Review Article

MANAGEMENT OF ANTERIOR RESIN BONDED CANTILEVER: A REVIEW OF RECENT LITERATURE

Abdullah Binassfour[1], Alhanouf Alamri[2], Yara bushnaq[2], Razan Almutairi[2], Badreah Alyaqoub[3], Nouf Alamri[4]*

[1]*Department of Prosthodontics, College of Dentistry, Riyadh Elm University, Riyadh, KSA. Abdullah.binassfour@riyadh.edu.sa*
[2]*Department of Internship training program, College of Dentistry, Riyadh Elm University, Riyadh, KSA.*
[3]*Department of general dentistry, College of Dentistry, Riyadh Elm University, Riyadh, KSA.*
[4]*Department of general dentistry, Private Clinic, Riyadh, KSA.*

https://doi.org/10.51847/7chQHKcYSH

ABSTRACT

There are many options to replace anterior missing teeth, including implant-supported prosthesis, fixed dental prosthesis, and resin-bonded fixed dental prosthesis. However, implant replacement has some limitations to placing it directly in an edentulous area. In such cases who have hard and soft tissue deficiency might need bone augmentation and connective tissue grafting. The Study aims to systematically review anterior resin bonded cantilever management and Educate practitioners about managing the failures of (RBCFPS). A systematic review was conducted after searching electronic databases Cochrane, Pubmed, google scholar, and SDL Research Databases for articles published in English between 2000 to 2022. Overall, 3225 articles were discovered from the initial electronic search, 110 studies were left after the manual search by titles, duplicate removal, and exclusion of the unwanted studies .40 articles were assessed as a full text, and only 14 were included in this review. It appears that RBFDPs have promising outcomes and high survival rates. It's also comparable to other treatment modalities, Debonding is a main issue, but it decreases when using a luting agent containing resin cement and the zirconia ceramic framework.

Key words: Resin bonded cantilever, Prosthodontics, Literature review, Dental rehabilitation.

Introduction

There are many options to replace anterior missing teeth, including implant-supported prosthesis, fixed dental prosthesis, and resin-bonded fixed dental prosthesis. However, implant replacement has some limitations to placing it directly in an edentulous area [1]. In such cases who have hard and soft tissue deficiency might need bone augmentation and connective tissue grafting [2]. In such situations, due to the aggressiveness of the treatment options and the patient fear of surgery, they will prefer alternative simple treatment [3]. other limitations, like the patient's age, who cannot receive implant-supported prosthesis until adulthood, to avoid potential complications with implant infra-position [4].

The conventional fixed dental prosthesis is securely retained in natural teeth. The crown preparation removes 63% to 72% of the total sound tooth structures. However, endodontic treatment might be needed due to the crown preparation or the size of the pulp chamber and morphology of the tooth, which will increase the cost of the treatment [5].

A resin-bonded fixed dental prosthesis is a conservative alternative treatment that will meet the patient's wishes for Esthetics and function needs [6]. In 1973, Rochette came up with the idea of bonding a metal retainer to enamel using adhesive cement. in the early 1990s, a modification was made to use oxide ceramics instead of metals as the framework material. The significant improvements in materials and clinical techniques have solved the failure rate of depending and ceramic chipping of RBFDPs [7].

The main advantages of a single retainer are the simplicity of the minimally invasive preparation design, reduced endodontic complications, and reduced financial costs [8]. The design of the resin-bonded cantilever is made of a wing-like extension, which is bonded to the abutment tooth or teeth, using strong dental adhesive so that it stays over the long term [9].

Retention of (RBFPD) is achieved by utilizing adhesive resin cement to adhere the restoration to the enamel [10]. Appropriate case selection and bridge design are important variables in the success of the project (RBFPD). Patient-related parameters (patient's age, expectations, pontic position, abutment tooth assessment, and occlusion) are all taken into account while choosing a case [11]. Periodontal health, a slightly repaired tooth, and acceptable clinical crown height are among the abutment tooth selection factors [12].

The aim of the Study is Review systematically Anterior resin bonded cantilever management and Educate practitioners about managing the failures of (RBCFPS).

Materials and Methods

A systematic review was conducted after searching electronic databases Cochrane, Pubmed, google scholar, and SDL Research Databases for articles published in English between 2000 to 2022. The search text words included (Anterior resin bonded cantilever and Management of cantilever). After the application of exclusion criteria, All the titles and abstracts were screened in detail, and the results were analyzed.

Inclusion criteria

1. Human subjects
2. English language
3. Studies on anterior all-ceramic and metal-ceramic cantilever RBFDPs
4. Randomized controlled clinical trials (RCTs), controlled clinical trials (CCTs), retrospective studies (RSs), and prospective studies (PSs)
5. Publications articles, starting from 2000 up to 2022.
6. Studies with a minimum observation time of 1 year
7. anterior RBFDPs
8. pree reviewed.

Exclusion criteria

1. Animal studies
2. Papers in a language other than English
3. In vitro and finite element analysis studies
4. Case reports, case studies, and posterior RBFDPs 5.
5. Studies before 2000
6. Short-term studies (less than 1 year)
7. Posterior RBFDPs

PICO

P- Patient with Anterior resin-bonded cantilever.
I- Identify the changes in the Anterior resin-bonded cantilever
C- Compare between the old and new cantilever management.
O- Educate practitioners about the improvement and management

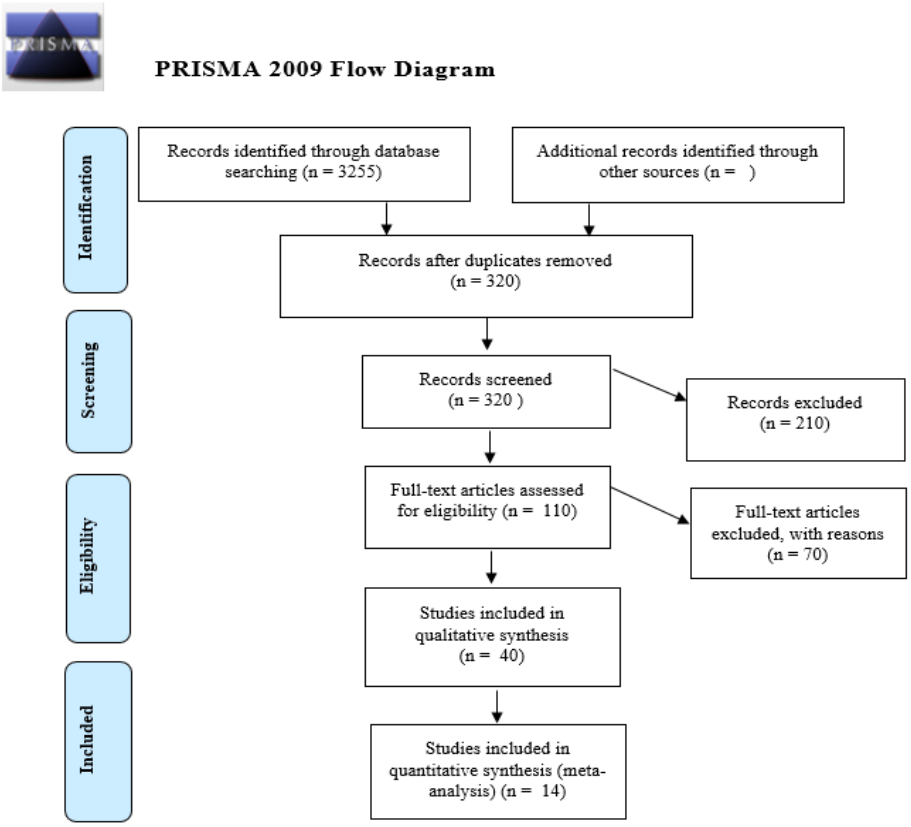

Figure 1. PRISMA flow chart showing the screening process of included studies

Results and Discussion

Overall, 3225 articles were discovered from the initial electronic search, 110 studies were left after the manual search by titles, duplicate removal, and exclusion of the unwanted studies .40 articles were assessed as a full text, and only 14 were included in this review.

This systematic review includes 5 retrospective studies, 6 prospective, and 3 randomized controlled trials that meet the inclusion criteria. the following was found :

List of the included literature **(Table 1)**

Table 1. Summary of results from included studies.

Auther /Year	Study Design	Sample Size	Follow Up Period	Material	Cement	Type of Failure	Success Rate/ Survival Rate	Complication
A. W. K. Chan *et al*. 2000	A prospective study patient divided into 2 groups: group A FF group B CL	24SUBJECT 25RBFPD 12FF 13CL	14 TO 45 months	METAL FRAMEWORK	Panavia (resin cement) + RUBBERDAM	Debonding ONE FF deboned, than it was turned into a CL and recemented	Retention was the only criteria for success no survival rete mentioned	the metal framework showing through thin or translucent anterior teeth
Matthias Kern *et al*. 2005	A prospective study	30P 37RBFPD 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 6FF: 1frctured in both connectors, 1removed accidentally, 4fractured at 1 connector and remained in situ as CL	-5YEAR 92.3% CL 73.9%FF survival rate	No complications mentioned
Martin Sasse 2012	Randomized clinical trial	30CL	5 years	zirconia ceramic (IPS e.max ZirCAD veneered with IPS e.max Ceram; both Ivoclar Vivadent)	Either a phosphate monomer containing resin (Panavia) without any primer or using an adhesive bonding system with a phosphoric acid acrylate primer for the zirconia ceramic (Multilink–Automix bonding system with Metal/ Zirconia primer.	2 debonding by tramatic event.	Both RBFPDs could be rebonded successfully, resulting in a three-year survival rate of 100%.	-
Martin Sasse *et al*. 2014	A prospective study	37p 42cl	-61.8 months	yttrium oxide-stabilized zirconium oxide ceramic	Panavia 21 TC	Debonding only 2 debonding happened	the success rate was 95.2% after 6 years	No complications mentioned

Aristidis A. Galiatsatos 2014	Clinical evaluation	54	1, 2, 4, 6, and 8 years after placement	glass-infiltrated alumina ceramic In-Ceram	Dual polymerizing composite resin cement (Variolink II, Ivoclar Vivadent)	2 Deboned,1 patient unsatisfied,6 Fractures	At 8 years, the success rate was 85.18%.	-
Samah Saker 2014	retrospective cohort study	(22 women, 18 men	60 Months	cobalt-chromium-ceramic or glass-infiltrated alumina	resin cement	Two fractures were observed with AC. No debonding was observed with MC (n = 0) but was observed with AC.	MC: 100%; AC: 90%;	-
Irena Sailer *2014*	Retrospective study	15	8 years	Zirconia ceramic	Resin cement (Panavia 21 TC).	2 debonding	No catastrophic failure due to fracture of an RBFDP occurred. Furthermore,noneoftheRBFDPs had to be removed due to technical or biological complications. Hence, the zirconia ceramic RBFDPs had a survival rate of 100%.	-
Michael G. Botelho *et al.* 2016	A prospective study	22p 13CL FF10	216.5 ±20.8 months	METAL FRAMEWORK	Panavia (resin cement) + RUBBERDAM		retention	absence of complications requiring intervention
Andrea Klink *et al.* 2016	A prospective study	18p 9m 9f 24CL	35 months	different zirconia materials	(all luting materials, Ivoclar Vivadent].	Debonding	95.5% success between 82.4% and 76% survival	-

Matthias Kern *et al*. 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 + RUBBERDAM	Debonding luted with Panavia 21 TC debonded (4.2%), luted with Multilink Automix debonded (14.2%). Loss of restoration	10-year survival rate of 98.2	
Menaka Abuzar 2018	A retrospective study		206Arrbs	-	adhesive resin cement	Debonding	95.1% at 12 years and beyond	-
Nadja Naenni 2020	Retrospective study	10 years	10	zirconia (IPS e.max ZirCAD, Ivoclar Vivadent; Cerion, Straumann	(Panavia 21 TC, Kuraray)	2 Loss of retention,	The survival rate after a mean follow-up time of at least 10.0 years was 100%	-
Hai-Yan Qiu *et al*. 2020	prospective	12 to 40 months.	186 CRBFPDs	Cobalt-chrome alloy	Panavia F 2.0	(1.1%) were regarded as failed	(88%) survived	- Complications were recorded when bridges were debonded on ! 2 occasions
Tine Malgaj 2021	Randomized clinical trial	3 year		zirconia frameworkS	Panavia (resin cement) + RUBBERDAM divided into 2 groups for different pretreatment the first group (n=15) (APA), where the bonding surface was airborne-particle abraded, served as the control. In the second group (n=16), the restorations were pretreated with NAC.	Debonding	The 2year survival rate of 93.8% for the NAC RBFDPs was higher than 86.7% for the APA RBFDPs	

The goal of this review is to assess the management of cantilever RBFDPs in the anterior region; cantilever RBFDPs can be considered as an alternative option to more invasive treatments like implant surgery or FDPs, especially since there are more contraindications for those treatment options like young or medically compromised

patients, also Mourshed *et al*. (2018) reported RBFDPs longevity can be comparable with FDP. Furthermore, the enhancement of the traditional two-retainer RBFDPs design to a cantilever design raised its survival rate and longevity [13, 14]. The cantilever has a higher success rate, as explained by Sasse *et al*. (2012), due to the differential movements of the abutment teeth that stress the bonding interface of the two-retainer design prosthesis. Such inter abutment stress is not possible with cantilever designs. The stress of the movement over time will fatigue the bonding interface, which leads to debonding [15]. In the literature extracted for this review, the main failure type is deboning, which a multi-faceted issue is caused by many factors such as the Design of the RBFDP, as discussed earlier, the choice of luting cement, and the RBFDP framework material [16].

Most of the studies included used phosphate monomer-containing composite resin like the (Panavia21) as a luting cement, and it showed positive results as it has a higher bonding strength than the other cement-like (Multilink-Automix). Despite that, there was no significant difference discovered between them. As well, debonding could occur due to other events, including trauma, habits, and food culture.

Naenni *et al*. (2020) reported the loss of retention is mainly dependent on the framework material, which in metal and zirconia frameworks is higher and less in alumina glass infiltrated ceramics, but conversely, fracture rates are higher in alumina glass infiltrated ceramics. Fracture of the RBFDP was only a failure that is observed in alumina-infiltrated ceramics [17]. Saker *et al*. explained the fracture might be attributed to the protrusive and lateral movement that leads to torque force in the abutment teeth. In the included literature, no fractures occurred using a zirconia ceramic (IPS E.maxZircad veneered with IPS e.max ceramic). Overall, zirconia has the highest fracture strength among dental ceramics, and it gives promising outcomes [18, 19].

Also, a rubber dam was used in the cementation process in some of the studies, but no advantage was observed in the survival of the prostheses. All the prostheses were pretreated with air-borne particles, but some authors reported RBFPDs made with zirconia and pretreated with nano-structured alumina particles are viable alternatives to conventional airborne-particle abrasion pretreatment [20, 21].

Conclusion

It appears that RBFDPs have promising outcomes and high survival rates. It's also comparable to other treatment modalities, Debonding is a main issue, but it's desirable when using a luting agent containing resin cement and the zirconia ceramic framework.

Acknowledgments: We would like to acknowledge the support of 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, Buhaș CL, Csep AN, Beiușanu 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. InAtti 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, Papšík 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.