

Original Article

## A Review of Recent Literature on the Handling of Anterior Resin-Bonded Cantilever Restorations

Adolfo Di Fiore<sup>1\*</sup>, Edoardo Stellini<sup>1</sup>, Gianpaolo Savio<sup>2</sup>, Stefano Rosso<sup>3</sup>, Lorenzo Graiff<sup>1</sup>, Stefano Granata<sup>1</sup>, Carlo Monaco<sup>4</sup>, Roberto Meneghello<sup>3</sup>

<sup>1</sup> Department of Neurosciences, School of Dentistry, Section of Prosthodontics and Digital Dentistry, University of Padova, 35100 Padova, Italy.

<sup>2</sup> Departments of Civil, Environmental and Architectural Engineering, University of Padova, 35100 Padova, Italy.

<sup>3</sup> Departments of Management and Engineering, University of Padova, 36100 Vicenza, Italy.

<sup>4</sup> Department of Biomedical and Neuromotor Sciences (DIBINEM), Division of Prosthodontics and Maxillofacial Rehabilitation, Alma Mater Studiorum— University of Bologna, 40121 Bologna, Italy.

\*E-mail ✉ [adolfo.difiore@unipd.it](mailto:adolfo.difiore@unipd.it)

Received: 23 November 2023; Revised: 29 January 2024; Accepted: 06 February 2024

### ABSTRACT

Various treatment options are available for replacing missing anterior teeth, including implant-supported prostheses, fixed dental prostheses, and resin-bonded fixed dental prostheses. However, implant placement can pose challenges, particularly in edentulous sites with insufficient bone or soft tissue. In such cases, procedures such as bone augmentation and connective tissue grafting may be required. This study systematically reviews the management of anterior resin-bonded cantilever restorations and provides insights for clinicians on addressing failures associated with RBFDPs. A comprehensive search was conducted using electronic databases, including PubMed, Cochrane, Google Scholar, and SDL research databases, for English-language articles published between 2000 and 2022. The initial search yielded 3,225 articles, which were refined through title screening, duplicate removal, and exclusion of irrelevant studies, leaving 110 relevant papers. After evaluating the full text of 40 studies, 14 studies were selected for inclusion in this review. The findings suggest that RBFDPs demonstrate favorable clinical performance with high survival rates, making them a viable alternative to other restorative approaches. While debonding remains a major concern, its incidence can be reduced through the use of resin-based luting agents and zirconia ceramic frameworks.

**Keywords:** Dental rehabilitation, Prosthodontics, Resin bonded cantilever, Literature review.

**How to Cite This Article:** Di Fiore A, Stellini E, Savio G, Rosso S, Graiff L, Granata S, et al. A Review of Recent Literature on the Handling of Anterior Resin-Bonded Cantilever Restorations. J Curr Res Oral Surg. 2024;4:1-8. <https://doi.org/10.51847/JcU1FD46Qw>

### Introduction

Several treatment options exist for replacing missing anterior teeth, including implant-supported prostheses, fixed dental prostheses, and resin-bonded fixed dental prostheses. However, placing an implant in an edentulous site can present challenges [1]. Patients with inadequate soft and hard tissue may require procedures such as bone augmentation and connective

tissue grafting [2]. In these cases, the invasiveness of surgical interventions and the anxiety associated with surgery often lead patients to seek simpler, less invasive alternatives [3]. Additional factors, such as age-related restrictions, may also prevent younger patients from receiving implant-supported prostheses until they reach adulthood to minimize the risk of implant infra-position [4].

A conventional fixed dental prosthesis relies on adjacent natural teeth for retention. However, its

placement requires extensive tooth preparation, resulting in the removal of approximately 63% to 72% of healthy tooth structure. In some instances, the preparation process, combined with factors such as pulp chamber size and tooth morphology, may necessitate endodontic treatment, further increasing treatment complexity and cost [5].

A resin-bonded fixed dental prosthesis provides a conservative solution that aligns with patients' expectations for both function and esthetics [6]. In 1973, Rochette pioneered a technique that involved securing a metal retainer to enamel using adhesive cement. By the early 1990s, this method evolved with the incorporation of oxide ceramics as a replacement for metal frameworks. Advances in material science and clinical methods have significantly minimized complications such as debonding and ceramic fractures in RBFDPs [7].

Opting for a single-retainer design comes with several advantages, including a minimally invasive preparation process, a lower likelihood of endodontic involvement, and cost-effectiveness [8]. The resin-bonded cantilever features an extended wing-like structure that is affixed to the abutment tooth or teeth using high-strength dental adhesive, ensuring long-lasting retention [9].

The retention of an (RBFDP) relies on the use of adhesive resin cement, which securely bonds the restoration to the enamel surface [10]. Successful outcomes depend on proper case selection and an optimal bridge design. Several patient-related factors must be evaluated, including age, expectations, pontic placement, abutment tooth condition, and occlusal considerations [11]. When selecting an abutment tooth, key criteria include good periodontal health, minimal previous restorations, and a clinically adequate crown height [12].

This study aims to systematically review the management of anterior resin-bonded cantilever restorations and provide practitioners with guidance on addressing (RBCFPS) failures.

## Materials and Methods

A systematic review was carried out by searching electronic databases, including Cochrane, Google

Scholar, SDL Research Databases, and PubMed, for English-language articles published between 2000 and 2022. The search terms used were (anterior resin bonded cantilever and management of cantilever). After applying exclusion criteria, all titles and abstracts underwent thorough screening, followed by a detailed analysis of the findings.

### Inclusion Criteria

1. Studies conducted on human subjects.
2. Articles published in English.
3. Research focusing on anterior all-ceramic and metal-ceramic cantilever RBFDPs.
4. Eligible study designs include randomized controlled clinical trials (RCTs), controlled clinical trials (CCTs), retrospective studies (RSs), and prospective studies (PSs).
5. Publications dated from 2000 to 2022.
6. Studies with a minimum follow-up period of one year.
7. Research specifically related to anterior RBFDPs.
8. Peer-reviewed publications.

### Exclusion Criteria

1. Studies involving animal models.
2. Articles published in languages other than English.
3. Research-based on in vitro experiments or finite element analysis.
4. Case reports, case series, and studies on posterior RBFDPs.
5. Publications before the year 2000.
6. Studies with an observation period shorter than one year.
7. Investigations focused on posterior RBFDPs.

### PICO

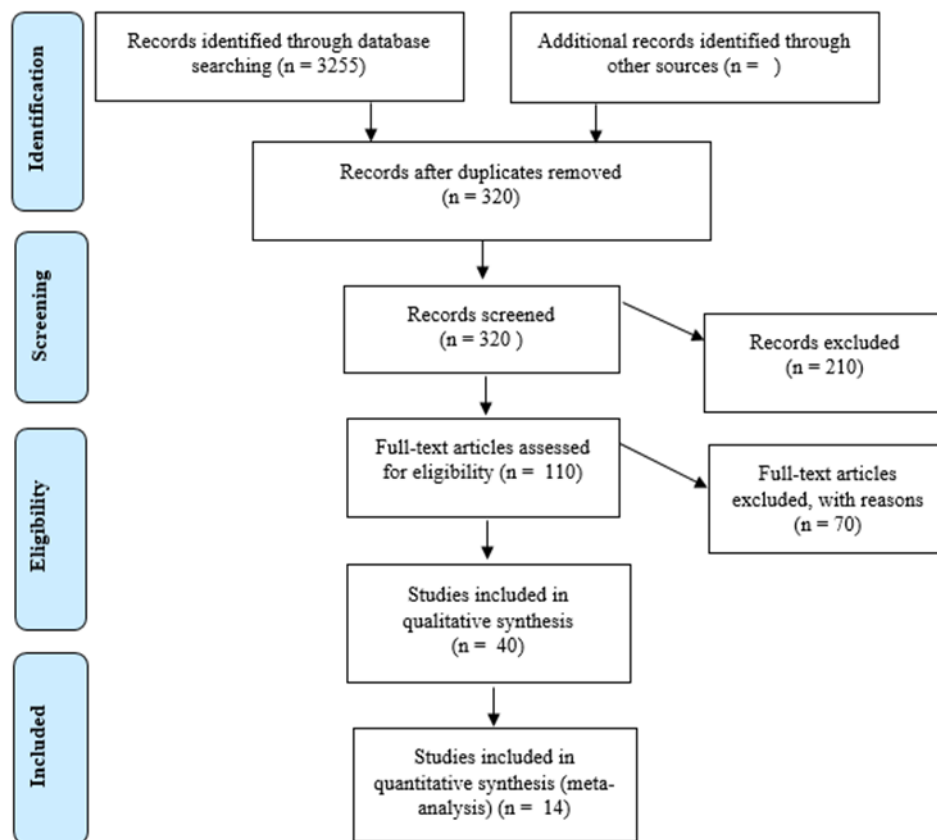
P: Patient with anterior resin-bonded cantilever.

I: Identify the changes in the anterior resin-bonded cantilever.

C: Compare the old and new cantilever management.

O: Educate practitioners about improvement and management.

PRISMA diagram illustrating the process of screening studies for inclusion is presented in **Figure 1**.

**PRISMA 2009 Flow Diagram****Figure 1.** PRISMA diagram illustrating the process of screening studies for inclusion

## Results and Discussion

A total of 3,225 articles were identified through the initial electronic search. After applying manual screening, removing duplicates, and excluding irrelevant studies, 110 studies remained. Following a

full-text evaluation of 40 articles, 14 studies were selected for inclusion in this review.

This systematic review consists of five retrospective studies, six prospective studies, and three randomized controlled trials that met the inclusion criteria. A summary of the included studies is provided in **Table 1**.

**Table 1.** Summary of results from included studies.

Author, Year	Study design	Sample size	Follow up period	Material	Cement	Type of failure	Success rate/ Survival rate	Complication
--------------	--------------	-------------	------------------	----------	--------	-----------------	--------------------------------	--------------

Galiatsatos, 2014	Clinical evaluation	54	1, 2, 4, 6, and 8 years following placement.	Glass-infiltrated alumina ceramic In-Ceram	Dual polymerizing composite resin cement (Variolink II, Ivoclar Vivadent)	Two debonded, one patient dissatisfied, and six fractures occurred.	After 8 years, the success rate was 85.18%	-
Sasse <i>et al.</i> , 2014	A prospective study	37p 42cl	-61.8 months	Yttrium oxide-stabilized zirconium oxide ceramic	Panavia 21 TC	Debonding only two debonding happened	The success rate stood at 95.2% after six years.	No issues were reported.
Sasse <i>et al.</i> , 2012	Randomized clinical trial	30CL	5 years	Zirconia ceramic (IPS e.max ZirCAD with IPS e.max Ceram veneer; both by Ivoclar Vivadent).	Either a resin containing phosphate monomer (Panavia) applied directly without a primer, or the use of an adhesive bonding system paired with a phosphoric acid acrylate primer for the zirconia ceramic (Multilink–Automix bonding system with Metal/Zirconia primer).	Two debonding by a traumatic event.	Both RBFDPs were successfully rebonded, achieving a 100% survival rate over three years.	-
Kern <i>et al.</i> , 2005	A prospective study	30P 37RBFDP 16FF 21CL	75.8 months in FF 51.7 months in CL	Glass-infiltrated alumina ceramic in cream	Panavia or panavia 21	Fracture: 1 CL, 6 FF - 1 fractured at both connectors, 1 was accidentally removed, and 4 fractured at one connector but stayed in place as CL.	-5 Year, 92.3% CL 73.9% FF survival rate	No issues were reported
Chan <i>et al.</i> , 2000	A prospective study patient divided into two groups: group A FF group B CL	24SUBJECT 25RBFDP 12FF 13CL	14 to 45 months	Metal framework	Panavia (resin cement) + Rubber dam	The debonding of ONE FF occurred, after which it was converted into a CL and reattached with new cement.	Success was solely determined by retention, with no mention of the survival rate.	The metal framework becomes visible through the thin or translucent anterior teeth.

Kern <i>et al.</i> , 2017	A retrospective study	92.2 ± 33 months. 108CL Restorations were designed using CAD/CAM technology and milled out of pre-sintered zirconia ceramic blocks. Restorations were designed using CAD/CAM technology and milled out of pre-sintered zirconia ceramic blocks.	Panavia 21 TC, Kuraray, or Multilink Automix + Rubber dam				
Klink <i>et al.</i> , 2016	A prospective study	18p 9m 9f 24CL 35 months Different zirconia materials	All luting materials, Ivoclar Vivadent	Debonding	A success rate of 95.5%, with survival rates ranging from 82.4% to 76%.	-	
Botelho <i>et al.</i> , 2016	A prospective study	22p 13CL FF10 216.5 ± 20.8 months Metal framework	Panavia (resin cement) + Rubber dam	Retention	No complications that necessitated intervention were observed.	-	
Sailer, 2014	Retrospective study	15 8 years Zirconia ceramic	Resin cement (Panavia 21 TC).	Two debonding	. There were no severe failures caused by RBFDP fractures. Additionally, none of the RBFDPs needed to be removed because of technical or biological issues. As a result, the zirconia ceramic RBFDPs achieved a 100% survival rate.	-	
Saker <i>et al.</i> , 2014	Retrospective cohort study	(22 women, 18 men 60 Months Cobalt-chromium-ceramic or glass-infiltrated alumina	Resin cement		2 fractures were noted with AC. No debonding occurred with MC (n = 0), while debonding was seen with AC. MC: 100 %; AC: 90%;	-	

Abuzar, 2018	A retrospective study		206Arbbs	-	Adhesive resin cement	Debonding	The survival rate reached 95.1% at twelve years and beyond.	-
Naenni, 2020	Retrospective study	10 years	10	Zirconia (IPS e.max ZirCAD, Ivoclar Vivadent; Cerion, Straumann)	Panavia 21 TC, Kuraray	Two loss of retention,	The survival rate was 100% after a mean follow-up period of no less than 10.0 years.	-
Qiu <i>et al.</i> , 2020	Prospective	12 to 40 months.	186 CRBFPDs	Cobalt-chrome alloy	Panavia F 2.0	A failure rate of 1.1% was observed.	88% of the cases were successful.	- Complications were recorded when bridges were debonded on 2 occasions
Malgaj, 2021	Randomized clinical trial	3 year		Zirconia frameworkS	Panavia (resin cement) was used with a rubber dam, and the samples were split into two groups for different pretreatment methods. The first group (n = 15) underwent airborne particle abrasion (APA) of the bonding surface and served as the control. The second group (n = 16) had the restorations pretreated with NAC.	Debonding	The NAC RBFDPs demonstrated a higher 2-year survival rate of 93.8%, compared to 86.7% for the APA RBFDPs.	

This review aims to evaluate the management of cantilever RBFDPs in the anterior region. Cantilever RBFDPs present a viable alternative to more invasive treatments like implant surgery or FDPs, particularly when there are contraindications for these options, such as in young or medically compromised patients. Mourshed *et al.* [13] found that the longevity of RBFDPs can be comparable to that of FDPs. Additionally, shifting from the traditional two-retainer RBFDP design to a cantilever design has been shown to improve survival rates and longevity [13, 14]. According to Sasse *et al.* [15], the cantilever design offers a higher success rate due to the absence of inter-abutment stress, which occurs in two-retainer designs. In these traditional designs, the differential movements of the abutment teeth place stress on the bonding interface, leading to fatigue and eventual debonding over time [15]. The literature reviewed highlights that debonding is the most common failure type, a complex issue influenced by factors such as RBFDP design,

choice of luting cement, and the material of the RBFDP framework [16].

Most of the studies included in this review utilized composite resin luting cement containing phosphate monomers, such as Panavia 21, which demonstrated superior bonding strength compared to alternatives like Multilink-Automix. However, no significant differences were found between these cements. Debonding may also occur due to various factors, including trauma, food culture, and patient habits. Naenni *et al.* [17] noted that retention loss is primarily influenced by the framework material, with metal and zirconia frameworks showing higher retention loss, while alumina glass-infiltrated ceramics exhibit lower retention loss, though they have higher fracture rates. Notably, fractures in RBFDPs were observed exclusively in alumina glass-infiltrated ceramics [17]. Saker *et al.* [18] suggested that fractures could result from the protrusive and lateral movements that apply torque forces on the abutment teeth. In the reviewed

studies, no fractures were observed with zirconia ceramics (specifically, IPS E.maxZircad veneered with IPS e.max ceramic). Zirconia is known to possess the highest fracture strength among dental ceramics and delivers promising results [18, 19].

In certain studies, a rubber dam was employed during the cementation process, but no clear benefit was found regarding the survival of the prostheses. All prostheses underwent air-borne particle pretreatment, although some researchers suggested that RBFDPs made from zirconia and pretreated with nano-structured alumina particles could serve as effective alternatives to the traditional airborne-particle abrasion method [20, 21].

## Conclusion

RBFDPs demonstrate favorable results with high survival rates, making them a viable option alongside other treatment methods. While debonding remains a significant concern, its occurrence is minimized when using resin cement-based luting agents and zirconia ceramic frameworks.

**Acknowledgments:** The authors wish to express gratitude for the support provided by the REU research center.

**Conflict of Interest:** None

**Financial Support:** None

**Ethics Statement:** None

## References

1. Mascetti T. Clinical management of lithium disilicate single-retainer resin-bonded fixed restorations. *Int J Esthet Dent*. 2022;17(2):140-51.
2. Mekeres GM, Buhaş CL, Csep AN, Beiuşanu C, Andreescu G, Marian P, et al. The importance of psychometric and physical scales for the evaluation of the consequences of scars—A literature review. *Clin Pract*. 2023;13(2):372-83.
3. Sosnovskikh EV, Rubtsov DA, Stepanova NY, Kruchinin EV, Autlev KM. Reproductive function in patients with morbid obesity after bariatric surgery. *J Biochem Technol*. 2021;12(1):63-6.
4. Di Fiore A, Mazzoleni S, Zuccon A, Gracco A, Stellini E. Biomechanical behavior of anterior cantilever resin-bonded fixed dental prostheses fabricated with four different metal-free materials. In *Atti 27° Congresso nazionale Collegio dei Docenti Universitari di discipline Odontostomatologiche* 2020 (Vol. 12, pp. 426-426).
5. Juanita M, Dammar I. Aesthetic management of anterior cantilever bridge with ovate pontic: A case report. *Makassar Dent J*. 2022;11(1):75-9.
6. Al Hussian BS, Al Hammad M, Al Amri N, Al F, Markhan AA, Al Deraibi Z, et al. Application of lasers in various procedures performed in prosthodontics; A systemic review. *Pharmacophore*. 2022;13(4):129-34.
7. Beh YH, Ariffin A. Critical evaluation of failed maxillary resin bonded: A Case Study. *J Dent Indones*. 2022;29(2):147-53.
8. Alshareef RAG, Mobarki GA, Alshemaisi MM, Altkhais YM, Alotaibi BS, Alshehri LS, et al. Evaluation of the use of photodynamic therapy in endodontics. *Pharmacophore*. 2021;12(6):37-42.
9. Anweigi L, Azam A, De Mata C, AlMadi E, Alsaleh S, Aldegheishem A. Resin bonded bridges in patients with hypodontia: Clinical performance over a 7 year observation period. *Saudi Dent J*. 2020;32(5):255-61.
10. Yazigi C, Kern M. Clinical evaluation of zirconia cantilevered single-retainer resin-bonded fixed dental prostheses replacing missing canines and posterior teeth. *J Dent*. 2022;116:103907.
11. Malgaj T, Papšik R, Abram A, Kocjan A, Jevnikar P. Bonding performance of surface-treated zirconia cantilevered resin-bonded fixed dental prostheses: In vitro evaluation and finite element analysis. *Materials*. 2023;16(7):2646.
12. El Yaagoubi S, Bouabid M, El Yamani A. Cantilever resin bonded bridges... what evolution? About case reports. *Integr J Med Sci*. 2021;8:1-6.
13. 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;27(3):266-75. doi:10.1111/jopr.12555
14. Kern M. Clinical long-term survival of two-retainer and single-retainer all-ceramic resin-bonded fixed partial dentures. *Quintessence Int*. 2005;36(2):141-7.
15. Sasse M, Eschbach S, Kern M. Randomized clinical trial on single retainer all-ceramic resin-bonded fixed partial dentures: influence of the bonding system after up to 55 months. *J Dent*. 2012;40(9):783-6.
16. Galiatsatos AA, Bergou D. Clinical evaluation of anterior all-ceramic resin-bonded fixed dental prostheses. *Quintessence Int*. 2014;45(1):9-14.



17. Naenni N, Michelotti G, Lee WZ, Sailer I, Hämmerle CH, Thoma DS. Resin-bonded fixed dental prostheses with zirconia ceramic single retainers show high survival rates and minimal tissue changes after a mean of 10 years of service. *Int J Prosthodont.* 2020;33(5):503-12.
18. Saker S, El-Fallal A, Abo-Madina M, Ghazy M, Özcan M. Clinical survival of anterior metal-ceramic and all-ceramic cantilever resin-bonded fixed dental prostheses over a period of 60 months. *Int J Prosthodont.* 2014;27(5):422-4.
19. Sailer I, Hans Franz Hämmerle C. Zirconia ceramic single-retainer resin-bonded fixed dental prostheses (RBFDPs) after 4 years of clinical service: A retrospective clinical and volumetric study. *Int J Periodontics Restorative Dent.* 2014;34(3):333-43.
20. Klink A, Hüttig F. Zirconia-based anterior resin-bonded single-retainer cantilever fixed dental prostheses: A 15-to 61-month follow-up. *Int J Prosthodont.* 2016;29(3):284-6.
21. Kern M, Passia N, Sasse M, Yazigi C. Ten-year outcome of zirconia ceramic cantilever resin-bonded fixed dental prostheses and the influence of the reasons for missing incisors. *J Dent.* 2017;65:51-5.