JPD DIGITAL

A MULTIMEDIA RESOURCE FROM
THE JOURNAL OF PROSTHETIC DENTISTRY

www.thejpd.org/video-do

JPD Digital: A Multimedia Resource from The Journal of Prosthetic Dentistry is an innovative video-based platform to advance skills and knowledge in prosthodontics

JPD DIGITAL

Optimized digital shade calibration technology for the restoration of a single central incisor

Miles R. Cone, DMD, MS, CDT,[a] James Choi,[b] and Marat Awdaljan, MDT[c]

SUMMARY

The demand on the contemporary dental practitioner to deliver life-like, indirect anterior restorations has intensified over the years as discerning patients have become increasingly aware of the reality that teeth make a significant impact on the overall esthetics of their outward appearance (Fig. 1).[1] One of the primary challenges encountered by the restorative dentist and dental laboratory technician is the ability to meticulously communicate and replicate the nuance parameters of tooth shade characteristics.[2]

ABSTRACT

Predictable shade matching and communicating shade information to the dental laboratory technician have proved to be a capricious undertaking. Numerous confounding variables exist for the observer—which may be extrinsic (such as light source and background color), intrinsic (such as genetics and eye fatigue), or a combination of both. To address these shortcomings, low-cost, easy-to-operate, color analysis instrumentation and software programs have been engineered for objective shade selection and precise color analysis. The shade matching protocols that now exist have made even the most challenging esthetic treatments predictable for both the clinician and the dental laboratory technician. (J Prosthet Dent 2022;128:1-3)

The use of dental color shade guides and intraoral photographs captured with a digital single-lens reflex (DSLR) camera is commonly used to match teeth to artificial materials; however, the process has been reported to be inconsistent and subjective.[3] Disparity in color between a fixed prosthesis and the adjacent natural dentition is unfortunately commonplace and has been reported to occur in as many as 63% of ceramic restorations.[4] To further complicate this process, various factors have been implicated in the struggle for precision in the shade selection process, including rapid tooth dehydration,[5] changing ambient lighting conditions,[6] operator experience,[7] and visual genetics.[8]

To overcome the shortcomings and frustrations associated with human visualization and acquisition of analog shade tabs, utilizing instrumental methods, such as spectrophotometers and colorimeters, albeit expensive and requiring additional training,[9] has been suggested because of their objective shade matching capacity.[10] The basis for this digital presentation was to demonstrate the straightforward communication between a dental clinician and a dental laboratory technician in the development of esthetic dental restorations. Successful collaboration was achieved by utilizing a novel colorimeter (Optishade StyleItaliano; Smile Line), a smartphone application (OptiShade App iOS; StyleItaliano), and a shade-matching software program (Matisse Software; LabMatisse; Fig. 2) that are cost-effective and uses a predictable shade-matching

[a]Owner, Nuance Dental Specialists, Private Dental Practice, Portland, Me.
[b]Owner, Maven Dental Studio, Private Dental Laboratory, Chicago, Ill.
[c]Owner, Lab Matisse, Private Dental Laboratory, Almere, Netherlands.

Figure 1. Initial presentation of 32-year-old patient with unesthetic composite resin restoration of fractured left maxillary central incisor. A, Portrait view. B, Smile view. C, Frontal view.

Figure 2. A, Optishade StyleItaliano colorimeter, Apple smartphone, and OptiShade App provide intuitive user interface and enable use by auxiliary staff with minimal training. B, Smartphone images obtained convert color information into CIELab values and facilitate conversion into analog shade guide values. C, Matisse Software uses predictive artificial intelligence models to generate "paint-by-number" ceramic recipe for the dental laboratory technician. Formula derived from tooth preparation's available space, preparation shade, and target shade of tooth to be matched.

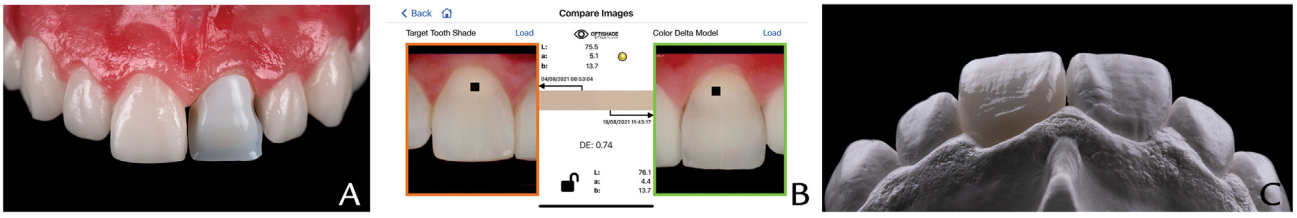

Figure 3. A, Color delta model fabricated to simulate appropriate shade of surrounding oral structures, including preparation shade, and to gauge influence of light transmission through zirconia framework. B, Dental laboratory technician able to objectively compare side-by-side clinical and laboratory images and CIELab values of target tooth and definitive restoration. C, Texture created on definitive restoration ready for delivery.

Figure 4. Completed restoration. Definitive layered zirconia restoration demonstrates seamless integration and harmonious esthetics. A, Portrait view with Duchenne smile at single-visit delivery appointment. B, Smile view. C, Frontal view.

technology that can be effectively operated without traditional shade guides or DSLR cameras (Fig. 3).

Traditional clinical and laboratory methods in the treatment planning and fabrication of esthetic restorations were reviewed. Contemporary, collaborative protocols employing the most-current dental shade matching technology were outlined for 2 patient treatments involving the restoration and single-visit delivery of single central maxillary incisors with complete-coverage high-strength ceramic crowns for a natural tooth (Fig. 4) and an endosseous implant.

REFERENCES

1. Burki Z, Watkins S, Wilson R, Fenlon M. A randomized controlled trial to investigate the effects of dehydration on tooth colour. J Dent 2013;41:250-7.
2. Mahn E, Tortora SC, Olate B, Cacciuttolo F, Kernitsky J, Jorquera G. Comparison of visual analog shade matching, a digital visual method and a cross-polarized light filter, and a spectrophotometer for dental color matching. J Prosthet Dent 2021;125:511-6.
3. Hatırlı H, Karaarslan EŞ, Yaşa B, Kılıç E, Yaylacı A. Clinical effects of dehydration on tooth color: how much and how long? J Esthet Restor Dent 2021;33:364-70.
4. Bergman B, Nilson H, Andersson M. A longitudinal study of Procera ceramic-veneered titanium copings. Int J Prosthodont 1999;12:135-9.
5. Suliman S, Sulaiman TA, Olafsson VG, Delgado AJ, Donovan TE, Heymann HO. Effect of time on tooth dehydration and rehydration. J Esthet Restor Dent 2019;31:118-23.
6. Carsten DL. Successful shade matching – what does it take? Compend Contin Educ Dent 2003;24:175-8. 180, 182 passim; quiz 188.
7. Okubo SR, Kanawati A, Richards MW, Childress S. Evaluation of visual and instrument shade matching. J Prosthet Dent 1998;80:642-8.
8. Wagner S, Rioseco M, Ortuño D, Cortés MF, Costa C. Effectiveness of a protocol for teaching dental tooth color in students with color vision impairment. J Esthet Restor Dent 2020;32:601-6.
9. Gurrea J, Gurrea M, Bruguera A, Sampaio CS, Janal M, Bonfante E, et al. Evaluation of dental shade guide variability using cross-polarized photography. Int J Periodontics Restorative Dent 2016;36:e76-81.
10. Chu SJ, Trushkowsky RD, Paravina RD. Dental color matching instruments and systems. Review of clinical and research aspects. J Dent 2010;38:Suppl 2:e2-16.

Corresponding author:
Dr Miles R. Cone
Nuance Dental Specialists
193 Middle St, 3rd Floor
Portland, ME 04101
Email: mreedcone@gmail.com

https://doi.org/10.1016/j.prosdent.2022.05.027

If you are reading this article via the journal's homepage, www.thejpd.org, or via ScienceDirect, www.sciencedirect.com/journal/the-journal-of-prosthetic-dentistry, click on the video to access via Supplementary Data.

If you are reading this article in the print edition of the journal scan the QR code to access the video or go to this URL: www.thejpd.org/video-do.