Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2023; 14:5:1-7.

Comparative evaluation of perception in tooth shade selection between patients and dental professional

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ABSTRACT

Background: To evaluate and compare the tooth shade selection perception in patients and dental professional using Vitapan classic shade guide. Assessment of tooth shade by a dental professional. Self-assessment of tooth shade by the patients. Comparison of tooth shade perception between patients and dental professional.

Materials And Methods: The assessment of tooth shade is carried out by dental professional using vitapan shade guide . Followed by , each participants were requested to estimate his or her shade selection using the same vitapan shade guide without the notice of what professional has chosen.

Results: In this study, a sample of 300 subjects was evaluated using the chi-square test, which revealed a highly significant difference ($p<0.0001$) in the distribution of perception choices between patients and dentists. Notably, 40% of the patients preferred a lighter shade compared to the dentist's perception. Additionally, younger patients displayed higher accuracy in tooth shade assessment compared to older patients.

Conclusion: To optimize patient satisfaction with the treatment outcome and ensure it aligns with their aesthetic preferences. It is vital to acknowledge that certain patients may specifically prefer a white and glossy appearance as opposed to a more natural aesthetic.

Keywords: Tooth shade selection , Vitapan classic shade guide , Perception , Appearance.

INTRODUCTION

Tooth shade selection is a critical aspect of prosthetic rehabilitation, as it significantly impacts patient satisfaction. The aim of this study is to reproduce the natural shade of teeth accurately, with the main objective of achieving an appropriate and satisfactory outcome(1). However, selecting the optimal shade for prosthesis fabrication poses a challenge for dentists, as they must consider the

Received: Mar. 17, 2023**: Accepted**: May. 16, 2023
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pISSN 2278-0076
eISSN 2321-9270

aesthetic requirements of patients(2). Simultaneously, patient preferences regarding shade selection must be taken into account, as some individuals may desire white and shiny teeth rather than a natural appearance. It is important to acknowledge the inherent variation in tooth shades among individuals, which further emphasizes the need to balance the preferences of both patients and dental professionals(2,3).

The selection of artificial teeth shade in accordance with the existing teeth shade is usually a perceptive task. However, in general, it is essential to provide an esthetic restoration that blends symmetrically with the adjacent teeth. The selection of teeth with the proper shade will influence the patient's aesthetic perception and acceptance of the prosthesis (1,4).

Literature evidence shows a strong correlation between tooth color and age, with dentin generally becoming darker and yellower over time. With increasing age, the pulp chamber becomes smaller due to the deposition of secondary dentin, which makes the tooth opaque(5).

Therefore, a comprehensive understanding of the natural appearance of teeth is necessary to improve shade-matching results. It's also the role of the dentist to educate the patient in regard to the shades, materials and perception. In this study we planned to find the difference in perception between patient and dentist and the level of understanding of shade.

MATERIALS AND METHODS

The sample size consisted of 300 participants, ranging from the age group of 18 to 60 years, who reported to the department of prosthodontics , Chettinad Dental College & Research Institute. The patients had no common background regarding education, socioeconomic status, and place of birth. The study was approved by the Institutional Human Ethics Committee.

(Ref No : IHEC-I/1170/22). All the participants volunteered, and proper written consent was obtained prior to the study.

For tooth shade evaluation, maxillary central incisors were considered. The Vitapan classic shade guide (VITA Zahnfabrik H. Rauter GmbH and Co., KG, Bad Säckingen, Germany), which is widely recognized and popularly used by dentists in institutions & private practices(6), was utilized for shade evaluation. The Vitapan classic shade guide (VITA Zahnfabrik H. Rauter GmbH and Co., KG, Bad Säckingen, Germany) encompasses hue, value, and chroma.

The study's first step was to evaluate shade by dentist using Vitapan shade guide(VITA Zahnfabrik H. Rauter GmbH and Co., KG, Bad Säckingen, Germany). Tooth shade evaluation was performed by professionals using the Vitapan shade guide(VITA Zahnfabrik H. Rauter GmbH and Co., KG, Bad Säckingen, Germany). A single examiner assessed the tooth shade selection under natural daylight. Subsequently, each participant was asked to estimate their shade selection using the same Vitapan shade guide(VITA Zahnfabrik H. Rauter GmbH and Co., KG, Bad Säckingen, Germany), without being informed of the professional's choice.

Inclusion criteria - participants with maxillary anterior teeth exhibiting normal tooth contours and structures.

Exlusion criteria - participants with

- Restored anterior teeth
- Intrinsic stains (fluorosis , tetracycline stain, and pulpitis)
- Extrinsic stains (food (e.g., coffee), tobacco, and plaque)

The data were analyzed using descriptive statistics with the aid of statistical software (sss).

RESULTS

The data collected from 300 subjects are presented in Table 1. The collected data was statistical analysed and evaluated using chi-square tests to compare patient and dentist perceptions of tooth shade selection.The distribution of study subjects is presented in Table 1 and Table 2. It was found that there was a significant difference in the distribution of perception choices between patients and dentists, with a notable preference for selecting hue B2 by both dentists and patients. The p-value (0.0001) indicated that only 65% of the participants chose the same shade as the dentist. Additionally,

younger patients demonstrated greater accuracy in tooth shade assessment compared to older patients. There is significant difference in the distribution of choices of perception between patients and dentists there is a significant preference for selecting hue B2 by dentist and patientTable 3a demonstrates a significant p-value (0.0001), indicating that 27% of the participants selected the same saturation level as the dentist in level 1, 32% in level 2, and 13% in level 3. Overall, 72% of the participants made the same selection as both the dentist and the patient in chroma evaluation.Furthermore, Table 3b indicates that 30% of the dentists and 40% of the participants chose level 1 saturation. Moreover, 50% of the dentists and 36% of the participants selected level 2 saturation, while 19% of the dentists and 23% of the participants chose level 3 saturation.Table 4a shows a significant p-value of 0.0001. Among the participants, 13% chose the same hue (Hue A) as the dentist, 39% chose Hue B, 26% chose Hue C, and 0.5% selected Hue D.In Table 4b, it is observed that 13% of the dentists and 20% of the participants chose shade A of Hue. Additionally, 52% of the dentists and 42% of the participants selected shade B of Hue. Furthermore, 32% of the dentists and 32% of the participants chose shade C of Hue, while 1.3% of the dentists and 14% of the participants opted for shade D of Hue.In 4b, it is evident that both dentists and patients preferred B shade (red-yellow). However, patients exhibited a stronger preference for A shade compared to dentists. Moreover, in the evaluation of hue, 80% of the participants made the same selection as both the dentist and the patient. 40% of the participants assessed their shade as lighter when compared to the dentist's assessment p (0.0001).

Table 1- Descriptive stastics

		N	%
Gender	Females	150	50.0%
	Male	150	50.0%
Dentist perception	A1	30	10.0
	A3	10	3.3
	B1	20	6.7
	B2	128	42.7
	B3	10	3.3
	C1	40	13.3
	C2	20	6.7
	C3	38	12.7
	D2	3	1.0
	D3	1	0.3
Patient perception	A1	50	16.7
	A3	10	3.3
	B1	21	7.0
	B2	87	29.0
	B3	20	6.7
	C1	49	16.3
	C2	20	6.7
	C3	29	9.7
	D1	3	1.0
	D2	1	0.3
	D3	10	3.3

Table 2 crosstabulations for overall color perception

				Patient									Chi-square	P value
		A1	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3		
Dentist	A1	30	0	0	0	0	0	0	0	0	0	0	1739.42	0.0001*
	A3	0	10	0	0	0	0	0	0	0	0	0		
	B1	0	0	20	0	0	0	0	0	0	0	0		
	B2	10	0	1	78	20	8	10	0	1	0	0		
	B3	0	0	0	0	0	0	0	0	0	0	10		
	C1	0	0	0	9	0	30	0	0	1	0	0		
	C2	0	0	0	0	0	0	10	10	0	0	0		
	C3	10	0	0	0	0	9	0	19	0	0	0		
	D2	0	0	0	0	0	2	0	0	1	0	0		
	D3	0	0	0	0	0	0	0	0	0	1	0		

Table 3a Chroma

Chroma	Dentist		Patient	
	Frequency	Percent	Frequency	Percent
1.00	90	30.0	123	41.0
2.00	151	50.3	108	36.0
3.00	59	19.7	69	23.0

Table 3b crosstabulation for chroma

		chroma - Patient			Chi-square	P value
		1.00	2.00	3.00		
chroma-Dentist	1.00	81	9	0	218.494	0.0001
	2.00	23	98	30		
	3.00	19	1	39		

Table 4a Hue

		Hue– Patient				Chi-square	P value
		A	B	C	D		
Hue -Dentist	A	40	0	0	0	357.708	0.0001
	B	10	119	18	11		
	C	10	9	78	1		
	D	0	0	2	2		

Table 4b: Crosstabulation for Hue

Hue	Dentist		Patient	
	Frequency	Percent	Frequency	Percent
A	40	13.3	60	20.0
B	158	52.7	127	42.7
C	98	32.7	98	32.7
D	4	1.3	14	4.7

DISCUSSIONS

The process of selecting tooth shades, based on natural anterior teeth, is influenced by numerous factors, with one of the primary considerations being the lighting conditions under which the shade is observed. Additionally, the proficiency of the dental professional and the specific shade guide system employed significantly impact the outcome of the shade selection process (5).

Extensive research has revealed that the coloration of natural teeth is subject to numerous influences, with age being a prominent factor among them. Additionally, the impact of light on tooth color is widely recognized as one of the most significant factors to consider(7).Midday sunlight is commonly regarded as the optimal lighting condition for accurate shade selection, surpassing the morning and evening sunlight exposures in terms of reliability(8,9).

There are multiple tooth shade selection option for dentists and this creates a challenge in achieving precise match between nature teeth and prosthetic restoration(8,10).

Hall developed a shade guide specifically designed for porcelain restorations, incorporating certain principles that later served as the foundation for the creation of the Vita 3D Master shade system. .In 1939, VITA Zahnfabrik introduced its first shade guide, which was developed as a result of an epidemiological study aimed at determining the range of tooth shades found in natural dentition.hat later served as the foundation for the creation of the Vita 3D Master shade system(11). During the 1970s, Sproull published a comprehensive three-part series on color, where he proposed that a thorough understanding of value, chroma, and hue would empower dentists to systematically address color-matching challenges(12).

The VITAPAN® classical shade guide (VITA Zahnfabrik H. Rauter GmbH and Co., KG, Bad Säckingen, Germany) served as the visual shade selection method for all participants in the study. (13,14). The visual method utilizing tooth form shade tabs is widely recognized as the most commonly used approach for shade matching(15).

In this study, it was observed that 60% of the participants tended to choose the same shade as the dentist, while 40% of the individuals selected a lighter shade. It is important to note that some patients have a preference for lighter shades and whiter teeth. However, it is worth considering that educating the patients about the appropriate shade selection may influence their perception and lead to more accurate choices.

The disadvantages of shade guides can be summarized as follows:

(a) Variation in colors: Colors within shade guides may differ among different manufacturing companies, leading to inconsistencies in shade matching.

(b) Variation in porcelain: The porcelain used in restorations may not perfectly match the shade guide, resulting in a discrepancy between the selected shade and the final restoration.

(c) Limited guidance for porcelain restorations: Shade guides may not provide specific instructions on the fabrication of porcelain restorations, making it challenging for dental technicians to reproduce the desired shade accurately.

(d) Incomplete color space coverage: Shade guides do not cover the entire range of colors found in

natural dentition, limiting the ability to select shades that perfectly match individual patients' teeth.

(e) Differences in material and thickness: Standard shade tabs in shade guides are typically made using synthetic resin, which can differ in material properties and thickness compared to the porcelain used in crowns or restorations.

(f) Variation in light reflection and transmission: Shade guide tabs may reflect and transmit light differently compared to dental restorations. While shade tabs exhibit translucency and vitality, restorations often appear denser and more opaque due to differences in how light is reflected and transmitted.

These disadvantages highlight the challenges and limitations of shade guides in achieving precise and accurate shade matching. Dental professionals should be aware of these limitations and consider alternative methods or technologies to improve shade selection and enhance the esthetic outcomes of restorations(16).

The goal is to create a seamless blend with the surrounding natural teeth, ensuring patient satisfaction and a harmonious smile(17,18).

CONCLUSION

In order to align with the patient's aesthetic expectations and enhance their satisfaction with the treatment outcome, it is essential to consider the patient's inclination towards a lighter shade during treatment planning. It is worth noting that some patients may express a preference for a white and glossy appearance over a more natural look.

Future prospects of the study: Our aim for future research is to compare physical and digital shade guides, as well as explore patient perception towards digital evaluation.

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