Original Article

Evaluating Shade Selection Procedure for Anterior Teeth among Dental House Surgeons and Dental Practitioners of Karachi

Imran Samejo, Bharat Kumar, Muneeb Ahmed Lone, Hira Musharraf, Lubna Memon, Maham Muneeb Lone

ABSTRACT

OBJECTIVE: To evaluate the shade selection procedure for anterior teeth among dental house surgeons, general dentists and specialists of Karachi.

METHODOLOGY: This descriptive cross-sectional study was carried out to assess knowledge, attitude and practice regarding shade selection among house surgeons, general dentists and specialistsof Karachi from February-April 2020. A structured questionnaire consisting of demographic data along with multiple choice questions related to shade matching was used to collect data. Questionnaires were distributed by hand and electronically through google forms by non-probability convenience sampling to participants who fulfilled the inclusion criteria. House surgeons, general dentists and specialists involved in provision of fixed restorations were included in the study. Participants who refused to give written informed consent were excluded from the study. SPSS v.18.0 was used for data analysis.

RESULTS: Out of the 350 forms distributed, 290 forms were returned completely filled, giving a response rate of 82.9%. Majority of house surgeons (70.96%), general dentists (72.46%) and specialists (56.75%) used visual method for shade selection in their practice, using the Vita classic shade guide. About 60% of specialist always selected the shade before any procedure and involved their team members and patients' opinion, in comparison 59% of house surgeon always selected shade after completion of procedure. Most of house surgeon never filled shade mapping chart and faced difficulty during shade selection. Majority of practitioners had blue colored walls and cabinets in their practice and used fluorescent light for shade matching. Specialists always selected the shade at patients' eye level within 5 seconds.

CONCLUSION: Specialists have better knowledge regarding principles of tooth shade selection procedure as compared to general dentists and house surgeons.

KEYWORDS: Shade selection, Anterior teeth, Dental practitioners

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INTRODUCTION

Correct tooth shade selection and communication with the dental laboratory are essential to the success of a restoration[1]. There are two methods of shade determination: comparison with shade tabs and shade measurement with electronic devices[2]. These two methods have gone under great improvement during last decades and their combination increases esthetic success[3]. Throughout the years, dental patients have grown to expect more from dental treatment; they want functionality, but also a pleasing smile[4]. The patient is likely to place a great deal of importance of the shade-match of any restorative work they may receive[5]. Shade-matching for such procedures is generally conducted subjectively; dentists must often use their best clinical judgment in the selection of the prescription shade and hope the restoration shade is clinically acceptable[6]. This air of subjectivity does not align well with current expectations. As a result, shade -matching continues to be a problem in the dental field. The complex nature of observing color does not make the problem of shade-matching any easier[7].

Shades of human teeth can vary from different angles due to the curved and multi-layered nature of tooth structure[8]. Shade-matching protocol outlines those recommendations for reliable shade match so as to achieve predictable esthetic results[1]. The process of taking the prescription shade using the shade guide is relatively simple, however some details and recommendations need to be considered[9]. The clinician should view the patient's teeth (reference teeth) from eye level. Shade-matching procedures should take place at the beginning of the appointment, keeping in mind that the patients' clothing could influence shade perception[10]. In general, the tabs that comprise the shade guide are organized in some fashion according to Mussel's color parameters. The best way to match these parameters can be confusing[11]. Some guides suggest assigning hue first. Other sources advise the opposite-match hue last[12].

There have been efforts to improve the qualitative,

subjective nature of shade guide as newer tools have been introduced into the market. Examples of these devices include: the colorimeter, the spectroradiometer and the spectrophotometer[13]. Specifically, the spectrophotometer is a multi-component machine capable of using the light signal that reflects from the tooth structure[14]. The capabilities of the spectrophotometer are also used in other fields such as advertising to insure accurate and precise recreations of the color associated with the brand logo[15]. The Spectrophotometer is able to perform the measurements required for this by comparing the reflectance from "pure white" on the color spectrum at various angles to the reflectance of light from the surface of the object.[14] In regards to esthetics, the patient's perception is the principle concern, therefore patient opinion needs to be incorporated in addition to the values obtained by color matching instruments or shade guides[10].

Despite shade matching being an integral part of planning a restoration, there is no study done to the best of our knowledge on the dentists working in Karachi to assess their practice when carrying out shade selection for a prosthesis. This study was therefore conducted to assess the knowledge, attitude and practices of shade matching among general dentists, house surgeons and specialists working in Karachi.

METHODOLOGY

A cross sectional study regarding shade selection procedure was conducted among house surgeons, general dentists and specialists from February - April 2020. Study was conducted at Dow University of Health Sciences, Jinnah Sindh Medical University and various private dental practices of Karachi. House surgeons, general dentists and specialists involved in provision of fixed restorations were included in the study. Participants who refused to give written (physical or electronic) informed consent were excluded from the study. Ethical approval was obtained from ethical review committee of Jinnah Sindh Medical University, Karachi (Reference No: JSMU/IRB/2019/294).

The participants were given the option of not revealing their name if they wanted to maintain confidentiality. The survey form was adapted from a previous study conducted in Saudi Arabia with changes made keeping the local context in mind[16]. The questionnaire was then sent to two senior content experts and the changes that they advised were incorporated. A pilot study was conducted by getting the questionnaire filled by 15 participants who fulfilled the inclusion criteria. Once filled, their feedback was sought on the administered questionnaire. Final changes were made in the questions after assessing thisfeedback regarding the clarity and contextual appropriateness of the questions.

The questions pertained to assess attitude and practice regarding shade selection. First part of questionnaire included thedemographic data such as name, age, gender and designation. Second part of questionnaire included 23 multiple choice questions related to shade matching, environment and lighting variability. Three hundred and fifty questionnaires were distributed by hand and electronically through google forms by non-probability convenience sampling to participants who fulfilled the inclusion criteria. For forms that were distributed by hand, the respondents were given ample time to fill out the survey forms. Data collectors were present to address any question the participants had while filling the forms.The survey forms distributed by hand were collected right afterwards to maximize the response rate. For the forms sent electronically via google forms, the participants were sent a reminder at 02 weeks interval to help improve response rate. Statistical Package for Social Sciences (SPSS) v.18.0 was used for data entry and analysis.

RESULTS

Three hundred and fifty survey forms were distributed among the participants, 290 questionnaires were returned completely filled, giving a response rate of 82.9%.The respondents included house surgeon 155 (53%), general dentists 98 (34%) and specialists 37 (13%) as shown in **Figure I**. Distribution of male and female participants are presented in **Figure II**.

FIGURE I: DESIGNATION OF PARTICIPANTS

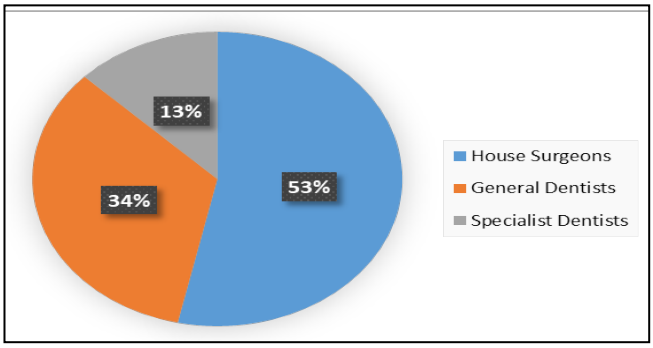
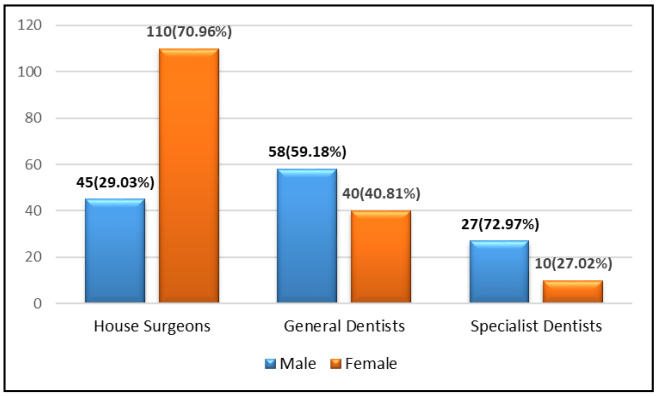


FIGURE II:
GENDER DISTRIBUTION OF PARTICIPANTS



Responses to the questions related to preference of methods for shade selection are tabulated in **Table I**. Majority of house surgeon110 (70.96%), general dentists 71 (72.46%) and specialists 21 (56.75%) used visual method for shade selection in their practice, while only 5- 8 % of them used instrument method for selection of shade. Vita classic shade guide is most commonly used by house surgeons76 (49.03%), general dentists 68 (69.38%) and specialists 23 (62.16%) for shade matching.

Twenty-two 22(59.45%) specialists always selected the shade prior to any procedure, while 76 (59.03%) of the house surgeon always selected shade at the end of procedure. Ninety-three (60%) house surgeons reported that they never fill the shade distribution chart after shade selection to communicate it to the dental laboratory. In contrast, 55 (56.12%) general dentists and 17 (45.94%) specialists fill the shade distribution chart some of the times. Most of house surgeon 96 (61.93%), general dentists81 (82.65%) and specialists 28 (75.67%) faced difficulty sometimes during shade selection.

Table II represents the response of participants to the questions related to effects of environmental conditions and lighting during the shade selection. Majority of house surgeons109 (70.32%), general 77 (78.57%) and specialist dentists26 (70.27%) stated that they had blue colored walls and cabinets in their practice for ambient shade-matching environment.

More than half of general and specialist dentists selected shade by using fluorescent light, while 73 (47.09%) house surgeons used natural day light for shade selection. Most of house surgeon sometime removed the patient facial cosmetics and clean teeth before selection of shade, while majority of general and specialist dentists always considered removal of patient's facial cosmetics and cleaning of teeth before shade selection.

TABLE I: RESPONSE TO QUESTIONS RELATED TO PREFERENCE OF SHADE SELECTION METHOD

Q: Method for shade selection?

	Visual	Instrumental	Both Methods
House Surgeon (155)	110(70.96%)	9(5.80%)	36(23.22%)
General Dentist (98)	71(72.44%)	8(8.16%)	19(19.38)
Specialists (37)	21(56.75%)	3(8.10%)	13(35.13%)

Q: Shade guide for shade selection?

	VITA Classic	VITA Tooth guide 3-D Master	Ivoclar Viva-dent Chromo-scope
House Surgeon (155)	76(49.03%)	42(27.09%)	37(23.87%)
General Dentist (98)	68(69.38%)	22(22.44%)	8(8.16%)
Specialists (37)	23(62.16%)	11(29.72%)	3(8.10%)

Q: Shade selection prior to the procedure?

	Always	Sometime	Never
House Surgeon (155)	56(36.12%)	68(43.87%)	31(20%)
General Dentist (98)	42(42.85%)	38(38.77%)	18(18.36%)
Specialists (37)	22(59.45%)	11(29.72%)	4(10.81%)

Q: Shade selection at the end of procedure?

	Always	Sometime	Never
House Surgeon (155)	76(59.03%)	23(14.83%)	56(36.12%)
General Dentist (98)	43(43.87%)	13(13.26%)	42(42.85%)
Specialists (37)	5(13.51%)	7(18.91%)	22(59.45%)

Q: Team involved in shade selection?

	Always	Sometime	Never
House Surgeon (155)	51(32.90%)	67(43.22%)	37(23.87%)
General Dentist (98)	38(38.77%)	24(24.48%)	36(36.73%)
Specialists (37)	13(35.13%)	19(51.35%)	5(13.51%)

Q: Do you take patients opinion while doing shade selection?

	Always	Sometime	Never
House Surgeon (155)	46(29.67%)	78(50.32%)	31(20%)
General Dentist (98)	42(42.85%)	47(47.95%)	9(9.18%)
Specialist (37)	27(72.97%)	8(21.62%)	2(5.40%)

Q: Filling of Shade Distribution Chart?

	Always	Sometime	Never
House Surgeon (155)	15(9.67%)	47(30.32%)	93(60%)
General Dentist (98)	19(19.38%)	55(56.12%)	24(24.48%)
Specialists (37)	15(40.54%)	17(45.94%)	5(13.51%)

Q: Difficulty faced during shade selection?

	Always	Sometime	Never
House Surgeon (155)	23(14.83%)	96(61.93%)	36(23.22%)
General Dentist (98)	8(8.16%)	81(82.65%)	9(9.18%)
Specialists (37)	2(5.40%)	28(75.67%)	7(18.21%)

TABLE II: RESPONSE TO QUESTIONS RELATED TO ENVIRONMENT CONDITIONS AND LIGHTING

Q: Shade-matching environment?

	Grey colored walls and cabinets	Blue colored walls and cabinets	White colored walls and cabinets
House Surgeon (155)	12(7.74%)	109(70.32%)	34(21.93%)
General Dentist (98)	16(16.32%)	77(78.57%)	5(5.10%)
Specialist Dentist (37)	11(29.72%)	26(70.27%	0(0%)

Q: What type of light do you use for shade selection?

	Dental unit Light	Fluorescent light	Natural day-light
House Surgeon (155)	27(17.41%)	55(35.48%)	73(47.09%)
General Dentist (98)	8(8.16%)	51(52.04%)	40(40.81%)
Specialist Dentist (37)	1(2.70%)	21(56.75%)	15(40.54%)

Q: Removal of facial cosmetics /lipstick before shade selection?

	Always	Sometime	Never
House Surgeon (155)	39(25.16%)	89(57.41%)	27(17.41%)
General Dentist (98)	61(62.24%)	32(32.65%)	5(5.10%)
Specialist Dentist (37)	29(78.37%)	6(16.21%)	2(5.40%)

Q: Cleaning the teeth before shade selection?

	Always	Sometime	Never
House Surgeon (155)	48(30.96%)	79(50.96%)	28(18.06%)
General Dentist (98)	67(68.36%)	25(25.51%)	6(6.12%)
Specialist Dentist (37)	28(75.67%)	8(21.62%)	1(2.70%)

Q: Having patients at eye level during shade selection?

	Always	Sometime	Never
House Surgeon (155)	55(35.48%)	61(39.35%)	39(25.16%)
General Dentist (98)	33(33.67%)	40(40.81%)	25(25.51%)
Specialist Dentist (37)	25(67.56%)	9(24.32%)	3(8.10%)

Q: Time taken for shade selection?

	Within 5 Seconds	5-10 Seconds	11-15 Seconds
House Surgeon (155)	29(18.70%)	43(27.74%)	47(30.32%)
General Dentist (98)	38(38.36%)	31(31.63%)	17(17.34%)
Specialist Dentist (37)	22(59.45%)	13(35.13%)	2(5.40%)

DISCUSSION

Our study is the first research to the best of our knowledge that reports the attitude and practice of shade selection among general dentists, house surgeons and specialists working in Karachi. The study identifies areas that need to be emphasized upon during clinical training during the undergraduate and post graduate years in order to improve shade selection when providing restorations.

Although comparable trends were seen among the participants; the house officers and general dentists had slightly varied responses compared to the specialists. Majority of the participants used the visual method for shade selection, but around 35% of the specialists preferred both the visual and the instrumental method for shade selection. Similar trends have been reported in several previous studies[16-18]. VITA classic and VITA 3-D master tooth guide were the most frequently employed shade guides by the participants of all study groups. The increased reliability on only the visual method may be one of the reasons that the study participants reported that they sometimes faced difficulty in shade selection, as the visual methods are known to have several inaccuracies and limitations[17,19,20].

Shade matching is considered an art more than it is a science. Closely matching an artificial restoration to the natural teeth is a challenge in restorative dentistry. Literature suggests that this color match should be done at the start of appointment, as a dry tooth looks whiter than its original shade because of decreased translucency and chroma, therefore giving an inaccurate shade match[10,16,21,22]. In our study 60% of specialists adhered to this principle, but in contrast, similar percentage of general dentists and the house officers (60%) selected the shade at the end of the procedure. This may lead to inaccurate shade selection and should therefore be emphasized in the undergraduate teaching years. These results are similar to results of Habib S 2012[16], who also reported that more specialists recorded the shade prior to tooth preparation compared to their junior colleagues.

No two natural teeth are alike. Each natural tooth has a distinctive color and shape, revealing information about ethnicity and personality of patients. Restoring a tooth closer to the original characteristics gives us the opportunity to reestablish our patients' unique characteristics. Irrespective of the number of teeth being restored at one time, information about the form and color of the restoration to be constructed needs to be communicated clearly to the laboratory for a successful restoration. It will only be possible to duplicate the characteristics in the laboratory if they have been properly understood during the shade matching process and subsequently communicated to the technician[21-23]. This should be reiterated to the dental practitioners at undergraduate as well as postgraduate level, asonly 40% dental specialists filled the shade distribution chart. Very few (less than 20%) house surgeons and general dentists filled out this form on routine basis.

The patient is the foremost stakeholder in the restorative treatment being provided to them. It is therefore of utmost importance that they are satisfied with the restoration being provided to them, especially when restoring teeth in the esthetic zone. Making the patient a part of the treatment plan improves the overall patient satisfaction to the treatment provided[10]. In our study, similar to a research conducted in India, almost 70% of the specialists understood this and included the patient's input when selecting the shade of their restoration[23]. In contrast, only around 30-40% of house surgeons and general dentists in the present study always asked the patient's opinion regarding the shade.

Almost 60% of specialist dentists selected the shade

within the ideal 5 seconds time duration. This is recommended because the longer the stare, the more eye fatigue sets in and hampers a good shade match[1,24]. A longer stare decreases the value of the shade, causing wrong shade selection. This needs to be reinforced in the undergraduate practice as majority of house surgeons and general dentists took up to 15 minutes to select a shade. Majority of the respondents of the present study preferred a blue colored background, which is in contrast to the guidelines for shade selection in literature[21]. Literature suggests an ideal setting of neutral grey colored background of the dental operatory as the color does not fatigue the eye, has no complementary color and thus helps in making a reliable shade match[16,21].

Majority of the respondents of our study reported the use of florescent and the natural daylight for shade selection, as per the standard recommended guidelines so as to minimize metamerism and therefore increase the chances of prosthesis matching the natural dentition in different lighting conditions[1,21,22]. Removing any facial cosmetics / lipstick and cleaning the teeth before shade selection is recommended and the same was understood by and practiced by majority of the study participants. Majority of the study participants also understood and reported that they carried out shade selection with the patient's teeth at eye level, as suggested in various shade matching guidelines[1,10,19,21].

CONCLUSION

Keeping the results of our study in mind, it can be concluded that although similar trends were seen during shade matching in our respondents, specialist dentists had a better understanding about the principles and guidelines of shade matching. It is thus imperative that guidelines of shade matching to be taught more thoroughly and their importance re-emphasized in the undergraduate years. This would help general dentists have a much better understanding of and adhere to principles of shade matching so they can provide esthetically pleasing restorations to their patients.

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AUTHOR CONTRIBUTIONS

Samejo I: Writing introduction, methodology, literature review
Kumar B: Perception of idea, data collection, results compilation
Lone MA: Data collection, discussion & review writing
Musharraf H: Writing discussion & references
Memon L: Data collection, Analysis
Lone MM: Data collection, Analysis, Abstract writing

REFERENCES

1. Ragain JC. A review of color science in Dentistry: Shade matching in the contemporary dental practice. J Dent Oral Disord Ther. 2016; 4(2): 1-5. doi:10.15226/jdodt.2016.00156.
2. Liberato WF, Barreto IC, Costa PP, de Almeida CC, Pimentel W, Tiossi R. A comparison between visual, intraoral scanner, and spectrophotometer shade matching: A clinical study. J Prosthet Dent. 2019; 121(2): 271-5. doi: 10.1016/j.prosdent. 2018.05.004.
3. Chen H, Huang J, Dong X, Qian J, He J, Qu X, et al. A systematic review of visual and instrumental measurements for tooth shade matching. Quintessence Int. 2012; 43(8): 649-59.
4. Viana PC, Kovacs Z, Correia A. Purpose of esthetic risk assessment in prosthetic rehabilitations with gingiva-shade ceramics. Int J Esthet Dent. 2014; 9(4): 480-9.
5. Papaspyridakos P, Amin S, El-Rafie K, Weber HP. Technique to match gingival shade when using pink ceramics for anterior fixed implant prostheses. J Prosthodont. 2018; 27(3): 311-3. doi: 10.1111/jopr.12483.
6. Igiel C, Lehmann KM, Ghinea R, Weyhrauch M, Hangx Y, Scheller H, et al. Reliability of visual and instrumental color matching. J Esthet Restor Dent. 2017; 29(5): 303-8. doi: 10.1111/jerd.12321.
7. Hein S, Tapia J, Bazos P. eLAB or_aid: a new approach to digital shade management. Int J Esthet Dent. 2017; 12(2): 186-202.
8. Pavicic DK, Spalj S, Uhac I, Lajnert V. A cross-sectional study of the influence of tooth color elements on satisfaction with smile esthetics. Int J Prosthodont. 2017; 30(2): 156-9.
9. Öngül D, Şermet B, Balkaya MC. Visual and instrumental evaluation of color match ability of 2 shade guides on a ceramic system. J Prosthet Dent. 2012; 108(1): 9-14.
10. Johnston WM. Color measurement in dentistry. J Dent. 2009; 37(suppl 1): e2-e6. doi: 10.1016/j. jdent.2009.03.011.
11. Paravina RD. Performance assessment of dental shade guides. J Dent. 2009; 37(1): e15-20. doi: 10.1016/j.jdent.2009.02.005.
12. Pecho OE, Perez MM, Ghinea R, Della Bona A. Lightness, chroma and hue differences on visual shade matching. Dent Mater. 2016; 32(11): 1362-73.
13. Tsiliagkou A, Diamantopoulou S, Papazoglou E, Kakaboura A. Evaluation of reliability and validity of three dental color-matching devices. Int J Esthet Dent. 2016; 11(1): 110-24.

14. Paul SJ, Peter A, Rodoni L, Pietrobon N. Conventional visual vs spectrophotometric shade taking for porcelain-fused-to-metal crowns: a clinical comparison. Int J Periodont Restor Dent. 2004; 24(3): 222-31.
15. Ballard E, Metz M, Harris B, Metz C, Chou J, Morton D, et al. Satisfaction of dental students, faculty, and patients with tooth shade-matching using a Spectrophotometer. J Dent Educ. 2017; 81(5): 545-53. doi: 10.21815/JDE.016.022.
16. Habib S. Awareness of tooth shade selection principles among dental students, interns, general dentists and specialists. Pak Oral Dent J. 2012; 32(3): 549-55.
17. Judeh A, Al-Wahadni A. A comparison between conventional and spectrophotometric methods for shade selection. Quintessence Int. 2009; 40(9): e69-79.
18. Klemetti E, Matela AM, Haag P, Kononen M. Shade selection performed by novice dental professionals and colorimeter. J Oral Rehabil. 2006; 33(1): 31-5.
19. Hall NR. Tooth colour selection: the application of colour science to dental colour matching. Aust Prosthodont J. 1991; 5: 41-6.
20. Li Q, Wang YN. Comparison of shade matching by visual observation and an intraoral dental colorimeter. J Oral Rehabil. 2007; 34(11): 848-54.
21. Fondriest JF. Shade matching in restorative dentistry: the science and strategies. Int J Periodont Restor Dent. 2003; 23(5): 467-79.
22. Joiner A. Tooth colour: a review of the literature. J Dent 2004; 32(1): 3-12.
23. Sambandam TV, Ramesh S. Knowledge, attitude, and practice of dental students and practitioners on shade matching of anterior teeth. J Adv Pharm Edu Res. 2017; 7(3): 368-70.
24. Jain A, Bhat V, Hedge C. A study to analyze the paramount way of shade selection among restorative dentists in South Canara district, Karnataka. Nitte Uni J Health Sci. 2017; 7(2): 19-23.

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