CASE REPORT

Recevied/ Geliş Tarihi: 22.01.2025
Accepted/ Kabul Tarihi: 21.03.2025
Published / Yayın Tarihi: 31.08.2025

Aydın Dental Journal - Volume **11** Issue **2** - August **2025** (155-161)

Aydın Dental Journal

Journal homepage: http://dergipark.ulakbim.gov.tr/adj

DOI: 10.17932/IAU.DENTAL.2015.009/dental_v011i2005

Digital Workflow in the Anterior Tooth Rehabilitation with Resin-Bonded Fixed Partial Dentures

Dijital İş Akışıyla Anterior Diş Eksikliklerinin Rezin Bağlı Sabit Bölümlü Protezler ile Rehabilitasyonu

Bensu Çalışkan Çelik[1*], Beril Bayraktar[2], Gökhan Akgüngör[3]

Özet

Introduction: Resin-bonded fixed partial dentures (RBFPDs) are a minimally invasive, aesthetic, and cost-effective treatment option for anterior tooth deficiencies. The use of a fully digital workflow in these restorations enhances comfort for both the patient and the clinician.

Case Report: In this case report, a glass ceramic RBFPD was fabricated using a computer-aided design and computer-aided manufacturing (CAD-CAM) system for a young patient with congenital tooth agenesis who had undergone orthodontic treatment. The RBFPD was intended for use until implant treatment could be performed. The restoration was cemented using adhesive resin cement.

Conclusion: After a one-year clinical follow-up of the lithium disilicate RBFPD restoration in a young patient with congenital tooth agenesis, successful outcomes were achieved.

Keywords: *Adhesive cementation, CAD-CAM, Lithium disilicate, Resin-bonded fixed partial dentures.*

Abstract

Giriş: Rezin bağlı sabit bölümlü protezler (RBSBP) anterior bölgedeki diş eksikliklerinde minimal invaziv, estetik ve ekonomik bir tedavi seçeneğidir. Bu restorasyonlarda tümüyle dijital iş akışının kullanımı hem hasta hem hekim konforunu arttırmaktadır.

Olgu Sunumu: Bu olgu sunumunda konjenital diş eksikliği olan ve ortodontik tedavi görmüş olan genç hastaya, implant tedavisi gerçekleşene kadar geçen sürede kullanılmak üzere bilgisayar destekli tasarım ve bilgisayar destekli üretim (CAD-CAM) sistemi kullanılarak cam seramik RBSBP üretilmiş ve adeziv rezin siman kullanılarak simante edilmiştir.

Sonuç: Konjenital diş eksikliği olan genç hastanın lityum disilikat RBSBP restorasyonu ile rehabilitasyonu sonrası 1 yıllık klinik takibinde başarılı sonuçlar elde edilmiştir.

Anahtar kelimeler: *Adeziv simantasyon, CAD-CAM, Lityum disilikat, Rezin bağlı sabit protez.*

[1]PhD Student, Institute of Graduate Studies in Health Sciences, Istanbul University, Istanbul, Turkiye
[2]Asst. Prof., Department of Prosthodontics, Istanbul Atlas University, Istanbul, Turkiye
[3]Prof. Dr., Department of Prosthodontics, Istanbul University, Istanbul, Turkiye

Corresponding Author: Bensu Çalışkan Çelik, **e-mail:** bensucaliskan@hotmail.com, **ORCID:** 0000-0003-1191-955X, Istanbul University, Institute of Graduate Studies in Health Sciences, Vezneciler, Istanbul, Turkiye.

Introduction

Various treatment options, including implant-supported prostheses, conventional fixed partial dentures and resin-bonded fixed partial dentures (RBFPD) are available for the rehabilitation of anterior tooth loss. Implant treatment may not be applicable to every patient.[1-3] In cases of hard and soft tissue deficiency in the edentulous area, patients may prefer tooth-supported prostheses due to surgical procedures, increased treatment costs, and fear of surgery. Additionally, if the patient is under 18 years old, implant placement should be postponed until adulthood due to the potential complications of implant infra-position.[1,4-6] Among tooth-supported restorations, fixed partial dentures are the most invasive option, as it has been reported that 63% to 72% of the total healthy tooth structure must be removed during crown preparations.[7,8] Furthermore, there is a risk of complications such as pulpal damage to the abutment tooth.[9]

RBFPDs are conservative restorations that do not irritate the pulp, requiring minimal preparation of abutment teeth and terminating the preparation margin at the enamel surface. Additionally, gingival and periodontal complications are less common due to the supragingival design of the restoration. The preference for this method is influenced by its short clinical and laboratory process, low cost, and ease of treatment application.[10-12] The indications for the clinical use of RBFPDs include vital and caries-free teeth and deficiencies of maxillary lateral, mandibular central or lateral incisors. They can be used as permanent or temporary prostheses in implant and fixed partial denture planning.[13,14] This method requires the treated tooth to have minimal or no occlusal interference. Shallow incisal guidance should be preferred to avoid vertical overlap. In the early years of application, bonding problems between the cement and RBFPD were observed. However, with the advancement of surface modification techniques and modern adhesive systems, these issues have been mostly resolved, and treatment success rates have increased.[15]

Metal-supported ceramic restorations have been used for many years in the fabrication of RBFPDs.[6] However, due to the disadvantages such as the bonding problem between dental tissues and metal alloys, esthetic problems and the risk of corrosion and allergy of metal alloys, fiber-reinforced composites, ceramics containing high glass particles (lithium disilicate, glass-infiltrated zirconia/alumina) or high-strength ceramics (zirconium oxide, aluminum oxide) are currently used as substructure materials or monolithic.[16-20] With the development of new dental materials and computer-aided design/computer-aided manufacturing (CAD-CAM) technology, RBFPDs can be fabricated using glass-infiltrated alumina ceramics, lithium disilicate glass ceramics or zirconia.[21,22] In recent years, the use of glass ceramics has increased in modern adhesive dentistry due to their high biocompatibility and strong bonding properties.[23-26]

By scanning and designing CAD-CAM-fabricated restorations directly in the mouth, expansion in plaster models, contamination from impression materials, inaccuracies in traditional impressions, and casting-related manufacturing errors can be prevented.[25]

This case report details the fabrication process of a double retainer RBFPD using CAD-CAM technology for a young patient with congenital lateral tooth agenesis, aiming to fulfill the patient's temporary fixed prosthesis needs. The purpose of this study is to evaluate the clinical effectiveness of CAD-CAM-based digital workflow, its impact on patient comfort, and the short-term success of the restoration.

Case Report

A 16-year-old female patient with congenital bilateral lateral teeth agenesis who had undergone orthodontic treatment presented to the Istanbul University Faculty of Dentistry. Clinical and radiographic evaluations were performed at the Department of Prosthodontics. Following consultations with the Departments of Orthodontics and Oral, Dental, and Maxillofacial Surgery, it was decided to delay implant surgery until the patient turned 21. A retention appliance was prepared to act as a space maintainer after orthodontic treatment. (Fig 1) Since the patient wished to use a fixed prosthesis during this period, her dental deficiencies were evaluated in terms of RBFPDs. The patient's long-term implant treatment plan, age, esthetic expectations, occlusion, vertical and horizontal overlap were assessed. It was decided to apply a double retainer RBFPD fabricated using lithium disilicate material through an indirect method.

Figure 1: a. Intraoral view of the patient before treatment. b. Occlusal view of the maxillary arch. c. The orthodontic retainer

Following the removal of the space maintainer previously made for the central incisors, minimal invasive tooth preparation was performed on the palatal surfaces of the central and canine teeth at the enamel level. After the preparation, digital impressions were taken using TRIOS 4 Move+ (3Shape, Copenhagen, Denmark) and the abutment teeth were identified. Shade selection was also performed digitally with TRIOS 4 Move+. (Fig 2) The shade for the canine teeth was determined as 3M2, while that for the central teeth was 2M2. Since the shade of the canine teeth was darker, the central teeth shade was used as the reference. The data were sent to the laboratory, where the three-dimensional printed resin models and IPS E-max CAD (Ivoclar Vivadent, Schaan, Liechtenstein) RBFPD were produced. (Fig 3)

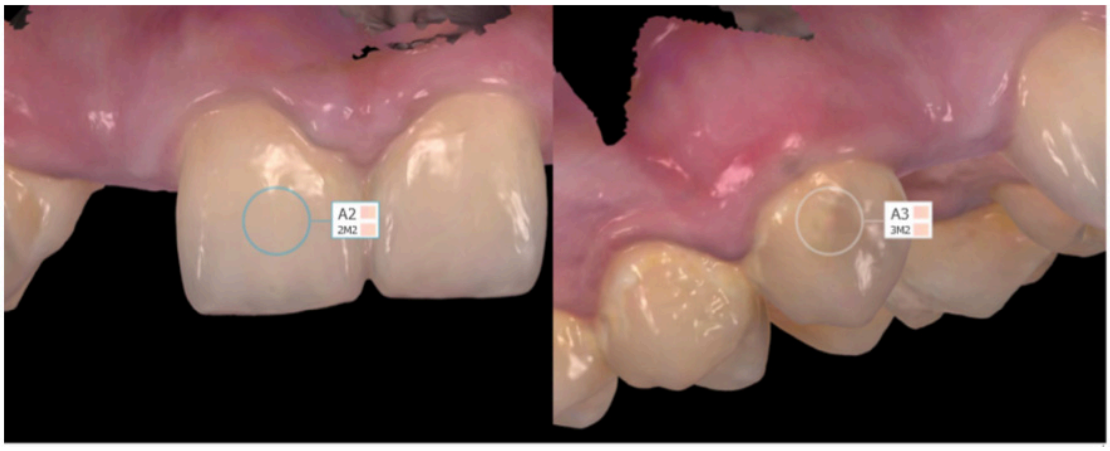

Figure 2: Shade selection with TRIOS 4 MOVE+.

After trial fitting, the cementation process was carried out. Initially, the inner surfaces of the palatal retainers were etched with 9% hydrofluoric acid for 20 seconds, rinsed, and dried. Subsequently, silane was applied and left for 60 seconds. The enamel was etched with 37% orthophosphoric acid for 15 seconds, rinsed, and dried. Bonding was applied and light-cured. A dual-cure resin cement (Nova Resin, Imicryl, Turkey) was used as the cement. After 5 seconds of initial light-curing, cement residues were cleaned. The restoration was then light-cured for 20 seconds from the palatal and incisal sides.

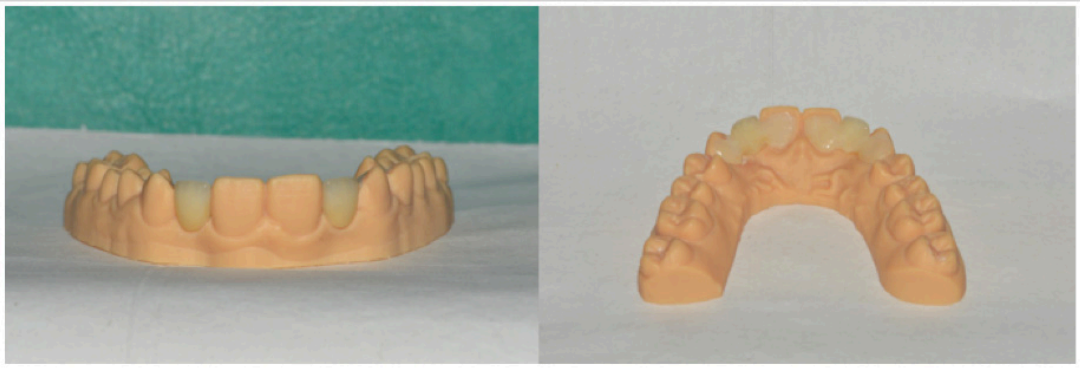

Figure 3: View of the restorations on the resin model.

After cementation, occlusion was checked using articulating paper, and premature contacts were adjusted with a diamond bur. (Figure 4)

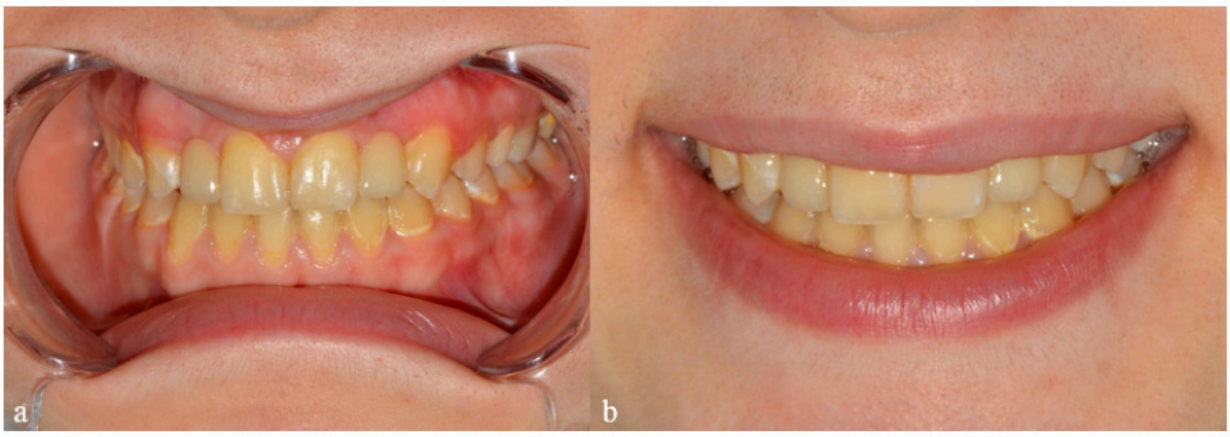

Figure 4: a. Intraoral view after cementation. b. Final appearance of the restoration.

Discussion

This case report presents the indirect restoration of dental deficiencies using all-ceramic lithium disilicate RBFDP, considering the patient's age, esthetic expectations, and economic circumstances. IPS e.max CAD lithium disilicate (Ivoclar Vivadent, Schaan, Liechtenstein) is the most commonly used glass-ceramic in dentistry. Compared to alternative materials like metal-ceramic, zirconia and fiber-reinforced composite, it offers superior properties.[13] Due to its translucency, it can mimic the natural appearance of teeth. Its high biocompatibility and the strong bonding to the tooth structures, making it a favorable choice.[5] The most common complication in RBFPDs is debonding. Metal-ceramic has the highest rate of debonding, followed by fiber-reinforced composite, zirconia and glass-ceramic respectively. In our case, lithium disilicate based glass-ceramic exhibited the best performance in these aspects. In lithium disilicate RBFPDs, the problem of debonding caused by the failure of the connection between the tooth and zirconia can be prevented.[11] Another common complication of RBFPDs is fractures.[8] Gresnigt et al.[22] reported that there was no statistically significant difference between the fracture strength values of lithium disilicate and metal RBFPDs. Additionally, lithium disilicate RBFPDs demonstrated comparable fracture resistance to zirconia RBFPDs.

A five-year clinical follow-up study in the literature reported survival rates of 91.3% for metal-ceramic and 95.3% for glass-ceramic RBFPDs. These findings indicate that glass-ceramic RBFPDs are a more successful alternative compared to metal-ceramic RBFPDs.[6] A systematic review of 23 articles published between 2000 and 2020 analyzed the five-year survival rates of RBFPDs fabricated from various materials. Fiber-reinforced composite RBFPDs had a survival rate of 81.7%, metal-ceramic 86.2%, zirconia 87.9%, while glass-ceramics demonstrated a 100% success rate.[23] Based on these findings, lithium disilicate RBFPDs can be considered a viable treatment option, both as a temporary and permanent solution, even in long-term follow-ups. Zhang et al.[5] attribute the superior fracture and flexural strength of lithium disilicate compared to other materials to its elastic modulus, which closely resembles that of enamel. Long-term data reveal that glass-ceramic cantilever RBFPDs show a decline in success after six years, necessitating continued monitoring. However, zirconia and glass-infiltrated alumina cantilever RBFPDs have demonstrated excellent durability with survival rates extending up to 10 and 15 years. These findings reinforce the clinical applicability of cantilevered RBFPDs and support their viability as a long-term treatment option for anterior tooth replacement. [26]

RBFPDs can be designed with single or double retainers. Studies in the literature have examined both designs.[1,5,10,15,23,24] Since RBFPDs rely solely on support from the palatal surfaces of abutment teeth, achieving adequate retention is crucial. This is explained by the bond strength of materials to enamel surfaces and is also associated with the clinical crown length. In cases with short clinical crown lengths, the reduced surface area negatively impacts retention when single-retainer designs are used.[14] In this case, double-retainer RBFPDs were preferred to achieve adequate retention and extend the survival. Furthermore, some studies have indicated that

manufacturers do not recommend fabricating single-retainer RBFPDs from lithium disilicate material.[2,22] Some studies found that the five-year survival rate of double-retainer RBFPDs was 89.3%.[6,9] Double-retainer RBFPDs are also known for their space-maintaining capability.[3,12] In this case, interdisciplinary consultations involving the Departments of Orthodontics and Oral, Dental, and Maxillofacial Surgery concluded that a double retainer RBFPD represented the most clinically appropriate approach for preserving the edentulous space in anticipation of future implant placement.

Studies evaluating patient satisfaction reported no statistically significant difference between single-retainer and double-retainer RBFPDs.[23]

The survival rate of RBFPDs is significantly influenced by the absence of long edentulous spans, deep overbites, and bruxism.[10] This case was evaluated in light of these factors and no risks were identified.

A digital workflow minimizes errors caused by impression materials, accelerates the production process and enhances patient comfort.[1,25] For this reason, in this case, production was done using digital impression technique and CAD-CAM. Additionally, shade selection was performed using an intraoral digital scanner, minimizing errors in highly esthetic anterior restorations and achieving a natural appearance.

After one year of clinical follow-up, no complications such as debonding, fracture, or discoloration were observed in the lithium disilicate RBFPDs. No caries or sensitivity was detected in the abutment teeth. According to the literature, RBFPDs have sufficient mechanical strength for the rehabilitation of short anterior edentulous spans, but further studies are needed to evaluate their survival in posterior regions and long-span edentulous areas.

Conclusion

Within the conditions and limitations of this case report, it was concluded that lithium disilicate RBFPDs can be used as an alternative to implant-supported prosthesis in congenital or traumatic lateral tooth deficiencies due to their high translucency, bonding strength to enamel, elastic modulus close to enamel and therefore good fracture and flexural strength values. Although the one-year follow-up demonstrated successful clinical outcomes, further long-term studies are necessary to comprehensively evaluate the durability and longevity of this treatment approach.

Acknowledgements

None.

Ethical Approval

Ethical approval is not necessary. An informed consent form is available.

Conflict of Interest

None of the authors of this article has any relationship, connection or financial interest in the subject matter or material discussed in the article.

Sources of Funding

During this study, no material and/or moral support was received from any pharmaceutical company directly related to the research topic, any company that supplies and/or manufactures medical devices, equipment and materials, or any commercial company that could negatively affect the decision to be made regarding the study during the study evaluation process.

Authorship Contributions

Idea/Concept: B.Ç.Ç Design: B.Ç.Ç Control/ Supervision: B.Ç.Ç, B.B Literature Review: B.Ç.Ç, B.B Data Collection and/or Processing: B.Ç.Ç Analysis and/or Interpretation: B.Ç.Ç, G.A Writing the Article: B.Ç.Ç Critical Review: B.Ç.Ç, G.A

References

1. 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;30(4):307-18.
2. Sun Q, Chen L, Tian L, Xu B. Single-tooth replacement in the anterior arch by means of a cantilevered IPS e.max Press veneer-retained fixed partial denture: case series of 35 patients. *Int J Prosthodont.* 2013;26(2):181-7.
3. Paduano S, Laino A, Michelotti A, Viglione G. Uso del Maryland Bridge come mantenitore di spazio: considerazioni su un caso clinico [Use of the Maryland Bridge for space maintenance: discussion of a clinical case]. *Arch Stomatol (Napoli).* 1988;29(6):1317-26.
4. Zitzmann NU, Arnold D, Ball J, Brusco D, Triaca A, Verna C. Treatment strategies for infraoccluded dental implants. *J Prosthet Dent.* 2015;113:169-74.
5. Zhang X, Li T, Wang X, Yang L, Wu J. Glass-ceramic resin-bonded fixed partial dentures for replacing a single premolar tooth: A prospective investigation with a 4-year follow-up. *J Prosthet Dent.* 2020;124(1):53-9.
6. Zitzmann NU, Büren AV, Glenz F, Rohr N, Joda T, Zaugg LK. Clinical outcome of metal- and all-ceramic resin-bonded fixed dental prostheses. *J Prosthodont Res.* 2021;65(2):243-8.
7. Edelhoff D, Sorensen JA. Tooth structure removal associated with various preparation designs for anterior teeth. *J Prosthet Dent.* 2002;87:503-9.
8. 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;27:266-75.
9. Yoshida T, Kurosaki Y, Mine A, Kimura-Omo A, Mino T, Osaka S, et al. Fifteen-year survival of resin-bonded vs full-coverage fixed dental prostheses. *J Prosthodont Res.* 2019;63:374-82.
10. Durkan R, Deste G, Özkır SE. Adeziv Maryland köprü restorasyonunda Y-TZP tam kontür zirkonya seramik sisteminin kullanılması: Klinik vaka raporu. *A.Ü. Diş Hek. Fak. Derg.* 2017;44(2):123-8.
11. 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;28(11):1421-32.
12. Thakur A, Dwivedi S, GV Babu. Maryland bridge in a 4 year old patient: A case report. *J Adv Med Dent Scie Res.* 2022;10(3):53-5.
13. Leos MFS, Flores LEC, Cruz N, Palencia PG. Materials used in rehabilitation of anterior teeth with Maryland adhesive bridge. *IJADS.* 2023;9(4):154-8.
14. Stylianou A, Liu PR, O'Neal SJ, Essig ME. Restoring Congenitally Missing Maxillary Lateral Incisors Using Zirconia-Based Resin Bonded Prostheses. *J Esthet Restor Dent.* 2016;28(1):8-17.
15. Lally U. Resin-bonded fixed partial dentures past and present--an overview. *J Ir Dent Assoc.* 2012;58(6):294-300.
16. Augusti D, Augusti G, Borgonovo A, Amato M, Re D. Inlay-retained fixed dental prosthesis: a clinical option using monolithic zirconia. *Case Rep Dent.* 2014;2014:629786.
17. Moslehifard E, Farid F. Single Tooth Replacement Using InCeram Resin Bonded Fixed Partial Denture: A Clinical Report. *J Dent (Tehran).* 2014;11(1):106-10.
18. Edelhoff D, Spiekermann H, Yildirim M. Metal-free inlay-retained fixed partial dentures. *Quintessence Int.* 2001;32(4):269-81.
19. Rosentiel SF, Land MF, Fujimoto J. Fiber reinforced composite fixed prostheses. *Contemporary Fixed Prosthodontics.* 4th ed. St.Louis, Miss: Elsevier Mosby; 2006. p.830-40.
20. Bahadırlı G, Ayyıldız S, Turp V, Şen D. Anterior Diş Eksikliklerinde Fiberle Güçlendirilmiş Adeziv Köprü Uygulamaları: Üç olgu sunumu. *ADO Klinik Bilimler Dergisi.* 2013;7(1):1419-26.
21. Kihara T, Shigeta Y, Ikawa T, Sasaki K, Shigemoto S, Ogawa T. Designing anterior cantilever resin-bonded fixed dental prostheses based on finite element analysis. *J Prosthodont Res.* 2023;67(3):418-23.
22. Gresnigt MMM, Tirlet G, Bošnjak M, van der Made S, Attal JP. Fracture strength of lithium disilicate cantilever resin bonded fixed dental prosthesis. *J Mech Behav Biomed Mater.* 2020;103:103615.
23. Mendes JM, Bentata ALG, de Sá J, Silva AS. Survival Rates of Anterior-Region Resin-Bonded Fixed Dental Prostheses: An Integrative Review. *Eur J Dent.* 2021;15(4):788-97.
24. Habibzadeh S, Khamisi F, Mosaddad SA, Fernandes GVO, Heboyan A. Full-ceramic resin-bonded fixed dental prostheses: A systematic review. *J Appl Biomater Funct Mater.* 2024;22:22808000241250118.
25. Jurado CA, Tsujimoto A, Watanabe H, et al. Chair-side CAD/CAM fabrication of a single-retainer resin bonded fixed dental prosthesis: a case report. *Restor Dent Endod.* 2020;45(2):e15.

26. Alqutaibi AY, Alghauli MA, Almuzaini SA, Alharbi AF, Alsani AA, Mubarak AM, et al. Failure and complication rates of different materials, designs, and bonding techniques of ceramic cantilever resin-bonded fixed dental prostheses for restoring missing anterior teeth: A systematic review and meta-analysis. *J Esthetic Restor Dent.* 2024;36(10):1396-411.