

Enhancing the Esthetics of a Maxillary Central Implant Crown with a Hybrid-Abutment: A Case Report

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Abstract

Reducing the fabrication time and costs involved in classical methods of implant crown production are goals being constantly pursued. Consequently, computer-aided design and computer-aided manufacturing technologies have evolved considerably, offering improved and predictable outcomes in terms of esthetics and function. The aim of this case report is to demonstrate how hybrid-abutments can provide optimum esthetics and biomechanical foundations. A 57-year-old woman had a non-restorable tooth #8, which was indicated for extraction and immediate implant placement. Lithium disilicate (LD) crowns were used to restore the adjacent teeth #7, 9, and 10. A zirconia abutment was used to block the gray color of the titanium base. The zirconia abutment finish line was designed to be placed 1-mm apical to the free marginal gingiva of the adjacent tooth, and an LD implant crown was cemented on the hybrid-abutment. The technique demonstrated promising results, and after more than 18 months of follow-up following the implant placement, the surrounding soft tissue was well adapted around the implant crown. The hybrid-abutment enhanced the esthetics of the definitive restoration as well as saved time and cost by elimination of the casting step.

Keywords: Immediate provisionalization, implant esthetics, single-tooth implant, titanium connection, zirconia abutments

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INTRODUCTION

Tooth loss due to decay, periodontal problems, or trauma remains an epidemic problem.^[1] Treatment planning involves intraoral photographs, periapical radiographs, cone beam computed tomography (CBCT), diagnostic wax up, and consultations with specialists from other fields to create a proper plan to replace missing teeth.^[2,3] Implants in the maxillary incisor area are known to be difficult to manage if not placed properly. Nowadays, clinicians place implants in the extraction site and

provisionalize with an implant crown if primary stability has been achieved.^[4]

As the price of precious metals such as gold increased, solutions were sought to reduce the cost and time of restoration fabrication. Titanium (Ti) abutments milled using computer-aided design and computer-aided manufacturing (CAD/CAM) technologies exhibit accuracy levels comparable to those of UCLA abutments made using the traditional gold cast technique, and they have

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been adopted by clinicians for single implant-supported restorations.^[5] Monolithic zirconia and lithium disilicate (LD) crowns cemented to Ti inserts have shown promising results in terms of the load to fracture, which exceeds the average occlusal biting loads.^[6] Clinical reports have documented cases where either zirconia or custom Ti abutments were used. However, to the best of the author's knowledge, no long-term data or clinical reports exist on combining LD crowns with zirconia abutments cemented to Ti-bases.^[7]

Here, this case is presented with the aim of demonstrating how hybrid-abutments can provide optimum esthetics and biomechanical foundations. A zirconia abutment cemented on a Ti-base blocked the gray color of the underlying Ti. With an LD crown cemented over the hybrid abutment, the implant ceramic crown matched the adjacent teeth-supported LD crowns and exhibited a better reflection under the soft tissue. In addition, the hybrid-abutment effectively reduced excess apical cement flow due to coronal placement of the future implant crown finish line away from the implant platform.

CASE REPORT

A 57-year-old woman presented with a chief complaint of being unhappy with how her front teeth looked when she smiled [Figure 1a]. Clinical examination revealed endodontic treatment in tooth 8, and the root canal was obturated with gutta-percha. Periapical radiographs revealed that tooth 8 had a fiber post, and teeth 7, 9, and 10 had defective proximal composite resin restorations [Figure 1b-d]. The insufficient tooth structure indicated the need for full-coverage crowns.

Tooth 8 had recurrent decay 2–3 mm beyond the cemento-enamel junction and was considered non-restorable. Treatment options other than an implant included crown lengthening; this was not an optimum option, as it would require excessive bone removal for a greater biological width. Consequently, tooth 8 would not appear esthetic, being 2–3 mm longer than the adjacent tooth. Orthodontic extrusion would result in a cervical neck narrower than that of tooth 9, resulting in a large black triangle. Therefore, we opted for tooth extraction and immediate implant placement. A traumatic extraction was performed for tooth 8 under local anesthesia [Figure 2a]. An implant (Nobel Speedy Replace, Nobel BioCare, Zürich, Switzerland) with a 4.3-mm diameter and 13-mm length was placed in the extraction socket [Figure 2b]; thereafter, a 4.3 × 3-mm Ti-based healing abutment was placed [Figure 2c]. A 0.25-cc NuOss xenograft (ACE Biomaterials, Franklin Lakes, USA) was

augmented between the buccal plate and the implant facial surface [Figure 2d]. Thereafter, a plastic temporary abutment was placed [Figure 3a]. An implant provisional crown was fabricated from bis-acryl (Prottemp 4, 3M ESPE, St. Paul, MN, USA). The crown's screw-access space was sealed using polytetrafluoroethylene (Teflon tape; Total Industrial Supply, Piedmont, SC, USA) and shade 2 flowable composite resin (Filtek Supreme XT Flowable, 3M ESPE, St. Paul, MN, USA) [Figure 3b]. Follow-up appointments at 1 week [Figure 3c] and 2 months [Figure 3d] showed that the soft tissue responded favorably, and bone augmentation was left to heal for 4 months. Amoxicillin 500 mg TID was prescribed for 7 days. Provisional crowns were splinted and fabricated from bis-acryl as a 4-unit provisional fixed dental prosthesis (FDP) [Figure 4a-c] modified per the patient's request [Figure 4d].

The double-cord technique was used for the final impression [Figure 5a]. Open-tray impression coping seating was confirmed using a periapical radiograph [Figure 5b]. Light-body vinyl polysiloxane (Imprint 3, 3M ESPE, St. Paul, MN, USA) was injected around the teeth and impression coping. The stock-tray was filled with heavy-body vinyl polysiloxane (Imprint 3, 3M ESPE, St. Paul, MN, USA). A medium body polyether (Impregum, 3M ESPE, St. Paul, MN, USA) was injected around the connection between the coping and the analog [Figure 5c]. The provisional FDP was cemented using non-eugenol temporary cement (TempBond NE, Kerr, Orange, CA, USA).

An NB-RS 4.3-L Ti-base (Dentsply Sirona Ti-base [Figure 6a right]; InLab, Bensheim, Germany) was scanned using Cerec AC Connect with Omnicam (Dentsply Sirona, York, PA, USA). The customized zirconium oxide abutment was designed using a digital software (inLab SW4.2, Dentsply Sirona, York, PA, USA). The zirconia abutment [Figure 6a left] was milled from a pre-sintered meso Zr shade F0.5 block (InCoris TZI, Sirona GmbH, Germany) using a milling production unit (inLab MCXL, Dentsply Sirona, York, PA, USA). The Ti-base was tried-in first on the implant; proper seating was confirmed with a periapical radiograph [Figure 6b]. The Ti-base outer surface and Zr-abutment intaglio were sandblasted with 50- μ m aluminum oxide. The screw-access channel of the Ti-base was sealed using Teflon tape; RelyX Ultimate was used to connect the Ti-base with the Zr-abutment and tried-in as one piece [Figure 6c]. The graft placed facial to the implant remained intact, and the soft tissue was in harmony with the adjacent tooth [Figure 6d]. Definitive crowns for the implant abutment and prepared teeth were fabricated from low-translucency IPS e.max Press LD (Ivoclar Vivadent, Schaan, Liechtenstein)

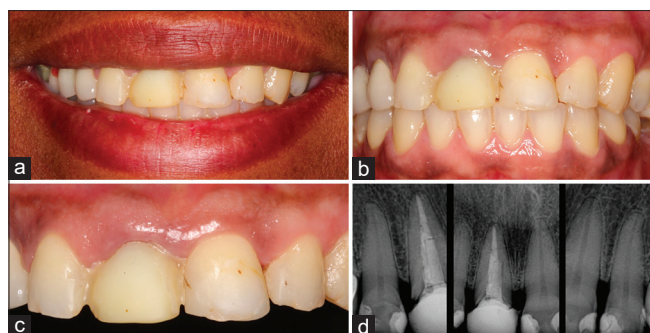


Figure 1: (a) Extraoral pre-operative condition of patient at smile position. (b) Intraoral preoperative condition of teeth in maximum intercuspation. (c) Intraoral close-up view of the maxillary incisors. (d) Periapical radiographs of the maxillary incisors

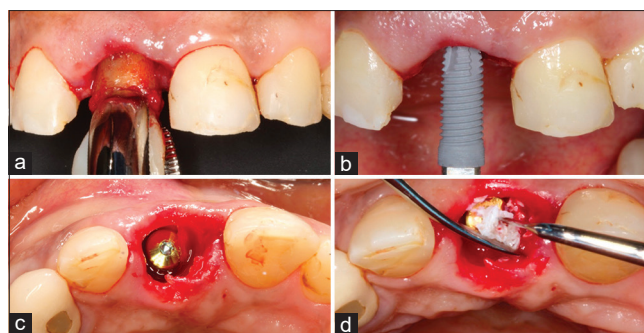


Figure 2: (a) Extraction of the maxillary central incisor. (b) Implant placement in the extraction socket of the maxillary central incisor. (c) Occlusal view of the healing abutment of the implant. (d) Bone grafting of the gap around the implant

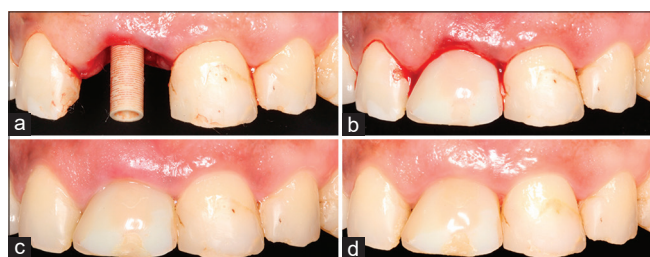


Figure 3: (a) Plastic temporary abutment. (b) Provisional implant crown on the day of surgery. (c) Provisional implant crown at the 1-week follow-up. (d) Provisional implant crown at the 2-month follow-up



Figure 4: (a) Mock-up before teeth preparation. (b) Provisional restorations in maximum intercuspation. (c) Close-up view of the provisional restorations of the maxillary incisors. (d) Provisional restorations of the maxillary incisors at smile position

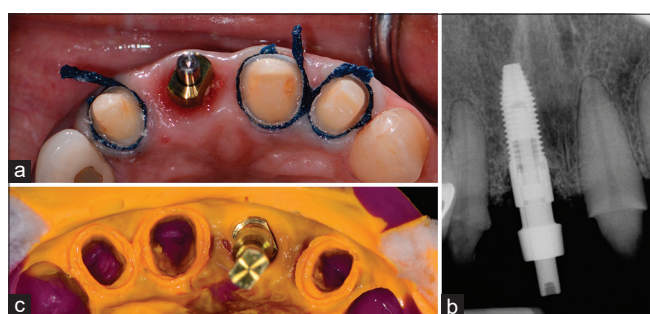


Figure 5: (a) Double retraction cord technique, with open tray impression coping. (b) Periapical radiograph to confirm the seating of the coping. (c) Lab analog connected to the impression post and ready to be poured

glass-ceramic shade A2 ingots [Figure 7a] and layered with IPS e.max Ceram-Power Dentin-A3 and Power Incisal-1.

The LD crowns were tried-in with a black fit checker before cementation [Figure 7b]. RelyX Ultimate was used to cement the crowns; the zirconia abutment screw-access channel was sealed using Teflon tape and flushed with the edges of the abutment. Teflon tape was wrapped around the adjacent teeth to prevent resin flow. Post-cementation follow-up photographs were obtained, and this concluded 20 months from the day the implant was placed and 16 months since the implant was restored.^[8] During treatment planning, the periodontal status was assessed: the pocket probing depths and bleeding on probing were

within normal ranges. After implant placement, the soft tissue color and recession, peri-implant probing depth, bleeding on probing, patient-reported outcomes, and biological complications were assessed. The soft tissue did not show any complications and healed well around the ceramic restorations [Figure 7c], improving the patient's smile [Figure 7d].

DISCUSSION

Clinicians strive to improve implant crowns and their biomechanical and esthetic characteristics. Screw-retained implants possess retrievability and are usually the first option to eliminate excess cement from extruding on the platform, especially for deeply placed implants. However, maxillary anterior implants have anatomical limitations that might place the implant at an angle where UCLA screw-retained crowns cannot be placed. In our case, it was evident with the provisional crown that the screw-access channel was from the incisal edge, and covering the definitive crown screw-access channel with composite on the incisal surface would not be esthetically acceptable. Accordingly, a cement-retained crown design was chosen for our implant; retrievability might not be a feature in cement-retained crowns, but they respond to functional

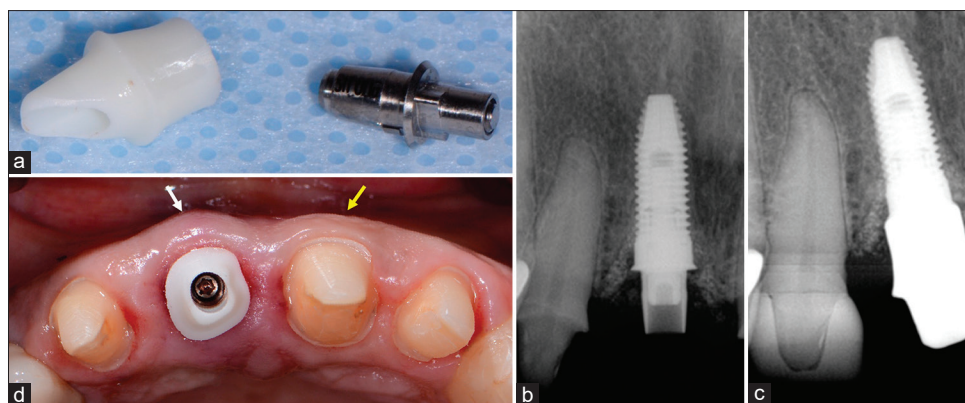


Figure 6: (a) Zirconia abutment (left) with titanium base (right). (b) Periapical radiograph showing the seating of the titanium base. (c) Periapical radiograph showing the seating of the one-piece abutment. (d) The graft buccal to the implant (white arrow) remained intact and followed the anatomy of the adjacent natural teeth (yellow arrow)

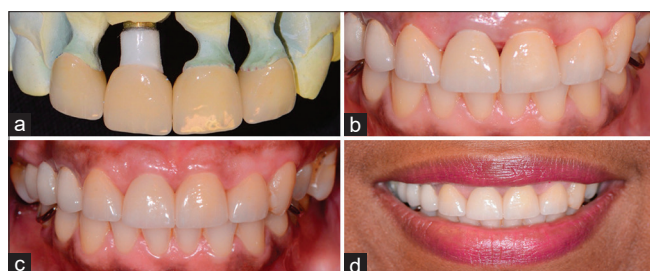


Figure 7: (a) Definitive lithium disilicate crowns on master cast. (b) Try-in of the lithium disilicate crowns with fit-checker. (c) Intraoral postoperative view. (d) Extraoral post-operative condition of patient at smile position

loads differently. Thus, abutment-screw loosening is not a major concern.^[9]

Other techniques have been introduced to overcome esthetical challenges. The acetalic coating technique helps mask the gray color of the cast-abutment; however, it still relies on the lost wax technique.^[10] The Procera copy milling system produces a Ti abutment without needing the casting step, as it does not rely on wax bur-out. This reduces the abutment fabrication time, but the metallic color remains.^[11] Elsayed *et al.* compared different ceramic abutments with Ti-bases and concluded that LD and Ti-based zirconia abutments showed promising durability and strength after long-term dynamic loading. Zirconia abutments without Ti-bases had lower fracture values compared to those of Ti-based zirconia abutments. However, the opacity of zirconia can block the grayish color and offer a more predictable esthetic outcome.^[12]

Ti-supported LD restorations would be recommended for pure screw-retained design restorations without compromising esthetics by having screw-access through the occlusal surface. This allows them to be cemented extraorally and screwed on the implants. In most anterior cases, such as the current one in this case report, definitive

restoration needs cement-retained implant crowns. The implant was placed 4–5 mm apical to the adjacent cemento-enamel junction so that the apical portion engaged the more native bone. If an LD crown was directly cemented on a Ti abutment intraorally, there would be flow of excess cement material and its extrusion close to the implant platform. Furthermore, the LD would be in direct contact at the 4–5-mm soft tissue area; no data currently shows how the LD surfaces interact with soft tissue in direct contact. A clinical study found no distinct differences in the health of peri-implant mucosa adjacent to zirconia and Ti abutment surfaces, with both showing favorable responses.^[13]

The zirconia abutment was designed with a finish line 1 mm sub-gingival to the adjacent teeth. This enabled the margin of the LD crown to be 3–4 mm coronal to the implant platform; furthermore, the copy abutment technique was used for implant crown cementation. These factors reduce excess cement extrusion beyond the zirconia abutment finish line.^[14] Upon follow-up, the interdental papilla responded positively and uneventfully, allowing the soft tissue around the implant crown to mature in a matter mimicking the free marginal gingiva around the adjacent central incisor. The presence of the implant and Ti-base was also concealed, enabling the implant crown to replicate a natural tooth-like emergence profile.

From an economic point of view, the cost was reduced by half: the dental laboratory cost of a gold abutment implant crown would be 1300–1500 Saudi Riyals (SR) per unit, while that for a ceramic crown with hybrid-abutment would be SR 800–900. Compared with a stock and cast abutments, the cost of a CAD/CAM implant abutment presently falls somewhere between the two.^[15]

A limitation of this technique is that it requires an additional clinical and laboratory step when compared with Ti-based monolithic restorations. A hybrid-abutment try-in appointment is required to evaluate the zirconia abutment finish line before proceeding with the definitive restoration; the LD implant crown was inserted at a later appointment.

CONCLUSION

The technique presented here eliminated the need for the casting step and of a high-noble metal substructure, thus reducing the estimated cost by half. It also allowed the definitive implant and teeth-supported LD crowns to blend in with the adjacent and opposing teeth. Follow-up demonstrated how the soft tissue surrounding the implant and teeth had a positive response. Longer follow-ups remain to be conducted to monitor bone levels upon crown insertion. Nonetheless, clinicians may use this alternative approach to fabricate single implant crowns, as they provide optimum esthetics and biomechanics in the anterior maxillary region.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the Journal. The patient understands that her name and initials will not be published, and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

Peer review

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Benjamin RM. Oral health: The silent epidemic. *Public Health Rep* 2010;125:158-9.
2. Gowd MS, Shankar T, Ranjan R, Singh A. Prosthetic consideration in implant-supported prosthesis: A review of literature. *J Int Soc Prev Community Dent* 2017;7:S1-7.
3. Afrashtehfar KI, Assery MK. Five considerations in cosmetic and esthetic dentistry. *J N J Dent Assoc* 2014;85:14-5.
4. Becker CM, Wilson TG Jr., Jensen OT. Minimum criteria for immediate provisionalization of single-tooth dental implants in extraction sites: A 1-year retrospective study of 100 consecutive cases. *J Oral Maxillofac Surg* 2011;69:491-7.
5. Park JM, Lee JB, Heo SJ, Park EJ. A comparative study of gold UCLA-type and CAD/CAM titanium implant abutments. *J Adv Prosthodont* 2014;6:46-52.
6. Elshiyab SH, Nawafleh N, Öchsner A, George R. Fracture resistance of implant-supported monolithic crowns cemented to zirconia hybrid-abutments: Zirconia-based crowns vs. lithium disilicate crowns. *J Adv Prosthodont* 2018;10:65-72.
7. Sailer I, Zembic A, Jung RE, Hämmerle CH, Mattioli A. Single-tooth implant reconstructions: Esthetic factors influencing the decision between titanium and zirconia abutments in anterior regions. *Eur J Esthet Dent* 2007;2:296-310.
8. Hasanzade M, Shirani M, Afrashtehfar KI, Naseri P, Alikhasi M. *In vivo* and *in vitro* comparison of internal and marginal fit of digital and conventional impressions for full-coverage fixed restorations: A systematic review and meta-analysis. *J Evid Based Dent Pract* 2019;19:236-54.
9. Amorfini L, Storelli S, Mosca D, Scanferla M, Romeo E. Comparison of cemented vs. screw-retained, customized computer-aided design/computer-assisted manufacture zirconia abutments for esthetically located single-tooth implants: A 10-year randomized prospective study. *Int J Prosthodont* 2018;31:359-66.
10. Corrente G, Vergnano L, Pascetta R, Ramadori G. A new custom-made abutment for dental implants: A technical note. *Int J Oral Maxillofac Implants* 1995;10:604-8.
11. Marchack CB. A custom titanium abutment for the anterior single-tooth implant. *J Prosthet Dent* 1996;76:288-91.
12. Elsayed A, Wille S, Al-Akhali M, Kern M. Effect of fatigue loading on the fracture strength and failure mode of lithium disilicate and zirconia implant abutments. *Clin Oral Implants Res* 2018;29:20-7.
13. van Brakel R, Meijer GJ, Verhoeven JW, Jansen J, de Putter C, Cune MS. Soft tissue response to zirconia and titanium implant abutments: An *in vivo* within-subject comparison. *J Clin Periodontol* 2012;39:995-1001.
14. Wang W, Chang J, Wang HM, Gu XH. Effects of precementation on minimizing residual cement around the marginal area of dental implants. *J Prosthet Dent* 2020;123:622-9.
15. Fuster-Torres MA, Albalat-Estela S, Alcañiz-Raya M, Peñarocha-Diogo M. CAD/CAM dental systems in implant dentistry: Update. *Med Oral Patol Oral Cir Bucal* 2009;14:E141-5.