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RESEARCH ARTICLE

Knowledge and Awareness of Tooth Shade Selection Principles among Senior Dental Students, Interns, and General Dentists of Hail Province of Saudi Arabia

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Abstract:

Background:

The study's objective was to ascertain the knowledge and practices of dental students in their final year, interns, and general practitioners regarding the protocols and principles of shade choosing.

Methods:

Structured questionnaires that were assigned to participants at random were used to gather data. The study was made available online through dental frame groups on WhatsApp and social media sites like Twitter. 102 dentists were conveniently chosen as a sample, encompassing dental students, interns, and general practitioners in their final year of study. The outcomes were examined using the Chi-square test.

Results:

The analysis shows that there was no influence of gender on shade choosing. There were no statistically significant ($p > 0.05$) differences between the educational level with the exception of a visual method for shade selection, the time required to determine the shade, define the shade by natural light or unite light, circumferential factors, and lipstick & clothes affect the shade selection ($p < 0.05$) difference among variables were recorded. For the experience level, when determining the shade, the time required to determine the shade plays a significant role in shade selection. Circumferential factors and lipstick and clothes affect the shade selection ($p < 0.05$) differences among variables were found.

Conclusions:

Compared to dental students and interns, general dentists had a greater understanding of and familiarity with the fundamentals of selecting tooth color. Hence, we must make improvements to meet the justifiably high standards of care that our patients have come to expect from us.

Keywords: Knowledge, Tooth shade selection, Dental students, Interns, General dentists, Hail province.

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1. BACKGROUND/INTRODUCTION

The restoration must be aesthetically pleasing and proportionate to the patient's adjacent teeth [1]. It could be difficult to match the prosthesis and natural teeth's shades exactly due to the wide range of natural tooth hues. Every dentist must know about the shade selection process to get the best outcomes. This is because inappropriate shade selection leads to the failure of many prostheses. The human eye can

distinguish a million or so colors, and 10 million or so various hues can be distinguished by precise technology. Electronic instruments can recognize about 100,000 different dental tones, although the human eye can only distinguish 1% of the colors in the human dentition [2].

Despite the challenge of effectively describing and interpreting shades in words, three terms—hue, value, and chroma—are employed to describe how light reflected off the tooth surface is perceived. The value represents the lightness or darkness of the tooth shade measured independently of the hue, whereas chroma is the property that describes the level of the vividness of the hue. The hue of the teeth describes their

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predominant color, which may be more yellowish or reddish [3].

A grin is one of the most prominent facial features that other people tend to notice, and a person believes that it significantly impacts his personal and social life. As a result, a patient's success with any treatments the dentist recommends depends on attaining a well-balanced, aesthetically beautiful smile [4]. Besides meeting the patient's primary functional needs, correct shade matching is now a crucial component of the therapeutic process because of these difficulties [5]. As a result, even for skilled dental professionals, choosing a chairside color has become crucial to the patient's overall care [6]. The shade-choosing process can be done using both instrumental and visual methods. Both approaches have advantages and disadvantages [6 - 14]. Both visual and instrumental methods are used in the procedure, while the visual method is favored because it is more readily available and less expensive. Visual shade selection is frequently used in commercial shade tabs like Vita Classic, Vita 3D Master, etc [5].

The very subjective nature of the visual technique, which allows for a range of shadow perceptions for the same item [7 - 9, 15], is one of its key drawbacks. Scientific principles and the aesthetic aspects of human vision have been used by researchers to explain these differences [12, 16]. While choosing a color, both considerations are taken into account.

To ensure accuracy, a number of shade selection methods have been devised for clinical setup, illumination, patient positioning, operator posture, and the use of a standard shade guide. It is crucial to have a good understanding of these methods in order to carry out visual shade selections precisely and repeatedly [16 - 18]. The bulk of the dental community, including undergraduate students, interns, and general dentists, are either unaware of these protocols or do not completely comprehend them [19, 20].

Many factors influence shade choice, which frequently leads to mistakes in how well restorations resemble natural teeth in appearance. Even among seasoned practitioners, choosing a traditional shade under ideal circumstances is a subjective judgement [21 - 23]. Limitations in the choice of visual shades are brought on by factors impacting how people perceive color, such as lighting circumstances and human physiologic variables [15, 23]. When two colors seem to match in terms of illumination but have differing spectral reflectances, this phenomenon is known as metamerism [24]. As a result, the colors do not match in various lighting conditions.

In Saudia Arabia, there is generally a lack of knowledge about shade selection among dental students, interns, general practitioners, and specialists. The Hail district, on the other hand, has not undergone such a probe. The paucity of reports on dental interns, students, general dentists, and specialists raises concerns. To help dental professionals to improve treatments, it is necessary to assess knowledge and practices about shade selection and establish its impact. Therefore, the study's objective was to ascertain the knowledge and practices of dental students in their final year, interns, general

practitioners, and specialists regarding the protocols and principles of shade choosing.

2. METHODS

A cross-sectional questionnaire-based descriptive study was conducted from June 2022 to December 2022 after obtaining ethical approval from the research committee of the University of Hail. The data were collected by a self-administered online questionnaire. The institutional review board of our university approved the study protocol (NO: H-2022-325), and informed consent was obtained from each participant. The inclusion criteria were senior dental students, interns, and general practitioners who live in the Hail.

Structured questionnaires were used to gather data, and participants were given them at random. The survey was distributed online *via* social media such as Twitter and WhatsApp groups of dental frames in Hail. Dental students, interns, and general dentists who practice in the Hail were included in the current study. A conveniently selected sample of 102 dentists, including final-year students, postgraduate trainees, and general dental Practitioners. These surveys were written in English and then translated into Arabic for ease of comprehension. The questions were modified versions of those from a prior study [18]. A cover page outlining the project and confirming the subjects' anonymity was followed by three sections in the questionnaire: First part: Personal Information and demographic data including gender, educational level and years of experience. Second Part: Questions related to the knowledge and assessment of the shade selection. Third Part: Questions related to circumferential factors that may influence the shade selection. Level and source of participant information are provided in supplementary 1.

The statistical package for the social sciences, version 22.0, was used to examine the results (SPSS Inc., Chicago, IL, USA). To provide subject characteristics and outcome variables, descriptive statistics were employed, including frequencies, percentages, means, and standard deviations. The variables were subjected to descriptive analysis, and their association was examined using the chi-squared test. Level of statistical significance was set at a p-value of 0.05.

3. RESULTS

A total of 102 participants answered the questionnaire. Among participants, females were 53 (51.5%) and males were 50 (48.5%) of the participants. The highest number of subjects was 41 (39.8%) between 24 and 26 years old. The highest number of participants 53 (51.5%) were general dentists, followed by 32 (31.1%) dental students, and 18 (17.5%) were interns. About 43 (41.7%) had experienced between 1 to 3 years, followed by 42 (40.8%) were with less than one year experience.

The participants' responses about their preferred shade selection technique are shown in Table 1. Most respondents (84; 82.4%) report experiencing trouble "sometimes" when choosing a color. A majority (88.3%) of respondents use the visual approach to choose shades "always" for 49 (48.0%) or "sometimes" for 50 (49.0%). The instrumental method is used "sometimes" by more than half (57.8%) of the participants

when choosing a shade. When the procedure is finished, 88 of the participants (86.3%) choose the shade. The ideal time required to determine the shade was reported at 5-10 seconds in 45 (44.1%) of the study sample. The major roles in shade selection were Hue (37.3%), Chroma (32.4%), and Value (30.4%). The majority of the respondents 69.6% “always” they define shade by natural light. The majority of the respondents 61.8% “never” they define shade by dental unit light. Also, the

majority of the participants 67.6% “always” they clean the patient's teeth prior shade selection. Half of the respondents, 48.0% they “always” take into consideration the circumferential factors that affect shade selection, such as skin color, lenses and clothes. More than half (56.9%) of the participants “always” take the patient's opinion for shade selection. Approximately half (49.0%) of the participants “always” think lipstick and clothes affect the shade selection.

Table 1. Responses toward shade selection among the respondents.

| Variable | (N%) | |
|---|---------------|----------|
| Are you having difficulty a shade selection? | Always | 4(3.9) |
| | Sometimes | 84(82.4) |
| | Never | 14(13.7) |
| Do you rely on Visual method for shade selection? | Always | 49(48.0) |
| | Sometimes | 50(49.0) |
| | Never | 3(2.9) |
| Do you rely on instrumental method for shade selection? | Always | 25(24.5) |
| | Sometimes | 59(57.8) |
| | Never | 18(17.6) |
| Do you selection the shade at the beginning or end of the procedure? | Beginning | 82(80.4) |
| | End | 20(19.6) |
| Do you consider that age & gender to affect the shade selection? | Yes | 88(86.3) |
| | No | 14(13.7) |
| What is the ideal time required to determine the shade? | Within 5sec | 29(28.4) |
| | 5-10sec | 45(44.1) |
| | 10-20sec | 28(27.5) |
| Which among these do you think plays a major role in shade selection? | Hue | 38(37.3) |
| | Chroma | 33(32.4) |
| | Value | 31(30.4) |
| Are you define the shade by natural light? | Always | 71(69.6) |
| | Sometimes | 26(25.5) |
| | Never | 5(4.9) |
| Are you define the shade by dental unit light? | Always | 8(7.8) |
| | Sometimes | 31(30.4) |
| | Never | 63(61.8) |
| Are you cleaning the teeth prior shade selection? | Always | 69(67.6) |
| | Sometimes | 27(26.5) |
| | Never | 6(5.9) |
| Do you determine the shade when the tooth is dry or wet? | Dry | 41(40.2) |
| | Wet | 54(52.9) |
| | I do not care | 7(6.9) |
| Are the circumferential factors affecting your shade selection, such as skin color, lenses and clothes? | Always | 49(48.0) |
| | Sometimes | 39(38.2) |
| | Never | 14(13.7) |
| Do you take the patient's opinion for shade selection? | Always | 58(56.9) |
| | Sometimes | 40(39.2) |
| | Never | 4(3.9) |
| Do you think lipstick & clothes affect the shade selection? | Always | 50(49.0) |
| | Sometimes | 32(31.4) |
| | Never | 20(19.6) |

Table 2. Influence of gender on shade selection among the respondents.

| Variable | | Male,(N%) | Female,(N%) | P-value |
|---|---------------|-----------|-------------|---------|
| Are you having difficulty a shade selection? | Always | 0 | -100 | > 0.05 |
| | Sometimes | -58.3 | -41.7 | |
| | Never | -28.6 | -71.4 | |
| Do you rely on Visual method for shade selection? | Always | -46.9 | -53.1 | > 0.05 |
| | Sometimes | -56 | -44 | |
| | Never | -66.7 | -33.3 | |
| Do you rely on instrumental method for shade selection? | Always | -52 | -48 | > 0.05 |
| | Sometimes | -47.5 | -52.5 | |
| | Never | -66.7 | -33.3 | |
| Do you selection the shade at the beginning or end of the procedure? | Beginning | -51.2 | -48.8 | > 0.05 |
| | End | -55 | -45 | |
| Do you consider that age & gender to affect the shade selection? | Yes | -53.4 | -46.6 | > 0.05 |
| | No | -42.9 | -57.1 | |
| What is the ideal time required to determine the shade? | Within 5sec | -55.2 | -44.8 | > 0.05 |
| | 5-10sec | -48.9 | -51.1 | |
| | 10-20sec | -53.6 | -46.4 | |
| Which among these do you think plays a major role in shade selection? | Hue | -57.9 | -42.1 | > 0.05 |
| | Chroma | -48.5 | -51.5 | |
| | Value | -48.4 | -51.6 | |
| Are you define the shade by natural light? | Always | -52.1 | -47.9 | > 0.05 |
| | Sometimes | -50 | -50 | |
| | Never | -60 | -40 | |
| Are you define the shade by dental unit light? | Always | -62.5 | -37.5 | > 0.05 |
| | Sometimes | -51.6 | -48.4 | |
| | Never | -50.8 | -49.2 | |
| Are you cleaning the teeth prior shade selection? | Always | -52.5 | -47.8 | > 0.05 |
| | Sometimes | -48.1 | -51.9 | |
| | Never | -66.7 | -33.3 | |
| Do you determine the shade when the tooth is dry or wet? | Dry | -58.5 | -41.5 | < 0.05 |
| | Wet | -51.9 | -48.1 | |
| | I do not care | -14.3 | -85.7 | |
| Are the circumferential factors affecting your shade selection, such as skin color, lenses and clothes? | Always | -42.9 | -57.1 | > 0.05 |
| | Sometimes | -64.1 | -35.9 | |
| | Never | -50 | -50 | |
| Do you take the patient's opinion for shade selection? | Always | -51.7 | -48.3 | > 0.05 |
| | Sometimes | -50 | -50 | |
| | Never | -75 | -25 | |
| Do you think lipstick & clothes affect the shade selection? | Always | -48 | -52 | > 0.05 |
| | Sometimes | -56.3 | -43.8 | |
| | Never | -55 | -45 | |

Table 2 shows a comparison of the information relating to the participants' gender. The analysis demonstrates that gender had no bearing on the results. Also, there were no statistically significant ($p > 0.05$) differences between the various age groups with the exception of the visual method for shade selection, the time required to determine the shade, defining the shade by natural light or unite light, cleaning the teeth prior to shade selection, circumferential factors and patient opinion on shade selection significant ($p < 0.05$) difference among variables were recorded (Table 3). The comparison of the data pertaining to the participants' educational level is presented in Table 4.

There were not statistically significant ($p > 0.05$) differences between the educational levels with the exception of the visual method for shade selection, time required to determine the shade, define the shade by natural light or unite light, circumferential factors, and lipstick & clothes affect the shade selection ($p < 0.05$) difference among variables were recorded. For the experience level, when determining the shade, the time required to determine the shade plays a major role in shade selection, circumferential factors and lipstick and clothes affect the shade selection ($p < 0.05$) difference among variables were found (Table 5).

Table 3. Influence of age on shade selection among the respondents.

| Variable | | 22-23 Years | 24-26 Years | > 26 Years | P-value |
|---|---------------|-------------|-------------|------------|---------|
| Are you having difficulty a shade selection? | Always | -75 | 0 | -25 | > 0.05 |
| | Sometimes | -27.4 | -38.1 | -34.5 | |
| | Never | -21.4 | -42.9 | -35.7 | |
| Do you rely on Visual method for shade selection? | Always | -36.7 | -34.7 | -28.6 | < 0.05 |
| | Sometimes | -22 | -38 | -40 | |
| | Never | 0 | -66.7 | -33.3 | |
| Do you rely on instrumental method for shade selection? | Always | -20 | -48 | -32 | > 0.05 |
| | Sometimes | -30.5 | -33.9 | -35.6 | |
| | Never | -33.3 | -33.3 | -33.3 | |
| Do you selection the shade at the beginning or end of the procedure? | Beginning | -29.3 | -36.6 | -34.1 | > 0.05 |
| | End | -25 | -40 | -35 | |
| Do you consider that age & gender to affect the shade selection? | Yes | -30.7 | -38.6 | -30.7 | < 0.05 |
| | No | -14.3 | -28.6 | -57.1 | |
| What is the ideal time required to determine the shade? | Within 5sec | -20.7 | -51.7 | -27.6 | < 0.05 |
| | 5-10sec | -24.4 | -26.7 | -48.9 | |
| | 10-20sec | -42.9 | -39.3 | -17.9 | |
| Which among these do you think plays a major role in shade selection? | Hue | -36.8 | -39.5 | -23.7 | > 0.05 |
| | Chroma | -12.1 | -36.4 | -51.5 | |
| | Value | -35.5 | -35.5 | -29 | |
| Are you define the shade by natural light? | Always | -29.6 | -32.4 | -38 | < 0.05 |
| | Sometimes | -19.2 | -50 | -30.8 | |
| | Never | -60 | -40 | 0 | |
| Are you define the shade by dental unit light? | Always | -75 | -12.5 | -12.5 | < 0.05 |
| | Sometimes | -16.1 | -51.6 | -32.3 | |
| | Never | -28.6 | -33.3 | -38.1 | |
| Are you cleaning the teeth prior shade selection? | Always | -33.3 | -37.7 | -29 | < 0.05 |
| | Sometimes | -18.5 | -37 | -44.4 | |
| | Never | -16.7 | -33.3 | -50 | |
| Do you determine the shade when the tooth is dry or wet? | Dry | -36.6 | -26.8 | -36.6 | > 0.05 |
| | Wet | -24.1 | -42.6 | -33.3 | |
| | I do not care | -14.3 | -57.1 | -28.6 | |
| Are the circumferential factors affecting your shade selection, such as skin color, lenses and clothes? | Always | -24.5 | -34.7 | -40.8 | > 0.05 |
| | Sometimes | -33.3 | -41.1 | -25.6 | |
| | Never | -28.6 | -35.7 | -35.7 | |
| Do you take the patient's opinion for shade selection? | Always | -37.9 | -29.3 | -32.8 | > 0.05 |
| | Sometimes | -15 | -52.5 | -32.5 | |
| | Never | -25 | 0 | -75 | |
| Do you think lipstick & clothes affect the shade selection? | Always | -36 | -36 | -28 | > 0.05 |
| | Sometimes | -28.1 | -31.3 | -40.6 | |
| | Never | -10 | -50 | -40 | |

Table 4. Influence of educational level on shade selection among the respondent.

| Variable | | General Dentists | Interns | Dental Student | P-value |
|---|-----------|------------------|---------|----------------|---------|
| Are you having difficulty a shade selection? | Always | 25.0)) | 0.0)) | 75.0)) | > 0.05 |
| | Sometimes | 54.8)) | 15.5)) | 29.8)) | |
| | Never | 42.9)) | 35.7)) | 21.4)) | |
| Do you rely on Visual method for shade selection? | Always | 46.9)) | 14.3)) | 38.8)) | < 0.05 |
| | Sometimes | 56.0)) | 22.0)) | 22.0)) | |
| | Never | 66.7)) | 0.0)) | -33.3 | |

(Table 4) contd.....

| Variable | General Dentists | Interns | Dental Student | P-value | |
|---|------------------|---------|----------------|---------|--------|
| Do you rely on instrumental method for shade selection? | Always | -48 | 16.0) | -36 | > 0.05 |
| | Sometimes | -50.8 | -22 | -27.1 | |
| | Never | -61.1 | -5.6 | -33.3 | |
| Do you selection the shade at the beginning or end of the procedure? | Beginning | -52.4 | -18.3 | -29.3 | > 0.05 |
| | End | -50 | -15 | -35 | |
| Do you consider that age & gender to affect the shade selection? | Yes | -50 | -18.2 | -31.8 | > 0.05 |
| | No | -64.3 | -14.3 | -21.4 | |
| What is the ideal time required to determine the shade? | Within 5sec | -62.1 | -17.2 | -20.7 | < 0.05 |
| | 5-10sec | -62.2 | -13.3 | -24.4 | |
| | 10-20sec | -25 | -25 | -50 | |
| Which among these do you think plays a major role in shade selection? | Hue | -39.5 | -26.3 | -34.2 | > 0.05 |
| | Chroma | -69.7 | -12.1 | -18.2 | |
| | Value | -48.4 | -12.9 | -38.7 | |
| Are you define the shade by natural light? | Always | -60.6 | -9.9 | -29.6 | < 0.05 |
| | Sometimes | -38.5 | -34.6 | -26.9 | |
| | Never | 0 | -40 | -60 | |
| Are you define the shade by dental unit light? | Always | -12.5 | -12.5 | -75 | < 0.05 |
| | Sometimes | -58.1 | -19.4 | -22.6 | |
| | Never | -54 | -17.5 | -28.6 | |
| Are you cleaning the teeth prior shade selection? | Always | -49.3 | -18.8 | -31.9 | > 0.05 |
| | Sometimes | -59.3 | -14.8 | -25.9 | |
| | Never | -50 | -16.7 | -33.3 | |
| Do you determine the shade when the tooth is dry or wet? | Dry | -56.1 | -12.2 | -31.7 | > 0.05 |
| | Wet | -50 | -20.4 | -29.6 | |
| | I do not care | -42.9 | -28.6 | -28.6 | |
| Are the circumferential factors affecting your shade selection, such as skin color, lenses and clothes? | Always | -59.2 | -16.3 | -24.5 | < 0.05 |
| | Sometimes | -46.2 | -20.5 | -33.3 | |
| | Never | -42.9 | -14.3 | -42.9 | |
| Do you take the patient's opinion for shade selection? | Always | -51.7 | -13.8 | -34.5 | > 0.05 |
| | Sometimes | -50 | -25 | -25 | |
| | Never | -75 | 0 | -25 | |
| Do you think lipstick & clothes affect the shade selection? | Always | -50 | -18 | -32 | < 0.05 |
| | Sometimes | -40.6 | -25 | -34.4 | |
| | Never | -75 | -5 | -20 | |

Table 5. Influence of years of experiences on shade selection among the respondents.

| Variable | <1,(N%) | 1-3,(N%) | 4-6,(N%) | >7,(N%) | P-value | |
|--|-----------|----------|----------|---------|---------|--------|
| Are you having difficulty a shade selection? | Always | -75 | -25 | 0 | 0 | > 0.05 |
| | Sometimes | -38.1 | -44 | -14.3 | -3.6 | |
| | Never | -42.9 | -35.7 | -21.4 | 0 | |
| Do you rely on Visual method for shade selection? | Always | -44.9 | -40.8 | -12.2 | -2 | > 0.05 |
| | Sometimes | -34 | -44 | -18 | -4 | |
| | Never | -66.7 | -33.3 | 0 | 0 | |
| Do you rely on instrumental method for shade selection? | Always | -40 | -48 | -8 | -4 | > 0.05 |
| | Sometimes | -37.3 | -44.1 | -16.9 | -1.7 | |
| | Never | -50 | -27.8 | -16.7 | -5.6 | |
| Do you selection the shade at the beginning or end of the procedure? | Beginning | -43.9 | -41.5 | -13.4 | -1.2 | < 0.05 |
| | End | -25 | (45.0)* | -20 | -10 | |
| Do you consider that age & gender to affect the shade selection? | Yes | -40.9 | -42 | -13.6 | -3.4 | > 0.05 |
| | No | -35.7 | -42.9 | -21.4 | 0 | |

(Table 5) contd.....

| Variable | | <1,(N%) | 1-3,(N%) | 4-6,(N%) | >7,(N%) | P-value |
|---|---------------|---------|----------|----------|---------|---------|
| What is the ideal time required to determine the shade? | Within 5sec | -39 | -34.5 | -6.9 | -3.4 | < 0.05 |
| | 5-10sec | -35.6 | -48.9 | -13.3 | -2.2 | |
| | 10-20sec | -32.1 | -39.3 | -25 | -3.6 | |
| Which among these do you think plays a major role in shade selection? | Hue | -36.8 | -44.7 | -13.2 | -5.3 | > 0.05 |
| | Chroma | -36.4 | -45.5 | -18.2 | 0 | |
| | Value | -48.4 | -35.5 | -12.9 | -3.2 | |
| Are you define the shade by natural light? | Always | -42.3 | -39.4 | -16.9 | -1.4 | < 0.05 |
| | Sometimes | -42.3 | -42.3 | -7.7 | -7.7 | |
| | Never | 0 | -80 | -20 | 0 | |
| Are you define the shade by dental unit light? | Always | -25 | -62.5 | -12.5 | 0 | < 0.05 |
| | Sometimes | -38.7 | -38.7 | -19.4 | -3.2 | |
| | Never | -42.9 | -41.3 | -12.7 | -3.2 | |
| Are you cleaning the teeth prior shade selection? | Always | -43.5 | -40.6 | -11.6 | -4.3 | > 0.05 |
| | Sometimes | -37 | -40.7 | -22.2 | 0 | |
| | Never | -16.7 | -66.7 | -16.7 | 0 | |
| Do you determine the shade when the tooth is dry or wet? | Dry | -48.8 | -34.1 | -12.2 | -4.9 | > 0.05 |
| | Wet | -37 | -42.6 | -18.5 | -1.9 | |
| | I do not care | -14.3 | -85.7 | 0 | 0 | |
| Are the circumferential factors affecting your shade selection, such as skin color, lenses and clothes? | Always | -34.7 | -40.8 | -20.4 | -4.1 | < 0.05 |
| | Sometimes | -48.7 | -41 | -7.7 | -2.6 | |
| | Never | -35.7 | -50 | -14.3 | 0 | |
| Do you take the patient's opinion for shade selection? | Always | -37.9 | -46.6 | -10.3 | -5.2 | > 0.05 |
| | Sometimes | -45 | -37.5 | -17.5 | 0 | |
| | Never | -25 | -25 | -50 | 0 | |
| Do you think lipstick & clothes affect the shade selection? | Always | -48 | -34 | -18 | 0 | < 0.05 |
| | Sometimes | -34.4 | (50.0)* | -12.5 | -3.1 | |
| | Never | -30 | -50 | -10 | -10 | |

4. DISCUSSION

The results of the current study have revealed what dental students, interns, and general dentists know regarding choosing tooth shade principles. The current study has pinpointed the areas in which clinical training for interns and students needs to be improved regarding choosing a tooth colour. The final year students and interns responded differently than the general dentists, despite similar trends being seen among the participants.

Even for skilled clinicians, choosing a tooth color has been viewed as a difficult process. The current study confirmed that the majority of participants have difficulty choosing their tooth hue, similar to other earlier studies [6 - 9]. The common practice of choosing a shade visually with the aid of a dental shade guide is acknowledged to have a number of shortcomings and inconsistencies [8, 9, 11, 14], which add to the high level of difficulty encountered. The drawbacks can be mitigated by employing the instrumental approach, which provides an objective and [20] precisely measured shade reading. However, cutting-edge equipment like colorimeters and spectrophotometers is expensive and challenging to use in a clinical context, so the visual technique is still the most often utilized for shade selection across the globe [8, 9, 14, 25].

When a rubber dam is applied, or near the end of a dental procedure, teeth tend to dry out. Thus, it has been advised to choose shades before having your teeth prepared [12, 26, 27]. This is particularly true for porcelain-to-metal restorations [12].

However, if entire porcelain restorations are being planned, shade must be chosen both before and after tooth preparation because the newer ceramic systems require the preparation of a tooth-colored die [12]. In our investigation, the shade selection before the operation did not significantly differ across the groups, but the shade selection after the procedure did differ significantly. These outcomes might simply be a coincidence, or they might have been affected by the participants' ultimate restoration option. It must, therefore, be further examined.

There are other ways to choose colors, but our study reveals that the manual method—used by 97% of respondents—remains the most common. The practitioner's expertise and experience in the field of shade-taking have a significant impact on the effectiveness of manual shade-taking. Yet, it didn't seem to be connected to any clinical experience. The fact that more than half of the responders followed best practice recommendations and passed the first vignette was encouraging. The second vignette, however, saw a decline in the pass rate, indicating that despite adhering to the evidence-based good practice guidelines compiled by the specialists, the respondents lacked the communication skills necessary to effectively convey important information to the laboratory technician, as shown by the low combined pass rate for both vignettes.

The majority of participants seemed to understand the importance of great lighting. The grasp of this topic among interns and students in their final year was also satisfactory.

Northern daylight is a yardstick for assessing appropriate lighting [28]. Because one cannot rely on sunlight for shade selection in routine dental practice, color-corrected fluorescent lights with a CRI of 90 or above are indicated for dental operatories [29, 30]. Due to their higher levels of yellow light emittance, incandescent bulbs and dental unit lights are not advised [12]. Using daylight makes it easier to take cover from the sun. The majority of responders claimed that they used natural light to take pictures of the shade. This showed that they were aware that natural sunshine (5500K) is recommended as the best source of light for taking in shade [16]. The presence of many lighting sources, such as artificial light from the window, chair-side lighting, and overhead lighting, demonstrated the importance of "Metamerism". The best light to choose a color in is daylight. The spectrum of daylight, which extends from 1,000 K to 20,000 K, varies throughout the day and year. The entire color spectrum should be present in the ideal light source. The light source, education and training level, and gender are other variables that have been researched as potential influences on shade matching [16]. Natural daylight, which is defined as "North sunshine at midday on a day with very low cloud cover," was often the best type of lighting. It would be preferable to select the shade of teeth using a handheld color-corrected light with a spectrum of 5,500 K because it is impossible to have optimal natural light [31].

Through contrast, colored surfaces or structures around the teeth, such as the gingiva, lips, skin on the face, patient clothing, and operatory walls, can alter how the tooth color is seen [32 - 34]. Therefore, it is suggested that female patients remove their lipstick before selecting a tooth color. The majority of participants consider the external elements, including clothing, lenses, and skin tone, those influence color choices.

Before choosing a shade, teeth need to be thoroughly cleaned of any dirt and stains [12, 26]. The participants' responses on brushing their teeth before choosing a shade varied significantly. Compared to the other participants, fewer students said they would find this step crucial. The discrepancy may be caused by the fact that students frequently prioritize finishing their clinical obligations while ignoring minute technical aspects. Another factor might be that the patient finishes receiving operative care and prophylaxis just before going to the prosthodontics department for a replacement or restoration.

According to Wagenaar *et al.* [35], the eyes' capacity for color vision rapidly declines, and the perceived color does not remain steady when an item, like a tooth, is observed for more than 10 seconds. When choosing a shade, it has been advised to acquire a second viewpoint, including the patient's opinion, to avoid any errors brought on by eye tiredness [12, 35, 36]. The majority of study participants understood the value of patients' personal opinions and second opinions during the shade selection procedure.

The results of this study strongly imply that dentists with more clinical experience and training can better comprehend the purpose and mechanics of the shade selection procedure. The findings also show that undergraduate students need to

spend more time and effort learning about shade selection so that interns and dentists won't overlook important aspects of shade selection in their routine clinical work. Dentists can take brief courses on the shade-choosing process as part of their training to fill up any knowledge gaps and stay up to date in this area.

The cross-sectional design and comparison with other studies are two factors that contribute to some of the limitations of the current study. Our understanding of sociodemographic trends and tooth shade selection knowledge may be improved by longitudinal approaches. Last but not least, because other research employs different markers to identify socioeconomic class, the current study may be less comparable to those others.

CONCLUSION

It can be concluded that the general dentists had, in comparison to dental students and interns, a higher awareness of and knowledge of the fundamentals of tooth color choosing. This survey reveals that these respondents' shade-taking techniques have a lot of space for improvement. To accomplish this, it would be ideal for the undergraduate dentistry curriculum and the pertinent postgraduate training programs to provide systematic teaching in this fascinating and highly relevant field in clinical practice. The majority of responders to this survey do take shade, although a sizeable portion of them do so with a greater degree of presumption than with precision and preparation. Therefore, we must make improvements in order to meet the justifiably high standards of care that our patients have come to expect from us. More research on shade-taking is required in order to enhance working practices.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study has obtained ethical approval from the research committee of the University of Hail, Hail, Saudi Arabia (Approval No. H-2022-325).

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

STANDARDS OF REPORTING

COREQ guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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