 International License. ©2021 Muslim OT et al.