SVOA Dentistry

ISSN: 2753-9172

ScienceVolks Open Access

Case Report

Custom-Made Composite Shade for Matching an Odd-Shaded Restoration

Guilherme Anziliero Arossi, DDS, MSc, PhD[1]* and David Vahid Mazza, DDS, CAGS, DABAD, DICOI[2]

[1] Full-time faculty, Clinical Assistant Professor, AEGD Program, Department of Comprehensive Dentistry, University of Maryland School of Dentistry, Baltimore, USA.

[2] Clinical Assistant Professor, AEGD Program, Department of Comprehensive Dentistry, University of Maryland School of Dentistry, Baltimore, USA.

***Corresponding Author**: Guilherme Anziliero Arossi, DDS, MSc, PhD, Full-time faculty, Clinical Assistant Professor, AEGD Program, Department of Comprehensive Dentistry, University of Maryland School of Dentistry, Baltimore, USA.*

DOI: https://doi.org/10.58624/SVOADE.2024.05.0172

***Received:** April 19, 2024* ***Published:** May 07, 2024*

Abstract

Objective: This case report aims to present how to fabricate a new restoration to match existing odd-shaded ones.

Clinical considerations: A polycarbonate provisional crown was used to produce a cement-retained immediate load provisional restoration over an implant of tooth number #9. Using a color correcting light source, it was noticed that existing restorations had very high value with excess gray hue. XL2 of Premise composite shade tab was the closest match found, and the base shade for the custom-made restoration. Once no shade match was found in commercially available shade guides, there was a demand to produce a custom-made shade to address this case. The facial surface of the provisional crown was prepared as a veneer. Utilizing XL2 Premise composite and adding different amounts of gray color modifier, shade matching was fulfilled by mixing the composite and the color modifier. In this case, five attempts were made to achieve color match. The restoration was polished utilizing Soflex Discs. Provisional crown was in function for 12 weeks.

Conclusions: By implementation of the principles of color, restorative materials and characterization kits, the new temporary restoration could match the existing ones using the technique described in this case report.

***Keywords:** Color match, Tint and Opaquers, Color Modifiers, Odd shade, Metamerism, Flair, Color Constancy*

Introduction

Natural teeth, due to their histological composition, are polychromatic structures. The structured hyper-mineralization of enamel lead to translucent properties and influence the color property “value”; while dentin present organic component surrounded by irregular mineralization, leading to opaque properties and influencing chroma and hue [4,9]. The dental industry has been trying to create materials that can match the multiple shades opacities and optical properties of natural dentition [7,14]. Occasionally, patients are submitted to different restorative procedures utilizing different restorative materials on different teeth. Consequently, in some clinical situations, the dentist must match the new restoration’s shade not only to natural tooth/teeth, a hard task by itself; but also, to other restorations of various dental materials placed on adjacent teeth [3].

Providing excellent dental services is the goal of a skillful practitioner. The ability to match the shade of a new restoration with existing natural dentition or existing restorations has paramount significance to this task [5]. Comprehensive knowledge of principles of color (value, chroma, hue, and translucency) is essential for a practitioner to be able to identify and create restorations without any mismatch with other restorations or natural dentition [2,16].

A dentist may also utilize the available cosmetic restorative materials (resin-based composite and ceramic systems), along with characterization kits (tint and opaquers, color modifiers and stains), as well as master the shade matching principles, in order to achieve the high esthetic demand of restorative procedures [11].

When restoring a single anterior tooth, the combinations of restorative materials and remaining tooth structure might create an odd-shaded tooth, which will be of difficult to match if an adjacent tooth shall need restoration in the future. Mimicking the esthetic of odd-shaded restorations, especially if they are not found in routine available shade guides, could be a hard demanding task for a dental professional. If existing shade of restorations is not a standard one and cannot be found in commercially available shade guides, replacement could be challenging.

How to fabricate a new restoration to match existing restorations that have odd shades that could not be identified in commercially available shade guides? In this case report, the sequence and steps observed to create a new restoration to match existing odd shade restorations are described.

Case Presentation

A 45-year-old female patient presented at a private practice dental office with a chief complaint towards her tooth number #9 [6]. According to her report, she was eating salad when she heard her tooth cracking, pointing to the upper left central incisor (Figures 1 and 2). The patient also stated that due to her high-stress job, being an obstetrician-gynecologist delivering neonates, she performs diurnal and nocturnal clenching and bruxism. Patients' medical history was within normal limits and did not relate to the dental problem she presented. Radiographs and cone beam computerized tomography (CBCT) scan were obtained with dental history, extra and intra-oral evaluation and diagnostics relating to the chief complaint. The patient had a coronal fracture of an endodontically treated tooth, invading the biological width and no remaining coronal structure.

Different treatment options (Table 1); were presented to the patient. All risks, benefits, limitations, advantages, disadvantages, prognosis, cost, and treatment time for each treatment option was reviewed. Ultimately, the patient decided for the tooth's extraction and replacement with a dental implant (figure 3 and 4). Upon studying the CBCT scan, it was determined that Division A bone exists [12]. Informed consents were obtained orally and in writing.

Figure 1. *Frontal view of tooth #9. Tooth was fractured at CEJ, gingival fibers were holding the tooth in place.*

Figure 2. *Palatal view of tooth #9*

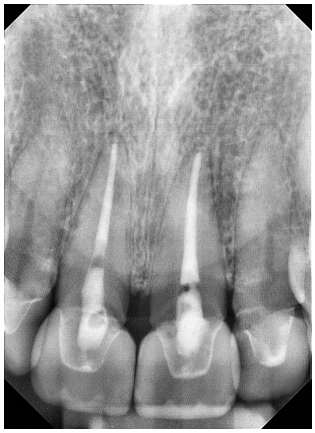

Figure 3. *Peri Apical radiograph of tooth.*

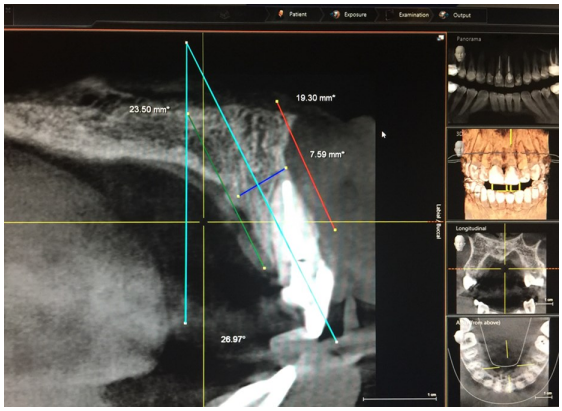

Figure 4. *Based on CBCT Scan, existing bone is examined, Division A bone is present.*

Table 1. Treatment options and respective pros and cons.

Treatment plan option	Pros	Cons
Clinical crown lengthening, post and core, crown;	Doctors friendly, Short treatment time Success	Surgical operation Crown/root ratio Periodontal Aesthetics
Forced eruption, post and core, crown;	Non-surgical Long term success Few consequences on failure	Crown/Root ratio Increased Tooth mobility Possible root fracture
Root Banking	Non-surgical approach Preserving alveolar process	Possible future complications (especially if tooth replaced by a fixed prosthesis)
Extraction without socket augmentation	Doctors' friendly procedure Insurance coverage	Surgical operation Horizontal and Vertical bone loss
Extraction with socket augmentation	Doctors' friendly procedure Alveolar process preservation	Surgical operation Cost
Three-unit FPD bridge	Doctor's friendly Short treatment time Few bone/soft tissue issue < 6-7mm mesio-distal space	Mean life span 10-15 years Caries and endodontic failure Preparation of healthy teeth Prosthetic failure
Flipper, RPD, Valplast, Essix appliance	Hygiene Soft Tissue replacement Minimum tooth preparation Reduced Cost	Bulk-need cross arch stabilization Hygiene Movement Loss of abutment teeth
MD bridge	Minimal Teeth Preparation Treatment at skeletal growth	High de-bond rates Risk of decay on abutment teeth
Implant	No Decay, RCT, Root fracture, Sensitivity Bone preservation No adjacent teeth preparation	Surgical procedure Healing time Hard and soft tissue consideration Available space Crestal bone loss Screw loosening No PDL, no proprioception Less occlusal awareness
No replacement	No Cost	Compromised Aesthetics Shift of adjacent and opposing dentition
No treatment	No Cost	Compromised Aesthetics Shift of adjacent and opposing dentition

Prior to any dental procedure, an attempt was made to choose the shade. It was noticed that the shade of the patient's anterior teeth was not included in regular shade guides, such as Vita Classic, Vita Toothguide 3D-Master (Vita, Yorba Linda, CA, USA), and Premise Kerr (Kerr Corp., Brea, CA, USA) composite shade guides.

Tooth #9 was extracted under oral conscious sedation with least traumatic technique [15] utilizing Periotomes (BioHorizons, Birmingham, AL, USA), and a 4.6X12mm, 3.5 mm platform implant was inserted (Tapered Internal Plus LaserLok, BioHorizons, Birmingham, AL, USA). This specific implant was chosen to enable "platform switching" [8] along with its LaserLok characterization at the cervical area [10].

The osteotomy site was prepared palatal to existing anatomic socket, based on CBCT Scan study (figures 5, 6, 7). After insertion of the implant body, using Osstell Unit (Osstell AB, Göteborg, Sweden), the resonance frequency analysis (RFA) was performed to assess the implant stability quotient (ISQ). The ISQ value of 76 (figures 8,9) revealed proper bone-implant interface, thus, immediate load was feasible [1].

A provisional abutment (PEEK Abutment, BioHorizons, Birmingham, AL, USA) was delivered, and the abutment screw was hand tightened. The gap between the implant body and facial bone plate was filled with 0.5 cc of 0.6-1.25 mm allogenic bone graft (Allograft, MinerOss, BioHorizons, Birmingham, AL, USA) mixed with 2ml of 300 mg Clindamycin (Cleocin, Pharmacia & Upjohn Company, Kalamazoo, MI, USA) (Figure 10). A Periapical radiograph confirms proper positioning of implant placement and bone augmentation (Figure 11).

Figure 5. *Tooth is removed by the least extensive extraction method, utilizing Periotomes.*

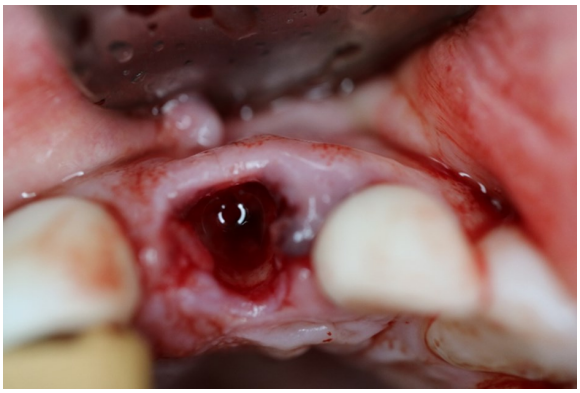

Figure 6. *Osteotomy site is made palatal to existing anatomic socket based on CB CT scan study.*

Figure 7. *Implant is placed palatal to existing extraction socket to maintain adequate bone thickness circumferential.*

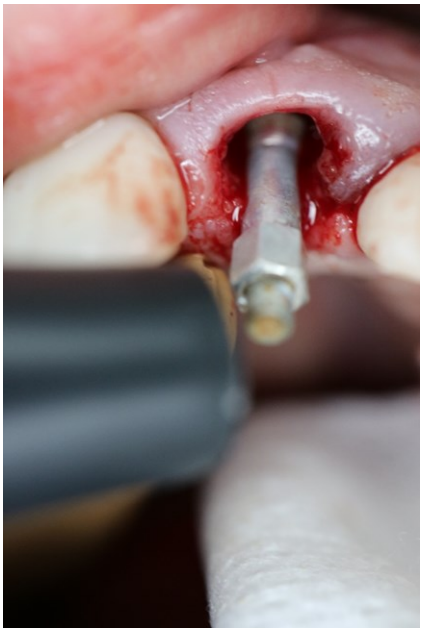

Figure 8. *ISQ of Implant is assessed by RFA utilizing Osstell unit.*

Figure 9. *ISQ of Implant displayed at Osstell unit display.*

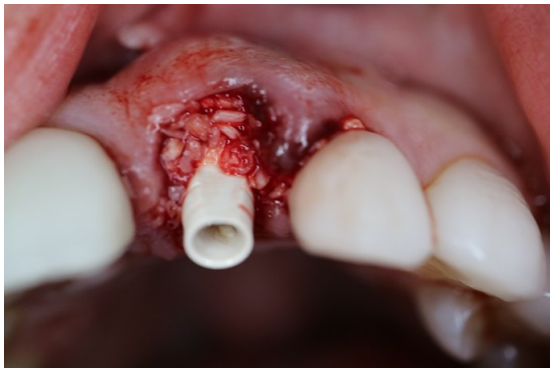

Figure 10. *Peek temporary plastic abutment is placed on implant body. The gap between implant body and facial bone is filled with Allograft mixed with Clindamycin antibiotic.*

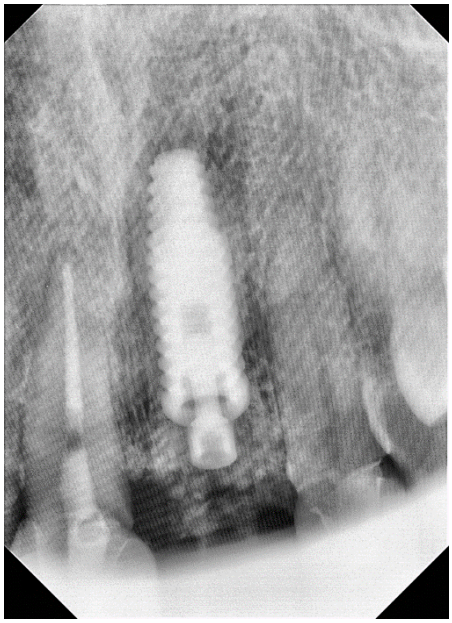

Figure 11. *PA Radiograph of inserted implant body along with Peek plastic temporary abutment and bone augmentation.*

A polycarbonate provisional crown (ION Crown, 3M Dental, Irvine, CA 92614, USA) relined with acrylic resin (Jet, Wheeling, IL, USA), was used to produce a cement-retained provisional restoration. Extra care was made to assure removal of all residual cement particles (Figure 12, 13, 14). Using a color correcting light source (Rite Lite 2, AdDent, Danbury, CT, USA) following the principles of "Shade Matching" [4], and taking into consideration the color properties of value, chroma, hue and translucency, the final shade of existing restoration was assessed (Fig 15). Considering that the cement-retained provisional crown presented a very unesthetic shade compared to the adjacent teeth, a new approach to match the temporary crown shade was needed. Once no shade match was found regarding the adjacent teeth compared to the shade guides (Figure 15), there was a demand to produce a custom-made shade to address this case. It's imperative to emphasize that proper shade matching should obey the step-by-step protocol previously described in the literature [4]. It was noticed that existing restorations had very high value with excess gray hue. XL2 of Premise composite (Kerr, Corporation, Brea, CA, USA) shade tab was the closest match found, and the base shade for the custom-made restoration.

The facial surface of the temporary crown was prepared, like a veneer reduction design. Utilizing resin-based composite (RBC) XL2 Premise (Kerr Corporation, Brea, CA, USA) and by addition of different amounts of gray color modifier (Kolor Plus, Kerr Corporation, Brea, CA, USA), shade matching was fulfilled. In this case five attempts were made to gain proper color match. Small increments of Gray Color Modifier were hand-mixed to the RBC until desired shade was created (Figure 16, 17).

Upon achieving the desired shade, a direct RBC veneer was placed on the facial area of the PEEK temporary crown using the custom-made shade. The restoration was finished and polished utilizing Soflex Discs (3M, St. Paul, MN, USA). Provisional crown was in function for 12 weeks (Figure 18). During this period, the shape of provisional was modified by addition or deduction to create gingival architecture similar to its contralateral tooth, #8.

Figure 12. *Polycarbonate ION provisional crown is relined with Jet acrylic.*

Figure 13. *Provisional crown is finished and polished.*

Figure 14. *Provisional crown is luted on Peek abutment. Extra care is implemented to assure removal of any cement residue.*

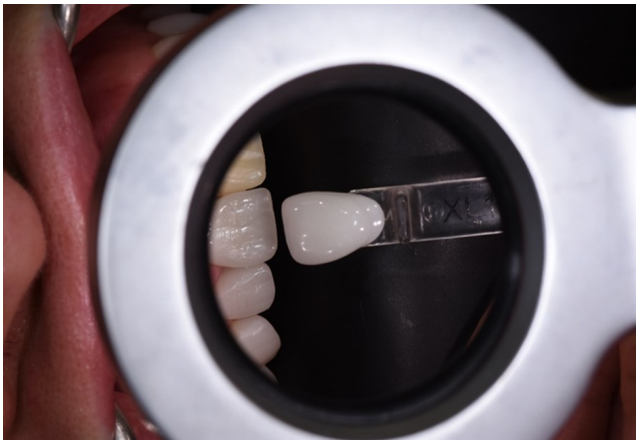

Figure 15. *Using principles of Shade Matching, Value, Chroma, Hue and Translucency of existing restorations were determined.*

Figure 16. *By mixing Gray Color Modifier with XL2 Premise Composite, desired shade is created. The choice of composite shade and color modifiers shade was determined based of principles of "Shade Matching (Value, Chroma, Hue and Translucency)".*

Figure 17. *In this case five attempts were made until desired shade match was achieved.*

Figure 18. *Provisional restoration shape and shade was created to optimize healing and esthetic outcome.*

Discussion

If existing shade of restorations is not a standard one and cannot be found in commercially available shade guides, replacement could be challenging. Familiarity with science and principles of color [4] along with being acquainted with various restorative materials, characterization kits, could enable a practitioner to create, fabricate and match restorations that might not be available in commercially available shade guides [14].

Immediate load over implants in anterior area is desired when one need to keep the gingival architecture [12]. In the presented case, the ISQ value of 76 allowed this practice [1]. However, due to extent esthetic involvement, a custom shade veneer had to be produced over the PMMA crown to fit patients' expectations. Five attempts were made until the final shade matched the adjacent teeth, and each attempt built the understanding of how much composite should be mix to the proper amount of the gray characterization kit color. The outcome was a systematic result of a scientific approach towards matching the shade, and not a blind attempt to mix materials and hope it fits.

This case report emphasizes the significance of the knowledge about principles of color and shade in dentistry to be able to identify and create restorations to match existing dentition or restorations even with odd shade that might not be available in commercial shade guides. For a practitioner who needs to create a restoration to match existing dentition or restorations, healthy eyesight, lack of color blindness, essential apparatus for shade matching and characterization kits are essential [13].

Conclusion

By implementation of the principles of color and utilization of restorative materials and characterization kits, the new temporary restoration could match the existing ones using the technique described in this case report.

Acknowledgments

The authors do not have any financial interest in the companies whose materials are included in this article.

Conflict of Interest

The authors declare no conflict of interest.

References

1. D. Bafijari, A. Benedetti, A. Stamatoski, F. Baftijari, Z. Susak, D. Veljanovski, Influence of Resonance Frequency Analysis (RFA) Measurements for Successful Osseointegration of Dental Implants During the Healing Period and Its Impact on Implant Assessed by Osstell Mentor Device, Open Access Maced J Med Sci 7 (2019) 4110–4115.
2. R.S. Basavanna, C. Gohil, V. Shivanna, Shade selection, International Journal of Oral Health Sciences 3 (2013) 26.
3. S. Borse, S.H. Chaware, Tooth shade analysis and selection in prosthodontics: A systematic review and meta-analysis, The Journal of Indian Prosthodontic Society 20 (2020) 131.
4. S. Chu, R. Paravina, I. Sailer, A. Mieleszko, Color in Dentistry: A clinical guide to predictable esthetics., Quintessence Publishing Company, Inc. (2017).

5. S.J. Chu, R.D. Trushkowsky, R.D. Paravina, Dental color matching instruments and systems. Review of clinical and research aspects, J Dent 38 Suppl 2 (2010) e2-16.

6. F. Deng, American Dental Association Universal Numbering System | Radiology Reference Article | Radiopaedia.org, Radiopaedia (n.d.).

7. C. Gómez-Polo, M. Gómez-Polo, J.A. Martínez Vázquez de Parga, A. Celemín-Viñuela, Clinical Study of the 3D-Master Color System among the Spanish Population, J Prosthodont 27 (2018) 708–715.

8. S. Gupta, R. Sabharwal, J. Nazeer, L. Taneja, B.K. Choudhury, S. Sahu, Platform Switching Technique and Crestal Bone Loss around the Dental Implants: A systematic review, Ann Afr Med 18 (2019) 1–6.

9. A. Joiner, Tooth colour: a review of the literature, J Dent 32 Suppl 1 (2004) 3–12.

10. R. Koodaryan, A. Hafezeqoran, Effect of laser-microtexturing on bone and soft tissue attachments to dental implants: A systematic review and meta-analysis, J Dent Res Dent Clin Dent Prospects 15 (2021) 290–296.

11. T.D. Larson, M. Strohbehn, Matching tooth shade with composite resin and porcelain materials. Part two, Northwest Dentistry Journal 93 (2014) 13–16.

12. C.E. Misch, Contemporary Implant Dentistry - E-Book: Contemporary Implant Dentistry - E-Book, Elsevier Health Sciences, 2007.

13. P.B. Özat, İ. Tuncel, E. Eroğlu, Repeatability and reliability of human eye in visual shade selection, J Oral Rehabil 40 (2013) 958–964.

14. G. Paolone, G. Orsini, J. Manauta, W. Devoto, A. Putignano, Composite shade guides and color matching, Int J Esthet Dent 9 (2014) 164–182.

15. S.D. Sharma, A. Gupta, P. Bansal, M. Alexander, B. Vidya, H. Gupta, Minimally traumatic extraction techniques in non-restorable endodontically treated teeth: A comparative study, Natl J Maxillofac Surg 13 (2022) S91–S96.

16. V.K. Sikri, Color: Implications in dentistry, J Conserv Dent 13 (2010) 249–255.

Citation: Arossi GA, Mazza DV. Custom-Made Composite Shade for Matching an Odd-Shaded Restoration. *SVOA Dentistry* 2024, 5:3, 65-72.