

Restoration of Missing Central Incisor with Cantilevered Zirconia Resin Bonded Fixed Dental Prosthesis



Sara Qureshi¹

BDS

Muhammad Waseem Ullah Khan²

BDS, FCPS

Momina Akram³

BDS, FCPS

Zarish Anjum⁴

BDS

Hafiz Muhammad Aamir Riaz⁵

BDS

Missing teeth in the anterior region can be a source of great aesthetic concern for the patient and its restoration presents an even greater challenge to the dentist. Invasive prosthodontic treatment modalities have many biological and biomechanical shortcomings. This clinical report presents a minimally invasive treatment option for a 17-year-old boy who wanted a replacement for his missing upper left central incisor, primarily due to aesthetic concerns. Missing tooth was restored with cantilevered zirconia resin bonded fixed dental prosthesis that has a durable functional and aesthetic outcome.

HOW TO CITE: Qureshi S, Khan MWU, Akram M, Anjum Z, Riaz HMA. Restoration of missing central incisor with cantilevered zirconia resin bonded fixed dental prosthesis. J Pak Dent Assoc 2022;31(4):194-197.

DOI: <https://doi.org/10.25301/JPDA.314.194>

Received: 18 March 2022, Accepted: 27 July 2022

INTRODUCTION

Missing teeth in the anterior region can be a source of various psychological implications for the patient due to compromised aesthetics and phonetic difficulties.¹ The replacement of a single anterior tooth in maxilla is one of the greatest challenges faced by dentists around the world. Implant supported crowns and conventional three unit fixed partial dentures are considered to be invasive prosthodontic treatment options with many biological and biomechanical complications.^{2,3,4} Resin bonded fixed dental prosthesis is a minimally invasive treatment modality especially for young adolescents. This reversible, cost-effective approach doesn't compromise the abutment tooth and the failures are often less disastrous when compared with the conventional bridge.⁵ The early resin bonded bridges were 'Rochette-bridges' with perforated metal retainers. Since they had limited longevity therefore, metal retainer surface was altered to provide micromechanical retention with the

aid of chemically active resin cements.⁶ The development of resin cements significantly improved the bond strength between the tooth surface and metal alloy.⁷

Zirconia Resin bonded Fixed Dental Prosthesis provides an aesthetic alternative to conventional metal framed resin bonded bridges. The superior aesthetic and mechanical properties of zirconia have made its use increasingly popular in restorative dentistry.⁸ Zirconia offers better strength, fracture resistance and toughness when compared with other ceramics.⁹ Single retainer cantilevered zirconia Resin Bonded Fixed Dental Prosthesis has shown promising results for the replacement of missing anterior maxillary tooth with significantly lower risk of failure.¹⁰ The decreased survival rate associated with the two-retainer design is due to the differential mobility of the abutment teeth which induces stress at the bonding interface and consequently results in debonding of the restoration.¹¹ Moreover two-retainer all ceramic RBFDP commonly experience unilateral fracture of the proximal connector due to interabutment stresses and eventually serve as a cantilever RBFDP later in life.¹²

This clinical report presents a viable treatment option for the replacement of a missing anterior tooth with careful treatment planning for a young patient who was extremely concerned about his aesthetics.

CLINICAL REPORT

A 17-year-old male patient reported to the Outpatient

1. MDS Resident, Department of Prosthodontics, de'Montmorency College of Dentistry, Lahore.
2. Assistant Professor, Department of Prosthodontics, de'Montmorency College of Dentistry, Lahore.
3. Assistant Professor, Department of Prosthodontics, de'Montmorency College of Dentistry, Lahore.
4. MDS Resident, Department of Prosthodontics, de'Montmorency College of Dentistry, Lahore.
5. MDS Resident, Department of Prosthodontics, de'Montmorency College of Dentistry, Lahore.

Corresponding author: "Dr. Sara Qureshi" < sara.fq14@gmail.com >



Figure 1a



Figure 1b



Figure 1c



Figure 2a

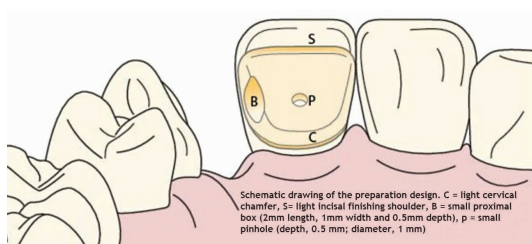


Figure 2b



Figure 2c

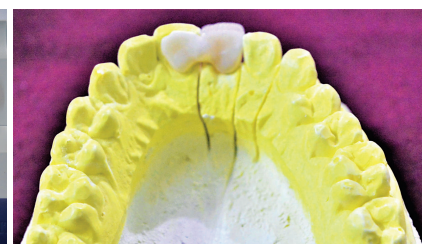


Figure 2d



Figure 3a



Figure 3b



Figure 3c

Department of Prosthodontics, de'Montmorency College of Dentistry, Lahore with the chief complaint of compromised aesthetics due to a missing maxillary left central incisor (figure 1a). The intra oral examination of the patient revealed healthy dentition with no signs of bruxism or wear facets on the occlusal surfaces. The patient had a vertical and horizontal overlap of approximately 2.5mm. Periapical X-ray of the abutments adjacent to the missing left central incisor showed no signs of bone loss or peri apical lesions (figure 1b). Extra oral examination of the patient exhibited no abnormal facial features or facial asymmetry (figure 1c) and the medical history of the patient was insignificant. Since the patient was not in favour of receiving any invasive dental treatment so porcelain veneered zirconia cantilever RBFDP was considered to be the most suitable treatment modality for the patient.

CLINICAL PROCEDURE

The clinical procedure began with the preparation of the maxillary right central incisor, which was chosen to serve as an abutment for the cantilever zirconia RBFDP. It was

prepared minimally on the lingual aspect with a supragingival finish line and 2mm short of incisal edge. A small proximal box of 2mm length, 1mm width and 0.5mm depth was prepared. Additionally, a pinhole (0.5mm depth; 1mm diameter) was made on the cingulum (figure 2a, 2b). After the abutment tooth preparation full arch dual phase single stage impression of the maxillary arch was taken in polyvinyl siloxane impression material, putty and light body (Zhermack Addition Silicone). The impression of the opposing arch was recorded in irreversible hydrocolloid. Shade selection was done using VITA tooth guide 3D Master (figure 2c).

Medit scanner was used to accurately scan the stone die. Exocad DentalCAD software created a 3D digital model of the dental restoration which was then milled from Y-TZP zirconia blanks and sintered to full density by Arum 5X milling machine. The thickness of the retainer wing was kept approximately 2mm. It was very important to consider the correct dimensions of the connector, because a properly designed and fabricated connector is fundamental to the success of zirconia restorations. The height of the connector was kept 4mm and the thickness was 4mm gingivally that gradually decreased to 2mm incisally with the cross-sectional

area >12mm² (figure 2d). Porcelain veneering was only done at the labial surface of the pontic. Prior to insertion the retainer wing was air abraded with 50-µm alumina particles.

The fit of the restoration was checked intra orally. After the maintenance of proper isolation, the prepared enamel surface of the abutment was etched with 37% phosphoric acid for 30 seconds. It was washed with water and then air dried. Bonding agent was applied and light cured for 10-20 seconds. The restoration was cemented with Calibra Universal resin cement (dual cure, self-adhesive). A thin, uniform layer of the resin cement was applied on the retainer wing of the restoration with the help of an auto mix syringe tip. The restoration was seated and light finger pressure was applied to prevent its movement during the initial light curing that was done for 20-40 seconds. Excess cement was cleaned as it remains in the gelled state for 45 seconds following light exposure. Afterwards the restoration was allowed to self-cure for approximately 6 minutes (figure 3a, 3b).

The pontic and retainer wing were made to be free of occlusal contacts in maximum intercuspation and dynamic excursions. Minimal occlusal adjustment was performed in the opposing arch while the zirconia restoration was left undisturbed. Various dietary instructions and necessary precautions were explained to the patient. Sticky foods like gum and chewy candies should be avoided which can cause potential damage to the restoration. Moreover, hard food items should not be incised from the anteriors. Patient was instructed to practice oral hygiene habits and clean around the bridge using a floss threader and dental floss.

Patient was recalled after two weeks for initial examination. He reported no discomfort and was very satisfied with the clinical outcome (figure 3c). Next follow-up visits were scheduled after one month and two months. Patient was then recalled after six months and the examination showed a completely intact restoration that was serving adequately in the oral cavity.

DISCUSSION

Replacement of a single missing anterior tooth in maxilla by zirconia cantilever RBFDP is relatively a simple and conservative treatment approach especially in young adolescents with aesthetically pleasing and durable clinical results.¹³ Careful treatment planning and skillful designing is a pre requisite for the clinical success of resin bonded bridges.¹⁴

Proper shade selection is vital to achieve perfect aesthetics. Shade selection should be done quickly to avert undue color fatigue of the eye. Since the fracture of the proximal connector is the most common cause for the failure of Zirconia RBFDP therefore vigilant designing of the

connector with correct dimensions provide an essential basis for the survival of these restorations. Air abrasion of the fitting surface of the retainer with 50µm alumina particles at a distance of 10mm from the bonding surface with 2.5bar pressure significantly improved the bond strength of resin cements to zirconia.¹⁵

The incidences of debonding can be substantially avoided by proper placement and careful cementation of the restoration. Surface pretreatment of enamel with etchant and bonding agent application comparatively improves the bond strength of self-adhesive resin cements than its single step application on the enamel without any prior surface treatments.^{16,17}

Evaluation of occlusion is very important such that contact on the pontic and retainer should be minimized in static and functional occlusion.¹⁸ The contact at the margin of the retainer should be avoided strictly to prevent any consequential episode of the restoration debonding.¹⁹ According to the literature, the ten-year clinical survival rate of anterior cantilever zirconia ceramic RBFDPs is found to be 95%.²⁰

CONCLUSION

The beneficial aspects of choosing a cantilever zirconia resin bonded restoration for the prosthodontic rehabilitation of a missing anterior tooth over invasive dental treatment modalities are lauded with great fervor. Careful case selection, framework design, occlusal management and cementation are imperative for the enduring success of these restorations.

CONFLICT OF INTEREST

None declared

REFERENCES

1. Gautam R, Nene P, Mehta K, Nene S, Hegde A, Jaju R. Treatment Strategies for Missing Maxillary Central Incisor-An Orthodontist's Perspective. *J Prosthodont.* 2014;23:509-13. <https://doi.org/10.1111/jopr.12133>
2. Sones AD. Complications with osseointegrated implants. *J Prosthetic Dent.* 1989;62:581-5. [https://doi.org/10.1016/0022-3913\(89\)90084-X](https://doi.org/10.1016/0022-3913(89)90084-X)
3. De Kok IJ, Duqum IS, Katz LH, Cooper LF. Management of Implant/Prosthodontic Complications. *Dental Clinics of North America.* 2019;63:217-31. <https://doi.org/10.1016/j.cden.2018.11.004>
4. Tan K, Pjetursson BE, Lang NP, Chan ESY. A systematic review of the survival and complication rates of fixed partial dentures (FPDs)

after an observation period of at least 5 years. III. Conventional FPDs. Clin Oral Implants Res. 2004;15:654-66.
<https://doi.org/10.1111/j.1600-0501.2004.01119.x>

5. Balasubramaniam GR. Predictability of resin bonded bridges - a systematic review. Bri Dent J. 2017;222:849-58.
<https://doi.org/10.1038/sj.bdj.2017.497>

6. Durey KA, Nixon PJ, Robinson S, Chan MFW-Y. Resin bonded bridges: techniques for success. Bri Dent J. 2011;211:113-8.
<https://doi.org/10.1038/sj.bdj.2011.619>

7. Miettinen M, Millar BJ. A review of the success and failure characteristics of resin-bonded bridges. Bri Dent J. 2013;215:E3-3.
<https://doi.org/10.1038/sj.bdj.2013.686>

8. Yoshida K, Tsuo Y, Atsuta M. Bonding of dual-cured resin cement to zirconia ceramic using phosphate acid ester monomer and zirconate coupler. J Biomedical Materials Res Part B: Applied Biomaterials. 2006;77B:28-33.
<https://doi.org/10.1002/jbm.b.30424>

9. Bona A, Pecho O, Alessandretti R. Zirconia as a Dental Biomaterial. Materials. 2015;8:4978-91.
<https://doi.org/10.3390/ma8084978>

10. 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;40:783-6.
<https://doi.org/10.1016/j.jdent.2012.05.009>

11. Sasse M, Kern M. Survival of anterior cantilevered all-ceramic resin-bonded fixed dental prostheses made from zirconia ceramic. J Dent. 2014;42:660-3.
<https://doi.org/10.1016/j.jdent.2014.02.021>

12. 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 Prosthodontics. 2016;27:266-75.
<https://doi.org/10.1111/jopr.12555>

13. Sailer I, Hämmerle C. Zirconia Ceramic Single-Retainer Resin-Bonded Fixed Dental Prostheses (RBFDPs) After 4 Years of Clinical Service: A Retrospective Clinical and Volumetric Study. International J Periodontics Restorative Dent. 2014;34:333-43.
<https://doi.org/10.11607/prd.1842>

14. Ibbetson R. Clinical Considerations for Adhesive Bridgework. Dental Update. 2004;31:254-65.
<https://doi.org/10.12968/denu.2004.31.5.254>

15. Yang B, Barloi A, Kern M. Influence of air-abrasion on zirconia ceramic bonding using an adhesive composite resin. Dent Materials. 2010;26:44-50.
<https://doi.org/10.1016/j.dental.2009.08.008>

16. Sekhri S. Tensile Bond Strength of Self Adhesive Resin Cement After Various Surface Treatment of Enamel. J Clin Diagnostic Res. 2016;
<https://doi.org/10.7860/JCDR/2016/13409.7026>

17. Lin J, Shinya A, Gomi H, Shinya A. Bonding of self-adhesive resin cements to enamel using different surface treatments: bond strength and etching pattern evaluations. Dent Materials J. 2010;29:425-32.
<https://doi.org/10.4012/dmj.2009-140>

18. Zitzmann NU, Özcan M, Scherrer SS, Bühler JM, Weiger R, Krastl G. Resin-bonded restorations: A strategy for managing anterior tooth loss in adolescence. J Prosthetic Dent. 2015;113:270-6.
<https://doi.org/10.1016/j.prosdent.2014.09.028>

19. Gulati JS, Tabiat-Pour S, Watkins S, Banerjee A. Resin-bonded bridges - the problem or the solution? part 1: assessment and design. Dental Update. 2016;43:506-21.
<https://doi.org/10.12968/denu.2016.43.6.506>

20. 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.
<https://doi.org/10.1016/j.jdent.2017.07.003>