

Evaluation of Shade Matching In Fixed Dental Prosthesis Using Usphs Guidelines

Type of study-Retrospective Study

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Article Info Volume 81 Page Number: 6792 - 6797 Publication Issue: November - December 2019 Article History Article Received: 5 March 2019 Revised: 18 May 2019 Accepted: 24 September 2019 Publication: 31 December 2019	Abstract: . Colour stability is one of the most important factors to achieve an esthetic smile. Proper shade selection has to be done with respect to adjacent teeth. Human eye perception is the most commonly used method for shade selection. Certain guidelines to score the colour matching can help in improving the esthetics. Hence, this study aims to check the prevalences of the scores of USPHS guidelines for colour matching and check its correlation with the qualification of the dental students. This retrospective study was carried out from the data obtained from the patients' case sheet. A total of 735 subjects were selected, undergoing treatment for fixed dental prosthesis. The prevalence of three different scores was checked. Group 1- Score of 0, Group 2- Score of 1, Group 3-Score of 2, Group 4- Score of 3 and Group 5- Score of 4.. The frequency of each score was checked and a Chi square test was done to evaluate the association between the scores and qualification of the dental student. It was observed that maximum students achieved a score of 1, followed by a score of 0, few people achieved a score of 2 and a handful of people achieved the scores of 3 and 4. Within the groups, it was seen that the prevalence of the score 0 was seen more in postgraduate students as compared to the undergraduate students. It can be concluded that the overall results achieved by the students were good. Further studies need to be done to verify the results. Keywords: Colour matching, Esthetics, USPHS guidelines
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I. INTRODUCTION

Prosthodontics is a branch of dentistry which helps to replace the damaged and missing teeth which provides masticatory efficiency and aesthetics(Kulkarni, 2014; Ariga *et al.*, 2018). Esthetics has been the main criteria of the patients since the introduction of esthetic dentistry(Website, no date; Jain, Ranganathan and Ganapathy, 2017). Esthetic replacement and physiological tooth arrangement made the dental prosthesis biologically compatible and desirable(Kumar *et al.*, 2011; Jyothi *et al.*, 2017). Proper placement of teeth should be functional and esthetically pleasing to enhance the patient's mental attitude(Ashok *et al.*, 2014;

Venugopalan *et al.*, 2014). The creation of an attractive but natural dental appearance has become a critical treatment success criterion in the field of dentistry('Patient satisfaction with dental appearance', 2016; Ajay *et al.*, 2017; Duraisamy *et al.*, 2019).

One of the most important criteria which cannot get unnoticed in a smile is colour of the teeth(Ganapathy *et al.*, 2016; Vijayalakshmi and Ganapathy, 2016). Hence clinicians should give utmost importance to shade matching(Ganapathy, Kannan and Venugopalan, 2017). Good shade selection is a demanding task even for experienced dental practitioners. Shade matching or colour science is based on Munsell's principles(Munsell, 1915). The most common clinical approach for

shade matching is the human eye (Ashok and Suvitha, 2016). A normal person with a good vision can differentiate between 300 different colours ('The Measurement of Appearance, 2nd ed. by Richard S. Hunter and Richard W. Harold, John Wiley & Sons, New York, 1987, 411 pages, hardcover. Price: \$29.95', 1988). Even so, the human eye does not give accurate results all the time. Culpepper et al (Culpepper, 1970) reported in his study that there was a disagreement among the dentists in shade matching of the same tooth. He reported the inability of the dentist to duplicate their shade selection on different days. Dancy et al (Dancy *et al.*, 2003) reported that the use of photo colorimetric analysis in shade selection can serve as an alternative to conventional visual shade selection.

Esthetics is an art with subjective rather than analytical interpretation. Hence, specific guidelines should be followed to generalize the esthetic perception among the dental practitioners. Hence, USPHS guidelines for colour matching was recognized as a gold standard for shade selection.

The scoring is as follows:

Alpha- No mismatch in colour, shade or translucency between restoration and adjacent tooth structure

Beta- Mismatch between the restoration and the tooth structure within the normal range of colour, shade and translucency.

Gamma- Mismatch between the restoration and the tooth structure outside the normal range of colour, shade and translucency.

Based on the scores, clinical decisions were taken. This study aims to evaluate the prevalence of different scores of USPHS guidelines for colour matching and check its association with the qualification of the operator.

II. MATERIALS AND METHODS

Study Design

This retrospective cross sectional study was carried out in the Department of Prosthodontics. The present study was approved by the Ethics Committee of the College. The data was obtained from the case records of the patients coming to the outpatient department of the college.

Ethical approval number- SDC
/SIHEC/2020/DIASDATA/0619-0320

III. SAMPLE SELECTION

From June 2019 to May 2020, the subject selection of this study was done in a Dental hospital based on the inclusion and exclusion criteria.

Inclusion Criteria

- 1) At least 18 years old.
- 2) Healthy subjects with no history of systemic diseases.
- 3) Both genders.
- 4) Patients undergoing a fixed partial denture treatment.
- 5) Signed informed consent

Exclusion criteria

- 1) Patients with systemic disease
- 2) Alcoholic patients
- 3) Patients indicated for metal crowns.
- 4) Patients indicated for monolithic zirconia crowns.
- 5) Patients indicated for implants
- 6) Patients not willing for the treatment.

After the inclusion and exclusion criteria, the number of subjects were shortlisted from 42960 to 735. Analysis of the occlusion was done with photographic assessment.

Groups

For convenience, the scoring was modified a little

Group 1: Score 0 (Very good colour match)

Group 2: Score 1 (Good colour match)

Group 3: Score 2 (Slight mismatch of the colour or the shade)

Group 4: Score 3 (Obvious mismatch)

Group 5: Score 4 (Gross mismatch)

Statistical Analysis

All analyses were conducted using SPSS 21 (SPSS Inc., Chicago, IL). Descriptive statistics such as frequency was carried out for each model. A Chi square test was done to determine the association between the score of the guidelines and the qualification of the operator.

Statistical Variables

The independent variables in this study are the study groups.

The dependent variables in this study are the scores of the USPHS guidelines.

IV. RESULTS AND DISCUSSION

In this study, it is observed that maximum students achieved a score of 1 (64.8%), which indicated a good colour match, followed by a score of 0 (23.9%), which indicated a very good colour match. Few students achieved a score of 2 (10.2%), which indicated slight mismatch of the colour or the shade and a handful of students achieved a score of 3 (0.8%), which indicated obvious colour match and 4 (0.3%), which indicated gross colour match.

Shade matching should be as perfect as possible, especially in the anterior teeth as an esthetic smile will be based on shade matching of the prosthesis. Although the human eye is the most common source of shade matching, it is bound to give some errors. With the recent advances in technology, it would be more prudent to use a spectrophotometer for shade matching (Selvan and Ganapathy, 2016; Subasree, Murthykumar and Dhanraj, 2016). It registers the hue, chroma and value of the colour to be checked, and accordingly sets the shade (Basha, Ganapathy and Venugopalan, 2018). One new innovation in machine based dentistry is intraoral spectrophotometer (Kannan and Venugopalan, 2018). It is able to identify reference shades from two different shade guides: the Vita 3D-Master (3D) (Vita Zahnfabrik, Bad Säckingen, Germany) and the Vitapan Classical (VC) (Vita Zahnfabrik, Bad Säckingen, Germany). Since the instrument is highly developed, with data of multiple shades, it presents itself as a very integrated system. The color-measurement area consists of two separate measuring apertures, a 1-mm and a 3-mm diameter and an illuminating diameter of 5mm. Dozic et al (Dozić et al., 2007) reported that the intraoral spectrophotometer was one of the most reliable machines for shade selection. However, there is no study which compares the accuracy of intraoral spectrophotometers with human eye perception. However, it has been reported that even these instruments have certain limitations. One of the

studies reported 50% accuracy in the instrument, whereas the shade matching perceived by the human eye reported 48% accuracy with no statistically significant difference (Okubo *et al.*, 1998). In another study, four clinicians used spectrophotometers and were made to take the shade from incisor and canine. There was a disagreement among the examiners, which resulted in different results with respect to central incisors (Hassel *et al.*, 2007). It is observed that both the groups of students got almost equal prevalences of the score.

The prevalence of the score 0 was more in the post graduate students (30.1%) as compared to the undergraduate students (22.4%). This can be due to experience of the postgraduate students to visualise the intricate details. The fact that postgraduate students are taught about the subject in detail is supported by the literature (Çiçek *et al.*, 2016). The prevalence of the score 1 was more in the undergraduate students (30.1%) as compared to the postgraduate students (22.4%). One more hypothesis here can be that the postgraduate students critically analysed the shade matching, and hence their scores got reduced, whereas, the undergraduate students, being unaware of the intricate details, gave better scores.

Although, this study showed that the prevalence of score 0 was the most, it has certain limitations. Firstly, even after specific guidelines, scoring is subjective from individual to individual. There might be a difference in the thought process between the undergraduates and post graduates (Kannan and Venugopalan, 2018). Secondly, there is a chance of some minute errors clinically (Ajay *et al.*, 2017). It should have been verified using a spectrophotometer for proper validation. Thirdly, the kind of coping framework can create bias in the results since metal copings might show a change in colour if the proper amount of opacifiers are not incorporated. Hence, more studies need to be done under one operator with proper standardization protocols.

V. TABLES AND FIGURES:

Groups	Frequency	Percentage
Score 0	176	23.9%
Score 1	476	64.8%
Score 2	75	10.2%
Score 3	6	0.8%
Score 4	2	0.3%

Table 1: Table depicting the frequencies of the scores of USPHS guidelines for colour matching.

			Score 0	Score 1	Score 2	Score 3	Score 4	Chi square value	p value
Student Qualification	Undergraduate	Count	132	389	61	6	1	6.365	0.173
		% within the groups	(22.4%)	(66.0%)	(10.4%)	(1.0%)	(0.2%)		
	Post graduate	Count	44	87	14	0	1		
		% within the groups	(30.1%)	(59.6%)	(9.6%)	(0.0%)	(0.7%)		

Table 2: Table depicting the association of the USPHS colour matching score with student qualification.

according to the USPHS guidelines and the Y- axis represents the number of patients. The most prevalent of the scores was score 1 (64.8%), followed by score 0 (23.9%), followed by score of 2 (10.2%), score of 3 (0.8%) and score of 4 (0.3%).

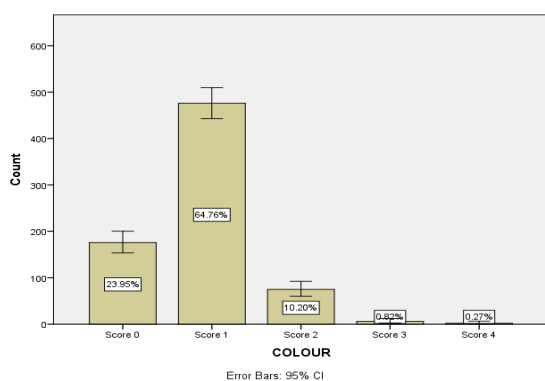


Figure 1: Bar Graph representing the prevalence of USPHS scores for colour matching. The X- axis represents the various scores for colour matching

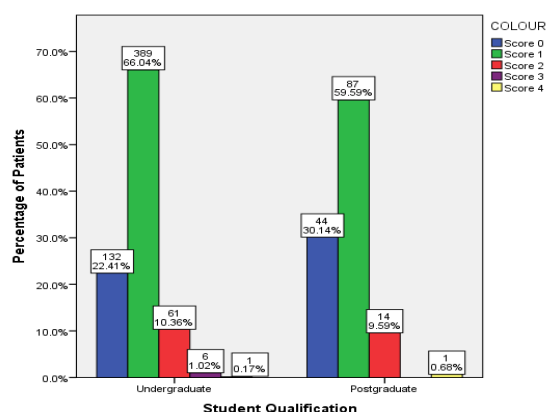


Figure 2: Bar graph representing the association between USPHS colour matching scores and student qualification. X-axis represents the student qualification and Y-axis represents the percentage of patients. There is no statistical significant association between USPHS colour matching scores and student qualification (Chi square value: 6.365, p value: 0.172, ($p > 0.05$). Postgraduates gave a higher count of colour matching score of 0, as compared to the undergraduates, whereas, the undergraduates gave a higher count of colour matching score of 1.

VI. CONCLUSION

The present study concludes that most of the dental students had achieved a score of 0, which indicated very good results. Other students should be motivated to get better outcomes. Postgraduate students should attend seminars and guest lectures related to esthetics and proper shade matching. They should be trained to use the latest instruments like intraoral spectrophotometer to obtain better results. Undergraduate students should be made to assist the postgraduates for mutual learning. More number of invivo studies needs to be done under one operator for optimum results.

VII. AUTHOR CONTRIBUTIONS:

The primary author contributed to establish the materials and methods and analysed the results followed by manuscript writing. The co-author verified the results and manuscript before submission.

VIII. CONFLICT OF INTEREST :

There is no conflict of interests.

IX. REFERENCES

- [1]. Ajay, R. *et al.* (2017) 'Effect of surface modifications on the retention of cement-retained implant crowns under fatigue loads: An In vitro study', *Journal of Pharmacy And Bioallied Sciences*, p. 154. doi: 10.4103/jpbbs.jpbb_146_17.
- [2]. Ariga, P. *et al.* (2018) 'Determination of Correlation of Width of Maxillary Anterior Teeth using Extraoral and Intraoral Factors in Indian Population: A Systematic Review', *World Journal of Dentistry*, pp. 68–75. doi: 10.5005/jp-journals-10015-1509.
- [3]. Ashok, V. *et al.* (2014) 'Lip Bumper Prosthesis for an Acromegaly Patient: A Clinical Report', *The Journal of Indian Prosthodontic Society*, pp. 279–282. doi: 10.1007/s13191-013-0339-6.
- [4]. Ashok, V. and Suvitha, S. (2016) 'Awareness of all ceramic restoration in rural population', *Research Journal of Pharmacy and Technology*, p. 1691. doi: 10.5958/0974-360x.2016.00340.1.
- [5]. Basha, F. Y. S., Ganapathy, D. and Venugopalan, S. (2018) 'Oral Hygiene Status among Pregnant Women', *Research Journal of Pharmacy and Technology*, p. 3099. doi: 10.5958/0974-360x.2018.00569.3.
- [6]. Çiçek, E. *et al.* (2016) 'Comparison of treatment choices among endodontists, postgraduate students, undergraduate students and general dentists for endodontically treated teeth', *International dental journal*, 66(4), pp. 201–207.
- [7]. Culpepper, W. D. (1970) 'A comparative study of shade-matching procedures', *The Journal of Prosthetic Dentistry*, pp. 166–173. doi: 10.1016/0022-3913(70)90140-x.
- [8]. Dancy, W. M. K. *et al.* (2003) 'Color Measurements as Quality Criteria for Clinical Shade Matching of Porcelain Crowns', *Journal of Esthetic and Restorative Dentistry*, pp. 114–122. doi: 10.1111/j.1708-8240.2003.tb00327.x.
- [9]. Dozić, A. *et al.* (2007) 'Performance of five commercially available tooth color-measuring devices', *Journal of prosthodontics: official journal of the American College of Prosthodontists*, 16(2), pp. 93–100.
- [10]. Duraisamy, R. *et al.* (2019) 'Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments', *Implant dentistry*, 28(3), pp. 289–295.
- [11]. Ganapathy, D. *et al.* (2016) 'Effect of Resin Bonded Luting Agents Influencing Marginal Discrepancy in All Ceramic Complete Veneer Crowns', *Journal of clinical and diagnostic research: JCDR*, 10(12), pp. ZC67–ZC70.

- [12]. Ganapathy, D. M., Kannan, A. and Venugopalan, S. (2017) 'Effect of Coated Surfaces influencing Screw Loosening in Implants: A Systematic Review and Meta-analysis', *World Journal of Dentistry*, pp. 496–502. doi: 10.5005/jp-journals-10015-1493.
- [13]. Hassel, A. J. *et al.* (2007) 'Interexaminer reliability in clinical measurement of L*C*h* values of anterior teeth using a spectrophotometer', *The International journal of prosthodontics*, 20(1), pp. 79–84.
- [14]. Jain, A., Ranganathan, H. and Ganapathy, D. (2017) 'Cervical and incisal marginal discrepancy in ceramic laminate veneering materials: A SEM analysis', *Contemporary Clinical Dentistry*, p. 272. doi: 10.4103/ccd.ccd_156_17.
- [15]. Jyothi, S. *et al.* (2017) 'Periodontal Health Status of Three Different Groups Wearing Temporary Partial Denture', *Research Journal of Pharmacy and Technology*, p. 4339. doi: 10.5958/0974-360x.2017.00795.8.
- [16]. Kannan, A. and Venugopalan, S. (2018) 'A systematic review on the effect of use of impregnated retraction cords on gingiva', *Research Journal of Pharmacy and Technology*, p. 2121. doi: 10.5958/0974-360x.2018.00393.1.
- [17]. Kulkarni, R. S. (2014) 'Esthetic and Functional Rehabilitation of a Patient with Abrasion, Attrition, and Missing Teeth', *International Journal of Prosthodontics and Restorative Dentistry*, pp. 52–55. doi: 10.5005/jp-journals-10019-1107.
- [18]. Kumar, M. V. *et al.* (2011) 'The Science of Anterior Teeth Selection for a Completely Edentulous Patient: A Literature Review', *The Journal of Indian Prosthodontic Society*, pp. 7–13. doi: 10.1007/s13191-011-0058-9.
- [19]. Munsell, A. H. (1915) 'Atlas of the Munsell color system'. doi: 10.5479/sil.129262.39088002718880.
- [20]. Okubo, S. R. *et al.* (1998) 'Evaluation of visual and instrument shade matching', *The Journal of prosthetic dentistry*, 80(6), pp. 642–648.
- [21]. 'Patient satisfaction with dental appearance' (2016) *Dental Abstracts*, p. e23. doi: 10.1016/j.denabs.2015.10.027.
- [22]. Selvan, S. R. and Ganapathy, D. (2016) 'Efficacy of fifth generation cephalosporins against methicillin-resistant Staphylococcus aureus-A review', *Research Journal of Pharmacy and Technology*, p. 1815. doi: 10.5958/0974-360x.2016.00369.3.
- [23]. Subasree, S., Murthykumar, K. and Dhanraj (2016) 'Effect of Aloe Vera in Oral Health-A Review', *Research Journal of Pharmacy and Technology*, p. 609. doi: 10.5958/0974-360x.2016.00116.5.
- [24]. 'The Measurement of Appearance, 2nd ed. by Richard S. Hunter and Richard W. Harold, John Wiley & Sons, New York, 1987, 411 pages, hardcover. Price: \$29.95' (1988) *Color Research & Application*, pp. 197–197. doi: 10.1002/col.5080130317.
- [25]. Venugopalan, S. *et al.* (2014) 'Magnetically retained silicone facial prosthesis', *Nigerian journal of clinical practice*, 17(2), pp. 260–264.
- [26]. Vijayalakshmi, B. and Ganapathy, D. (2016) 'Medical management of cellulitis', *Research Journal of Pharmacy and Technology*, p. 2067. doi: 10.5958/0974-360x.2016.00422.4.
- [27]. Website (no date). Available at: Zaina F, Negrini S, Fusco C, Atanasio S. How to improve aesthetics in patients with Adolescent Idiopathic Scoliosis (AIS): a SPoRT brace treatment according to SOSORT management criteria. Scoliosis [Internet]. 2009;4(1). Available from: <http://dx.doi.org/10.1186/1748-7161-4-18> (Accessed: 15 June 2020).