

Aesthetic Dentistry - What You Decided and What I Want: Shade Selection

Kaleswararao Atluri¹, Sunil Chandra Tripuraneni¹, SriHarsha Vadapalli¹, Rajeswari Kommu¹,
Sudhakar Vundavalli²

¹Department of Prosthodontics, Drs Sudha and Nageswara Rao Siddhartha Institute of Dental Sciences, Gannavaram, Andhra Pradesh, India.

²Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamilnadu, India.

Corresponding author: Sudhakar Vundavalli

E-mail: dr.sudhakar.vundavalli@jodent.org

Academic Editor: Wilton Wilney Nascimento Padilha

Received: December 14, 2022 / **Review:** April 09, 2023 / **Accepted:** June 03, 2023

How to cite: Atluri K, Tripuraneni SC, Vadapalli S, Kommu R, Vundavalli S. Aesthetic Dentistry - What you decided and what I want: Shade selection. *Pesqui Bras Odontopediatria Clín Integr.* 2024; 24:e220186. <https://doi.org/10.1590/pboci.2024.021>

ABSTRACT

Objective: To assess the relationship between patients' and dentists' perceptions of shade selection and its impact on satisfaction with the prosthesis. **Material and Methods:** A single group pre-post study was conducted at the Prosthodontics department of a teaching hospital in India. One hundred ten participants were selected through a systematic random sampling technique with inclusion and exclusion criteria. Patients' attitudes regarding the aesthetics of their maxillary anterior teeth were recorded using a validated questionnaire. Shades for the intended prosthetic crown selected by the dentist and chosen by the patient were recorded separately, and patient satisfaction with the appearance of the final prosthesis was recorded. We used descriptive statistics followed by Pearson's Chi-square test and a binomial logistic regression model for inferential statistics. **Results:** 109 participant's data were available for final analysis. Patients choose lighter shades than the dentist's selection, which is statistically significant ($p=0.000$). 73.4% were satisfied with the final prosthesis, and the binomial logistic regression model identified using patient-selected shade for the final prosthesis was significantly associated with patients' satisfaction with the final prosthesis ($OR=3.3$, $p=0.001$). **Conclusion:** The patient's preference should be considered with the dentist's option when selecting a shade to create good esthetics.

Keywords: Patient Satisfaction; Tooth Crown; Esthetics, Dental; Prosthodontics.

Introduction

Up until three to four decades ago, restorative dentistry's main focus was restoring teeth ravaged by dental caries and replacing missing teeth to restore masticatory function [1]. As dental caries have decreased and dental aesthetics have become more important, the concept of functional dentistry has gradually given way to aesthetic dentistry [2]. As a result, changes in patient demands should be influenced by how today's age perceives dental aesthetics. In modern dentistry, a dentist's challenge is assessing, planning, and carrying out the treatment to meet the patient's expectations [3].

To achieve cosmetic dental restorations, it is essential to determine the precise color of the teeth. It entails color assessment, verbal communication with the technician, deciphering color information, constructing the restoration, and color confirmation before cementing in the patient's mouth [4]. The choice of color or shade may also change depending on factors like the light source, adjacent tissues, and the patient's skin tone. However, a clinician's sense of color is one of the most critical factors in determining the color of teeth [5].

The viewer's perception of a visual experience might be pleasant or unpleasant depending on cultural and personal factors associated with the teeth's appearance [6]. The majority of dental procedures now focus more and more on aesthetics. Successful shade matching is a complicated and multidimensional process [7].

A study conducted by Valittu et al. [3] about the attitudes of different patient groups about dental aesthetics identified that female patients were more concerned about esthetics than males and the perception that lighter shades are more beautiful as inversely proportional to age.

Although shade selection is routine, limited research about patients' perceptions and role in shade selection was available. Most studies compare shade selection processes or patients' attitudes toward dental aesthetics [7,8]. A study about patient satisfaction with shade choosing reported by Alzeghaibi et al. [4] has specifically determined the patient's self-evaluation of the shade selection about the clinician's evaluation. 81% of the patients were satisfied with their final prosthesis shade, and around one-third desired a lighter shade [4]. Another study reported by Samorodnitzky-Naveh et al. [2] has identified that among the patients dissatisfied with prosthetic dental care, 29.3% were due to the teeth color of the final prosthesis.

In a typical clinical situation, the dental professional chooses the shade. Patients may or may not be happy with the final prosthesis shade, but incorporating their opinions into the shade choosing may improve the likelihood that they will be. Therefore, this study was conducted to evaluate how patients perceive the shade of their teeth and how that affects their satisfaction with the prosthesis' final shade.

The study aims to assess the relationship between patients' and dentists' perception of shade selection and its impact on satisfaction with the prosthesis.

Material and Methods

Design and Ethical Approval

In this investigation, a single group participated in a pre-post study. The Institutional Review Board of Drs Sudha and Nageswara Rao Siddhartha Institute of Health Sciences, India, with approval number (2022-11869) granted ethical clearance for the study protocol. All the procedures followed in this research were by Helsinki's Declaration on Human Research Ethics.

Setting and Participants

This study was conducted among the patients visiting the outpatient department of Prosthodontics at a Dental college for the treatment of fixed partial dentures from 01 July through 30 September 2022.

Inclusion and Exclusion Criteria

The inclusion criteria was adopted: Patients who require at least one full ceramic or Porcelain fused to metal crown for maxillary anterior teeth. As exclusion criteria were established: 1) People who have impaired eye vision to the extent that they cannot appreciate differences in crown shades; 2) People who are suffering from psychological disorders who cannot answer/fill out the questionnaire.

Sample Size

The sample size was calculated based on the previous study about patient satisfaction with shade selection reported by Alzeghaibi et al. [4]. A sample of 90 is required to detect the difference of 10% with 80% power and 95% CI. Anticipating 15-20% non-responsiveness, the sample size has been adjusted to 110. Henceforth, the final sample includes 110 patients.

Sampling Method

Participants were selected by systematic random sampling from patients visiting the Department of Prosthodontics to treat fixed partial dentures. The first subject was chosen by the lottery method, and then onwards, every 5th subject was selected until the sample size was fulfilled.

Data Collection

Data was collected with the help of a proforma developed for this study, including a questionnaire and clinical data. The questionnaire consists of 13 questions about patients' attitudes regarding the aesthetics part of their teeth, and responses were recorded on a five-point scale (Strongly agree to strongly disagree). The questionnaire is based on the study conducted by Vallittu et al. [3], and a Telugu translation was done. The internal validity of the Telugu questionnaire was pilot-tested on 30 participants, and the Cronbach's Alpha score for this questionnaire was 0.90. Clinical findings such as the number of missing teeth, shade selection, and assessment of patient satisfaction were done by two calibrated investigators. These two investigators have been trained by an expert clinician (AK); intra-rater Kappa values were 0.86 and 0.90, and the inter-rater value was 0.90. The shade guide used in this study was the VITAPAN 3D Master™.

The following procedural steps were followed:

- STEP 1: Record the dentists' shade selection for the patient by an investigator and the patient's choice on the same shade guide separately by different investigators.
- STEP 2: If there are any differences, inform the patient about this, and the patient should make the final decision.
- STEP 3: Patient satisfaction after delivering crowns was evaluated.

Statistical Analysis

Statistical Package for Social Sciences, version 20, (IBM SPSS Corp., Armonk, NY, USA) was used for data analysis. Descriptive statistics were performed, and Pearson's Chi-square test was used to compare selected shades. A binomial logistic regression model was used to assess the factors influencing patient satisfaction with the final prosthesis. For all comparisons, a p-value ≤ 0.05 was considered statistically significant.

Results

Out of 110 participants, data from about 109 were available for final analysis (one participant did not attend subsequent treatment appointments). Among the participants, 54% were males, and the remaining were females; 43.1% of them belonged to the 26–35-year age group, 6.4% were in the less than 25-year age group, 14.7% were in the 46–55 year age group, 8.3% were in the 56–65 year age group, and 1.8% were in above 65 year age group. More than half (56%) of them were Urban dwellers. Nearly 10% had no education, 38.5% completed primary education, 46.8% completed secondary education, and 4.6% completed professional degrees. Almost one-third were homemakers, 28.9% were salaried employees, 13.8% were daily wage laborers, and 19.3% were professionals (Table 1).

Table 1. Demographic data of the study participants.

Variables	N (%)
Age	
<25 Years	7 (6.4)
26-35 Years	47 (43.1)
36-45 Years	28 (25.7)
46-55 Years	16 (14.7)
56-65 Years	9 (8.3)
>65 Years	2 (1.8)
Total	109 (100.0)
Gender	
Male	59 (54.1)
Female	50 (45.9)
Area of Residence	
Urban	43 (39.4)
Peri-Urban	5 (4.6)
Rural	61 (56)
Education	
No Education	11 (10.1)
Primary	42 (38.5)
Secondary	51 (46.8)
Professional	5 (4.6)
Occupation	
Homemaker	34 (31.2)
Farmer	8 (7.3)
Daily Wage Laborer	15 (13.8)
Salaried Employee	31 (28.4)
Professional	21 (19.3)

Table 2 compares the shades chosen by patients and those selected by dentists; there are minor differences in shades chosen by patients and dentists, which is statistically significant ($p < 0.001$). Patients chose lighter shades than dentists, especially for shade 'A. A total of 73.4% of them were satisfied with the final prosthesis versus 26.6% who were dissatisfied.

Table 2. Comparison between shades selected by dentists and patients.

Shade	Shade Decided by the Dentist	Shade Decided by Patient	p-value
	N (%)	N (%)	
A1	8 (7.3)	12 (11.0)	<0.001
A2	43 (39.4)	54 (49.5)	
A3	39 (35.8)	22 (20.1)	
A3.5	6 (5.5)	6 (5.5)	
A4	1 (0.9)	4 (3.7)	
B1	6 (5.5)	6 (5.5)	
B2	6 (5.5)	5 (4.6)	

Patient's attitudes about the appearance of upper front teeth were reported in Table 3. All the participants (100%) responded that the patient's appearance should be given importance while performing prosthodontic treatment, and 86.2% believed that teeth play a vital role in their facial appearance. Nearly 90% of them said that very white teeth looked unnatural.

Table 3. Patients' attitude regarding the esthetics of the upper anterior teeth.

Questions	Strongly Disagree N (%)	Disagree N (%)	Neutral N (%)	Agree N (%)	Strongly Agree N (%)
Do you feel very white teeth are the most beautiful teeth?	17 (15.6)	51 (46.8)	0 (0.0)	33 (30.3)	8 (7.3)
Do very white teeth look unnatural?	3 (2.8)	6 (5.5)	3 (2.8)	60 (55.0)	37 (33.9)
Do you prefer having white teeth?	1 (0.9)	37 (33.9)	6 (5.5)	44 (40.4)	21 (19.3)
Is it natural that the teeth may be stained, E.g., coffee?	7 (6.4)	37 (33.9)	25 (22.9)	38 (34.9)	2 (1.8)
Do you feel that function is the most important property of teeth?	0 (0.0)	0 (0.0)	1 (0.9)	28 (25.7)	80 (73.4)
Do you feel that the appearance of the teeth is their most important property?	0 (0.0)	3 (2.8)	3 (2.8)	34 (31.2)	69 (63.2)
Should the patient's appearance be considered when a dental professional treats them?	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	109 (100.0)
Is it not essential to have regular teeth?	7 (6.4)	51 (46.8)	6 (5.5)	40 (36.7)	5 (4.6)
Is it natural that the teeth may be worn?	5 (4.6)	39 (35.8)	11 (10.1)	48 (44.0)	6 (5.5)
Do you feel the teeth greatly affect a person's appearance?	0 (0.0)	1 (0.9)	0 (0.0)	14 (12.8)	94 (86.2)
Do you wish to have natural-looking teeth according to your age?	1 (0.9)	1 (0.9)	4 (3.7)	28 (25.7)	75 (68.8)
It does not bother me even if the front teeth are a bit worn?	7 (6.4)	74 (67.9)	10 (9.2)	14 (12.8)	4 (3.7)
Are you pleased with the current appearance of the upper front teeth?	5 (4.6)	39 (35.8)	10 (9.2)	48 (44.0)	7 (6.4)

Table 4 depicts the Binomial logistic regression model used to assess the factors influencing patient satisfaction with a final prosthesis. Among the factors included in the model, the chosen shade guide significantly influenced the patient's satisfaction with the final prosthesis (OR= 3.3, p=0.001).

Table 4. Binary logistics regression analysis to identify the factors influencing patient satisfaction with final prosthesis.

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
Age	0.051	0.215	0.057	1	0.812	1.053	0.691	1.604
Sex	-0.102	0.556	0.034	1	0.854	0.903	0.303	2.688
Residence	-0.254	0.232	1.198	1	0.274	0.776	0.492	1.223
Education	0.209	0.325	0.416	1	0.519	1.233	0.652	2.330
Occupation	0.129	0.201	0.415	1	0.520	1.138	0.768	1.688
Patient satisfaction before prosthetic treatment	0.009	0.232	0.002	1	0.969	1.009	0.640	1.590
Dentist selected shade	-0.113	0.306	0.137	1	0.712	0.893	0.490	1.627
Having the patient opt for shade for the final prosthesis	1.206	0.367	10.818	1	0.001*	3.340	1.628	6.853
Constant	-1.272	1.631	0.609	1	0.435	0.280		

*Statistically Significant.

Discussion

This study assessed the relationship between patients' and dentists' perception of shade selection and its impact on satisfaction with the prosthesis. The results of the present study reject the null hypothesis that there is no difference between shades selected by dentists and patients.

Accurate shade plays a vital role in patient satisfaction regarding the final prosthesis, and every individual has different levels of perception [9]. According to numerous research, people's preferences for tooth shades depend on their cultural background and socioeconomic class, and this can also affect how adjacent teeth are recognized by their shades [10,11]. Even today, the human eye shade selection method with some shade guides is the standard method to identify the color of an object compared with other operative or auxiliary guides [12].

In the present study, data from 110 participants, about 109, were included in the final analysis. There were statistically significant differences between the shades the dentist selected, with patients choosing shades and those choosing lighter shades than the dentist. These findings are similar to the study reported by Alzghaibi et al. [4], in which 33% of the patients chose a lighter shade than the dentist. This finding can be attributed to the level of education among the participants in our study; nearly 50% of the patients had either no education or had just completed primary education. Our findings were similar to the study reported by Vallittu et al. [3], in which patients with limited education highly preferred lighter shades.

Among the participants, 73.4% of patients were satisfied with their final prosthesis, which is slightly lower than the study reported by Alzghaibi et al. [4], in which 83% of the patients were satisfied with the final prosthesis; however, other factors like contour, size of the final prosthesis, etc., also influence patient's satisfaction apart from the shade.

Our study used a binomial logistic regression model to assess the factors influencing patient satisfaction in the shade selection procedure that significantly influenced patient satisfaction. The current study confirms that the patient involvement in the shade selection before preparation significantly influenced their level of satisfaction towards the shade of the prosthesis delivered (OR = 3.3; $p=0.001$). These findings were similar to those reported in the study by Alzghaibi et al. [4], in which the patient satisfaction rate was higher among the patients who participated in shade selection (88% versus 83%).

This study also assessed the attitude of patients regarding the appearance of their maxillary anterior teeth and their attitude regarding tooth shades. The patient's attitude was assessed, as attitude influences patient satisfaction with the final prosthesis. Patients' responses to attitude questions were quite contradicting; nearly 90% of the patients agreed with the statement that very white teeth look unnatural, while at the same time, 65% of them preferred to have white teeth for their prosthesis. These findings were similar to the study reported by Alzghaibi et al. [4], which found that 33% of the patients, although satisfied with the final prosthesis, would still prefer lighter shades if given a second chance. These findings can be correlated to the difference between patients' and dentists' selected shades in our study and why patients chose lighter shades.

This study has certain limitations, such as only one type of shade guide used in this study, i.e., VITAPAN 3D Master™, which has too many shades to choose from, causing some confusion, especially for the patients [13,14]. However, if appropriately utilized, the VITAPAN 3D Master™ is made to reduce options to seven in one step, so it shouldn't be a problem. Everything, however, depends on how well the VITAPAN 3D Master™ system is used.

Care must be taken while generalizing the findings of this study, as this data is from a specific cohort of patients who visited the prosthodontics department of a teaching hospital; however, selection bias has been avoided or minimized by following systemic random sampling, and investigators don't have control over who






visits the prosthodontics department for treatment. Another limitation of the study is that the investigators were not calibrated against the spectrophotometric method but were calibrated against the senior prosthodontist. Perhaps the naked visual eye shade selection method is the most common clinical practice even today [12].

Based on the results of the present study, there is a strong association between the patient's perception of the shade and satisfaction with the dental prosthesis. The clinicians should include the patient's perception and selection of shade during the treatment to avoid dissatisfaction with the anterior teeth restorative treatments.

Conclusion

There is a difference in the patient's choice, and the dentist selected shade for the maxillary anterior prosthesis. To achieve good esthetics, the patient's preference should accompany the dentist's decision in the shade selection process.

Authors' Contributions

KA		https://orcid.org/0000-0003-2085-8007	Conceptualization, Methodology, Data Curation, Writing - Original Draft, Writing - Review and Editing and Project Administration.
SCT		https://orcid.org/0000-0003-1131-1966	Data Curation, Writing - Original Draft and Writing - Review and Editing.
SV		https://orcid.org/0000-0002-2403-0939	Data Curation, Writing - Review and Editing and Visualization.
RK		https://orcid.org/0009-0006-6013-3114	Resources, Data Curation and Writing - Original Draft.
SV		https://orcid.org/0000-0003-0613-5179	Methodology, Software, Writing - Original Draft and Writing - Review and Editing.
All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.			

Financial Support

None.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

Acknowledgements

We thank Dr. Ramoji Rao. M, principal of Drs Sudha and Nageswara Rao Siddhartha Institute of Dental Sciences for his help in participant selection.

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