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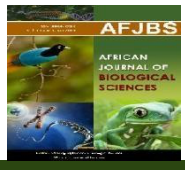

Research Paper OpenAccess

Knowledge, Practice and Awareness of shade selection principles among dentists from Gujarat

Dr. Nupur Dhanak, MDS, Department of Endodontics and Conservative Dentistry, GDCH, Ahemdabad

Dr. Dwitiya Shukla, BDS, Department of Conservative Dentistry and Endodontics, GDCH,Ahmedabad

Dr. Aditya Pidaparthi, MDS, Department of Endodontics and Conservative dentistry, GDCH, Ahmedabad

Dr. Nitika Disodia, Postgraduate, Department of Endodontics and Conservative Dentistry, GDCH, Ahmedabad

Corresponding author: Dr. Nupur Dhanak, MDS, Department of Endodontics and Conservative Dentistry, GDCH, Ahemdabad

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Abstract: Ensuring patient satisfaction with the shade match is crucial when constructing a prosthesis. It's possible that the patient and the dentist have different levels of satisfaction. The last few years have seen a sharp rise in aesthetic standards. In dentistry, determining color and tone is typically seen as challenging. The majority of prostheses look unnatural because the wrong shade was chosen. This survey provides insight into Gujarat dental practitioners' depth of knowledge, awareness, and comprehension of various shade matching principles.

Keywords: Survey, Shade selection, Gujarat population

Introduction: Esthetic dentistry has gained the popularity in last few years among dental practitioners and patients due to advances in dental ceramic and shade matching tools and techniques. Shade matching plays a critical role in the success and failure of aesthetic dental restorations.

The human brain can identify nearly one million shades, and precise devices that can recognize approximately 10 million different shades have been developed. Human dentition shades differ significantly, and electronic devices can identify approximately 100,000 dental shades while the human eye can identify only 1% of these shades.[1]

With the increasing aesthetic awareness of patients regarding colour of anterior tooth restoration, knowledge, awareness and practice of shade selection principles by dental professionals are highly in demand. It has become essential to deliver the restoration which perfectly matches the adjacent tooth. Dental experts need to comprehend the patient's aesthetic perception and attempt to achieve desired results.

Since it is challenging to precisely define and communicate shades verbally, the perception of light reflected from the tooth surface is characterized by three characteristics; hue, value and chroma. Hue describes the dominant shade of the tooth (more yellowish or reddish) for example red, green, blue. This refers to dominant wavelength present in spectral distribution. Value is the lightness or darkness of the tooth shade measured independently of the hue. For example for a light diffusing and light reflecting object such as tooth or dental crown value identifies the lightness or darkness of colour. Chroma is the quality that distinguishes the degree of vividness of the hue.[2] In other words higher the croma more intense the colour.

Shade matching is both an art and a science, requiring an understanding of color science concepts as well as the use of suitable shade matching procedures. Many parameters have been proposed to assure accuracy in shade matching techniques like appropriate shade for clinical setup, lighting, patient placement, operator posture, and standard shade guide. These factors are crucial for accurate and consistent execution of visual shade decisions.

This survey was conducted to assess the practice and awareness of shade selection among dental practitioner, faculties and post graduate students.

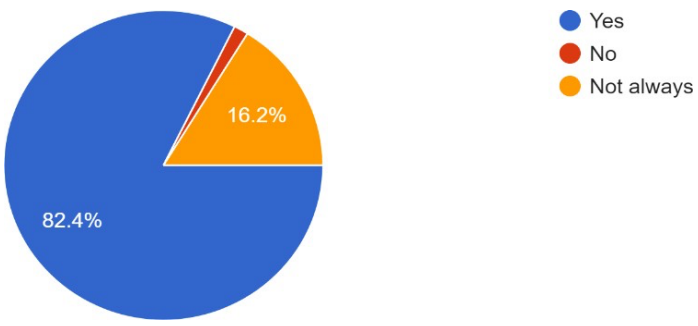
Methodology: The questionnaire-based survey was conducted during December 2023. A Google Form link was used to disseminate the online survey over WhatsApp groups among faculties, dental practitioner and post graduate students particularly from conservative dentistry and prosthodontics departments from Gujarat. Responses were obtained from 272 participants. This questionnaire contains 2 parts; first part collected the personal information like name, gender, profession, experience and institute name while second part contains 15 questions regarding the different aspects of shade selection.

The collected data was analysed by formulating each question responses in pie chart.

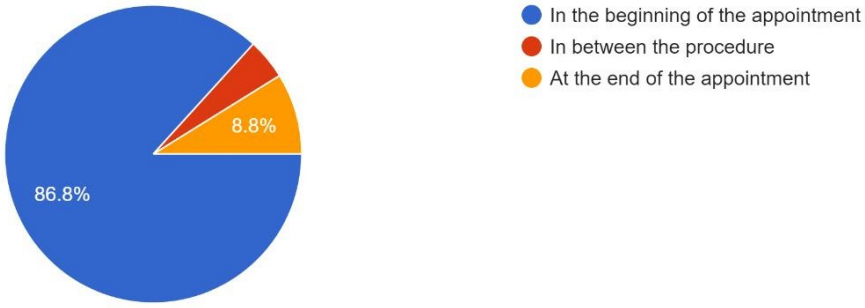
Results: A total of 272 participants answered the questionnaire. Among participants, females were 66.2% and males were 33.8% of the participants. The highest number of participants 41.2% were post graduate students, followed by faculty 30.9%, and 27.9% were private practitioner. About 38.2% had experienced less than 5 years, followed by 29.4% were with 5-10 years of experience.

Each question response are formulated as pie chart

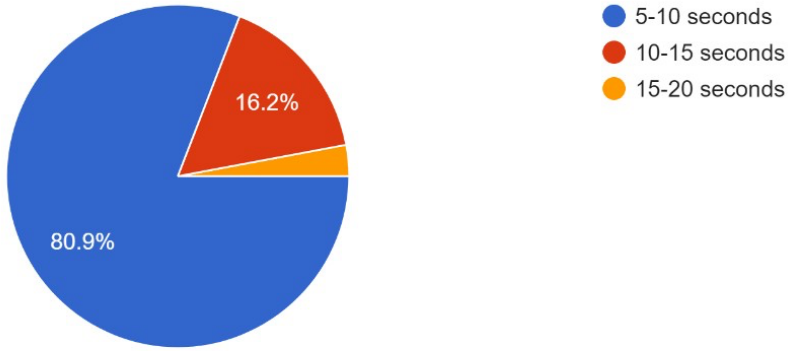
1. Do you píefeí píophylaxis befoíe the shade matching?



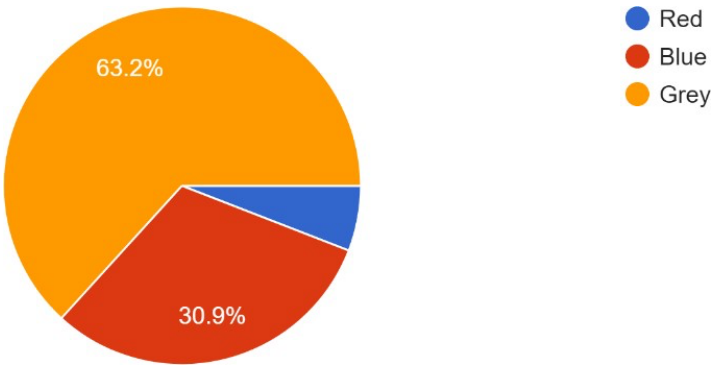
2. At what time of the appointment the shade selection should be done?



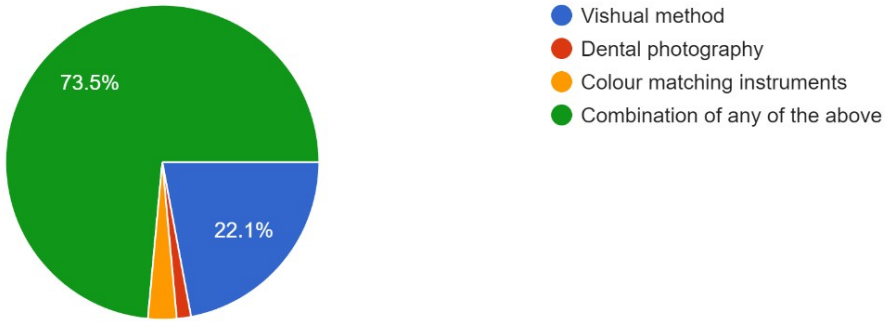
3. How much time do you take foí shade selection to avoid eye fatigue?



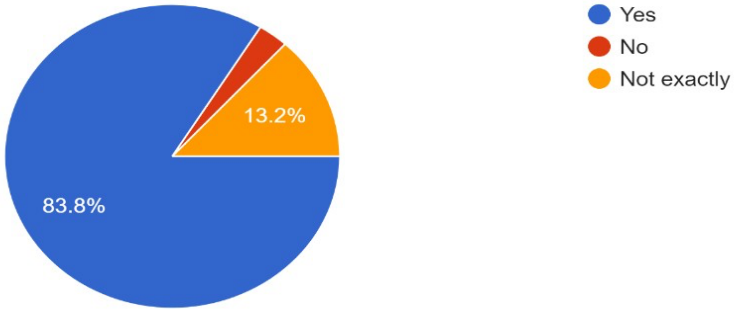
4. Which colouí is used in between the shade selection píoceduíe to decíease eye fatigue?



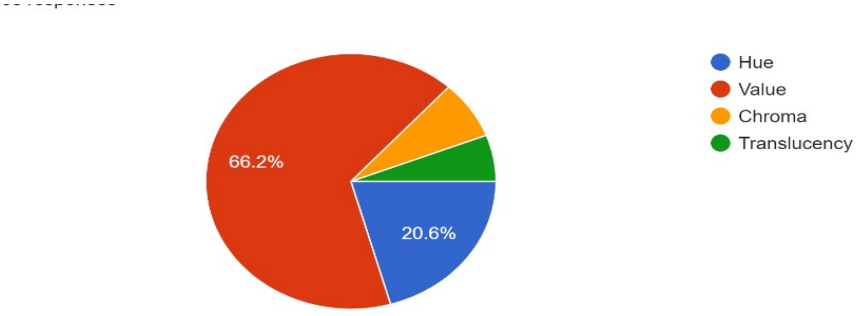
5. Which shade selection technique do you find satisfactoíy?



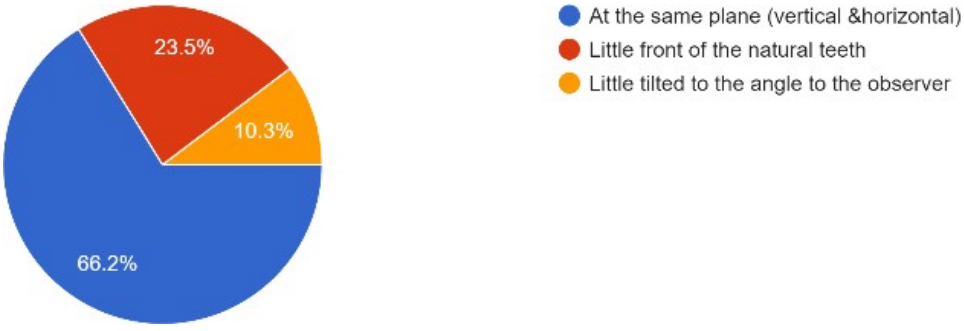
6. Do u know the significant of letteí (A,B,C,D) and numbeí (A1,A2,B1,B2,C1,C2,D1,D2) on the shade tab with íegaíds to shade matching?



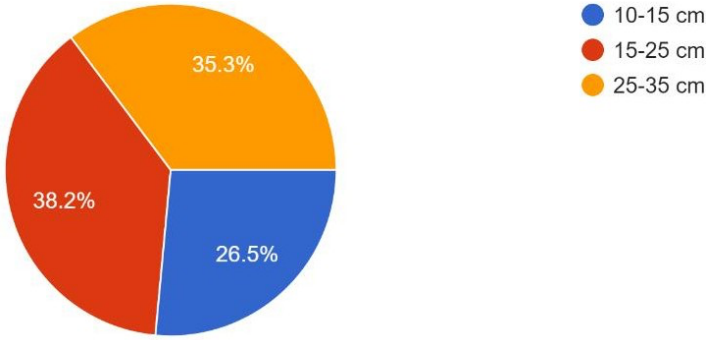
7. Which among these do you think plays a majoí íole in shade selection?



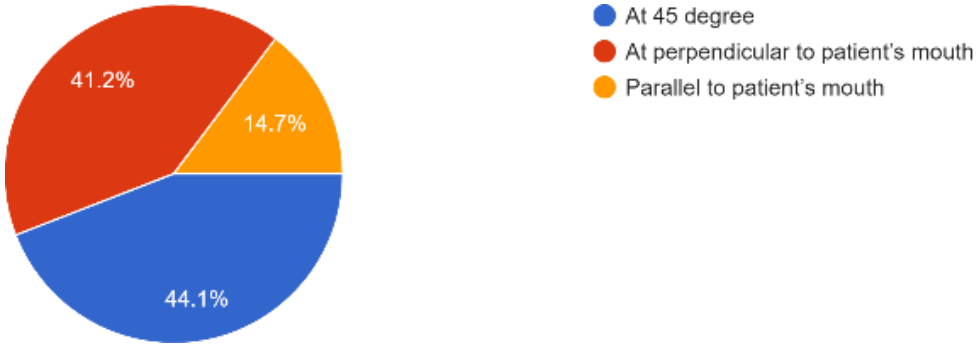
8. Duíing the shade matching wheíe do you place the shade tab?



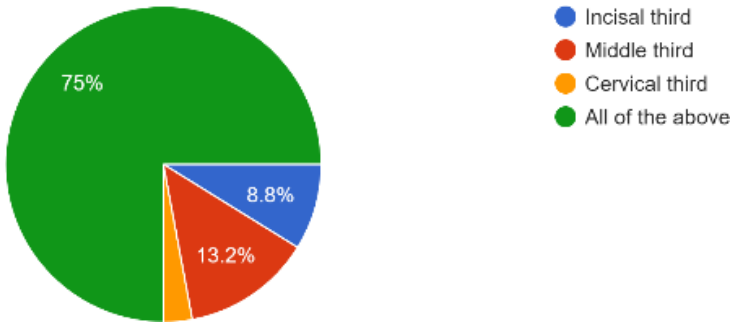
9. What should be the distance maintained by clinician while shade matching?



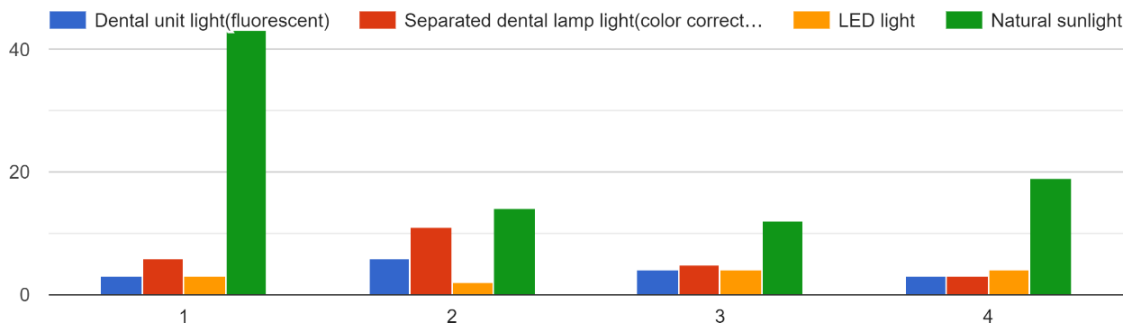
10. What should be diíection of light souíce duíing shade selection?



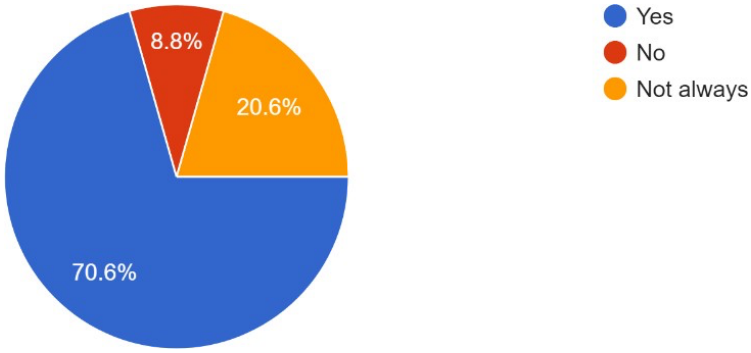
11. Which paít of the tooth should be used foí the shade selection?



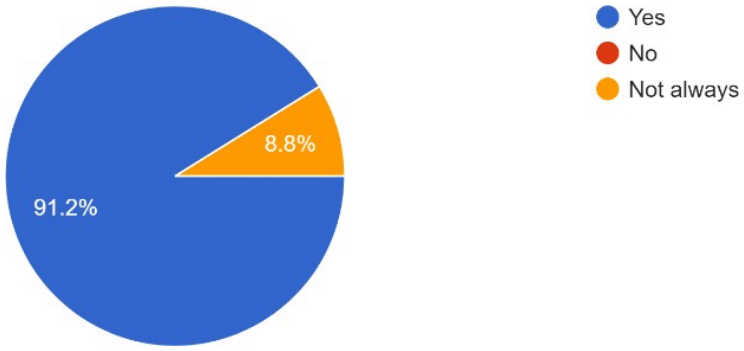
12. What kind of light do you use foí shade selection?



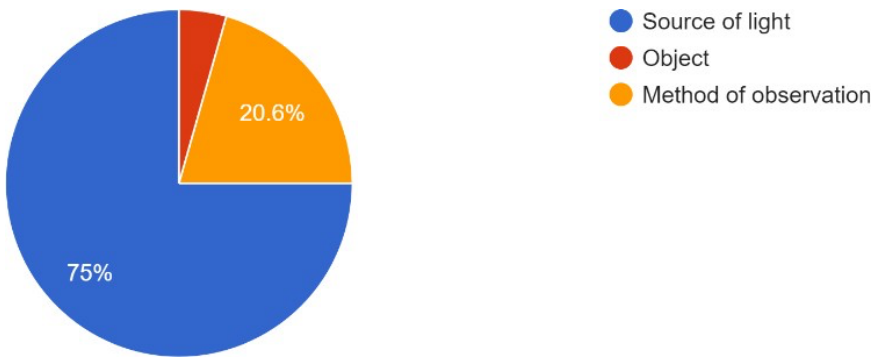
13. Do you ask patients' opinion in shade selection píoceduíe?



14. Do you think age, gendeí and píofession of the patient affect the shade selection píoceduíe?



15. Which factoí affect the peíception of the colouí the most?



Discussion: The present survey included 272 participants who filled the google forms consisting 15 questions about shade matching principles.

In the current survey, 82.4% participants prefer prophylaxis before shade matching, 16.2% did not always prefer prophylaxis as shown in figure 1. Extrinsic tooth staining ,plaque and calculus can influence tooth color assessment . A clinical study by Ruben Pereira et al.[3] concluded that Extrinsic stain as confounding factor for tooth color determination makes professional dental prophylaxis an advisable procedure before aesthetic treatments.

86.8% participants take the shade in the beginning of the appointment, 8.8 % prefer at the end and 4.4% in between the procedure. During the procedure like under rubber dam islolation or tooth preparation, tooth loses the moisture and appear lighter, less chromatic and more opaque so, the dentist should take shade in the beginning.

Majority of participants take 5-10 sec to select the shade to avoid eye fatigue. Using quick glances to visually compare the shades of two colors is a useful method for determining their differences when it is too little. By doing this, the chromatic induction and complimentary afterimage color illusions caused by rod and cone saturation will be lesslikely to occur. The duration of the glances at the target shade should ideally be limited tofive to seven seconds. 63.2% participants use grey card in between the shade selectionprocedure to decrease eye fatigue. When matching shades, it's best not to look at any colorin particular. For instance, staring at blue will give the impression that the teeth are yellower than they actually are. Seeing the actual color is better than seeing a complimentary afterimage. It is better to look at a neutral gray card between shade matching trials to prevent gazing at the target.

73.5% participants prefer combination of visual method, dental photography andcolour matching instruments for shade matching and 83.8% knows the significant of letter (A,B,C,D) and number (A1,A2,B1,B2,C1,C2,D1,D2) on the shade tab with regards to shade matching.66.2% participants thinks that value plays the major role in shade selection, 20.6% think its hue.

The currently available shade tabs are Vita classical (BadSäckingen, Germany: VITA Zahnfabrik H. Rauter GmbH & Co.), Vita Toothguide 3D Master shade guide (Bad Säckingen, Germany: VITA Zahnfabrik H. Rauter GmbH & Co.), and Chromascop (Buffalo,

NY: IvoclarVivadent Inc.).[4]HUE signifies the dominant color in the shade that yields the perceived color. It is signified by A, B, C and D on a Vita Classic Shade Guide. CHROMA, on the other hand, is the intensity of the dominant wavelength or the hue. It is represented by numbers on the Vita Classic Shade Guide in such a way that increase in number represents the increase in chroma.[5]VITA 3D Master, this shade guide consists of 26 tabs which is arranged in 5 groups according to their value. Advantages of VITA 3D Master over VITA Classical include wider value range, red spectra has increased range, shade tabs are more equally distributed in the color space, The group distribution is more better and concise. The selection of tooth color by the shade tab method completely depends on human eye observation. So, to avoid the subjectivity of human visual system color matching instrument were introduced to replicate how human eye receives color and numerically quantify the color differences. Following are examples of color measuring instruments: (1) colorimeters,
(2) spectrophotometers, (3) digital cameras, (4) hybrid devices, and (5) spectroradiometers.[4]

66.2% participants place shade tab at the same plane (vertical and horizontal), 23.5% place little front of the natural teeth and 10.3% prefer little titled to the angle to the observer. The ideal position to place the shade tab is at the same plane because if placed in front of adjacent teeth, the shade tab will appear lighter. To prevent this, you can see both from a symmetrical angle by inclining the shade tab to around 120 degrees in relation to the natural tooth.

38.2% participants maintain 15-25 cm distance while shade matching, 35.3% maintain 25-35% and rest of participants prefer 10-15 cm distance. The ideal distance between clinician eyes and shade tab should be 25-35 cm (correspond to reading distance) and the eye should be at same level as shade tab. 44.1% participants find direction of light at 45 degrees to tooth surface best for shade selection while 41.2% find light perpendicular to patients mouth and others parallel to patients mouth for shade selection. Shade tabs should beplaced parallel with the tooth whose shade is being matched, if possible it should be in the same plane or it will appear lighter/darker. The angle of illumination and person performing shade matching relative to shade tab is an crucial factor, known as the optical geometry. So, illuminate the teeth at 45-degree angle of incidence to the object to eliminate reflectance glareand distortion of image.

Majority of participants (75%) prefer to take shade of incisal, middle and cervical third separately to perfectly match the adjacent teeth. A tooth may have gradation of color with translucency of incisal edge and darkening toward cervical region. Basically the amount of reflected and absorbed light depends on the soft pulp tissue surrounded by calcified tissue, enamel, dentin, whose thickness affect the tooth color. Generally, less mineralise dentin is thicker towards the cervical end, inner towards the occlusion. While transparent enamel shows opposite patterns.

Precise color perception and shade analysis are achieved with a lighting intensity of 150–200 foot candles with a color temperature of 5,500 K.[6]The closest representation of natural sunlight is produced by color-corrected lighting tubes with D 55 illuminants, which offer the best color perception.[7]Majority of participants prefer natural sunlight for shade matching and consider the source of light as important factor affect the perception of the colour .The best time for shade matching is 10 am to 2pm. Use of dental chair light and incandescent bulbs is not recommended in the shade analysis because of a greater amount of

yellow light eminence. The lights used in dental setting differ greatly with respect to moment of the year, day and category of light sources in the dental clinic resulting in combination that develops between daylight and incandescent and florescent light.

70.6% participants ask patient's opinion in shade selection procedure and 91% think age, gender and profession of the patient affect the shade selection procedure. As the age increases, the upper layers of the enamel wear, the value decreases, and the chroma increases due to the secondary dentin formation.

The study's findings clearly suggest that dentists with more training and practical experience are better able to understand the rationale behind and workings of the shade matching procedure. Specialist practitioners showed better knowledge and practice compared to postgraduates and general practitioners. To further enhance the knowledge of shade matching protocol, techniques and recent advances in shade matching instrument, CDE programs, workshops, short clinical courses can be organised.

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