

# Knowledge, awareness and perception regarding the role of different light sources in shade selection of ceramic

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## ABSTRACT

**AIM:** To assess the knowledge, awareness and perception regarding the role of different light sources in shade selection of ceramic

**OBJECTIVE:** To analyse the level of the knowledge, awareness and perception regarding the role of different light sources in shade selection of ceramic

**MATERIALS AND METHODS:** An open ended questionnaire was distributed through an online survey application called survey planet to 100 students consisting of both undergraduate and postgraduate students. The questionnaire contained 15 question which also collected demographic data of the participant. . The data collected was further analysed statistically and interpreted graphically

**CONCLUSION:** Shade matching is both a skill and art. Practical skill thoroughly depend on experience and awareness among the population must be increased .

**KEYWORDS:** shade matching, light source, natural light, munsell system, cie\*lab, color rendering index

## INTRODUCTION:

Restorative dentistry is a blend of science and art. The success of restorative dentistry is determined on the basis of functional and aesthetic results. To achieve aesthetics, four basic determinants are required in sequence; viz., position, contour, texture and colour. [1]Colour combination not only improves aesthetics but also makes the restoration appear natural and attractive [2]. The ability of dentists to select and communicate an acceptable shade match to a dental laboratory is important in operative dentistry. Traditionally, dentists select shades for restorations by matching the natural teeth with shade tabs from a manufacturer's shade guide. [3]. There is inconsistency in shade matching abilities using traditional methods, one in part, because shade selection is affected by a host of variables, such as age, experience, and degree of colour deficiency of the individual choosing the shade, the shape and texture of the tooth being matched, and the type of lighting, not to mention the range of shades and materials of the shade guide tabs. Shade guide tabs vary even among the same manufacturer.

Knowledge of the basic colour principles is important for shade selection. Colour has been described by Munsell as a 3-dimensional phenomenon, consisting of hue (colour), value (brightness), and Chroma (saturation). Hue distinguishes one colour family from another. Value is the relative amount of lightness or darkness of the hue, or the scale of white to black/grey. Value, although achromatic (without colour), is critical for obtaining an acceptable shade match. Chroma is the amount of saturation, intensity, or strength of the hue. Chroma and value are inversely related; that is, as the chroma increases, the value decreases. In general, the higher numbers on the Vitapan Classical shade guide represent increased chroma, and the lower numbers represent an increase in value.

Another system that has gained acceptance in dental research is the CIE\*LAB colour system introduced by Commission Internationale de le<sup>e</sup> clairage in the late 1970s. The advantage of this system is that it defines colour changes in more uniform gradations than does the Munsell system. [4]More complete explanations of the aforementioned systems can be found in the literature. The Vitapan Classical shade guide (Vident, Brea, Calif), using the terminology of the Munsell system, is arranged by value as well as by hue; the hue is represented by the letters A, B, C, and D. The A shades are of a similar hue, as are the B, C, and D shades. Value is represented by the numbers 1, 2, 3, and 4[5

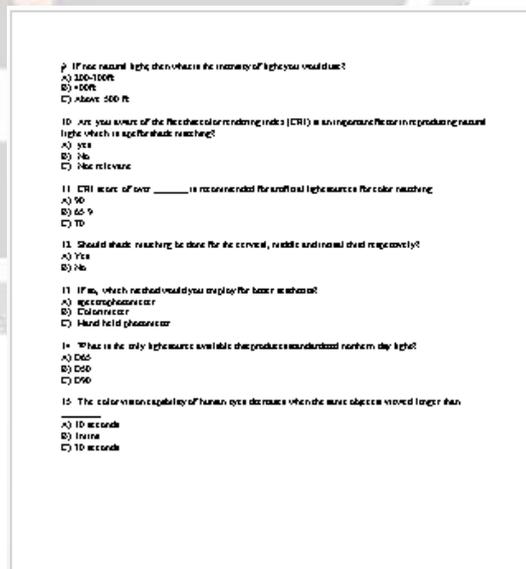
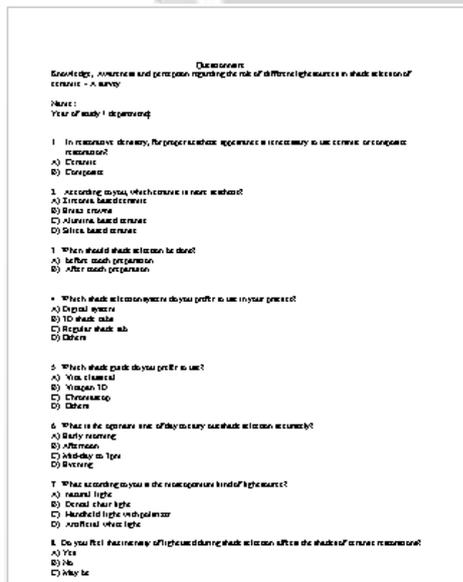
The awareness among budding dentists about the appropriate methods for aesthetic shade selection must be incorporated from the beginning .Colour appearance is an important parameter for patient acceptance of dental restorations. [6]

The appearance of teeth is mostly determined by how light interacts with its curved and varied surface. . The ideal light source is natural light occurring between mid-day and 3 PM for accurate colour comparison. Northern exposure sunlight that is slightly overcast is considered preferable. This can be referred to as standard daylight, which occurs at about 5500 K. To this end, sunlight has been standardized for shade selection purposes in the form of “northern daylight”i.e. Sunlight around the noon hour on a bright day with slight overcast. It has a CRI of close to 100 and is also used as a normal standard for judging light from other sources. This is where the artificial light comes into play .It can be incandescent (which emits higher concentration of yellow light) or fluorescent (which emits higher concentrations of blue light waves). Neither of these is pure white light. The only artificial light suitable for reproducing the standardized northern daylight is a D65 light source

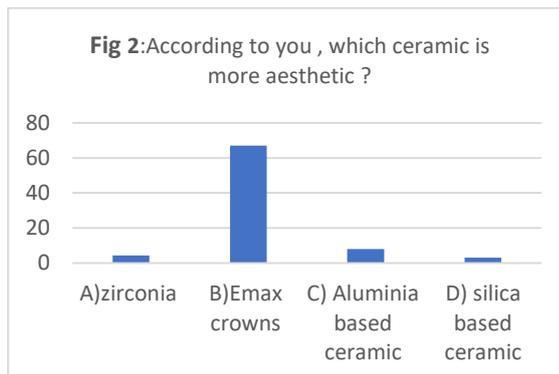
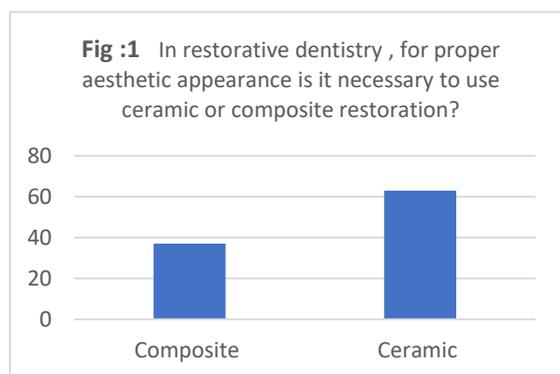
The aesthetic demands of patients and dental professionals have additionally elevated the importance of accurate shade selection. Clinicians must pay attention to shade matching variables, such as an accurate and reproducible light sources and colour education and training. Colour matching, like many other aspects of dentistry, requires a fine skill and should be practiced regularly. There is a difference between experience and education and training in dental colour matching. [7].The aim of this study was to access the knowledge, awareness and perception regarding the role of different light sources in shade selection of ceramic.

**MATERIALS AND METHODS:**

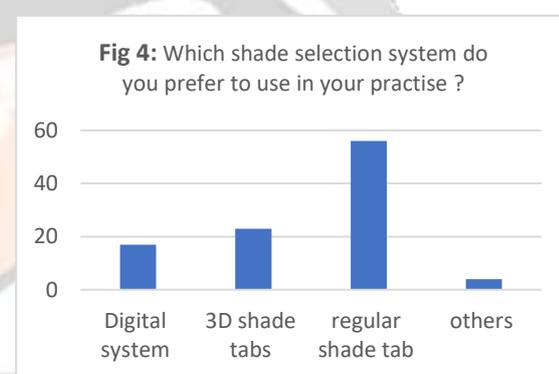
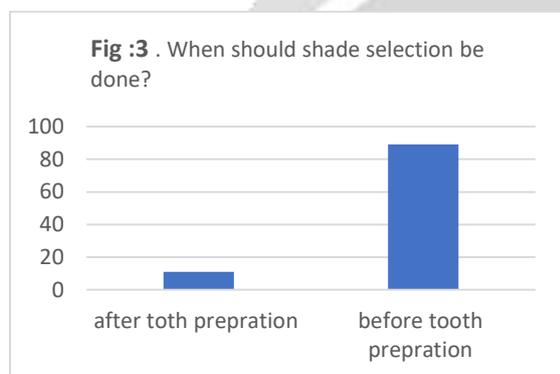
An open ended thorough questionnaire was distributed through an online survey application called survey planet to 100 people belonging to Saveetha Dental College. The questionnaire contained 15 question and also collected demographic data of the participant and also the year of study. The data collected was further analysed statistically and interpreted graphically. The questions included in the survey are:



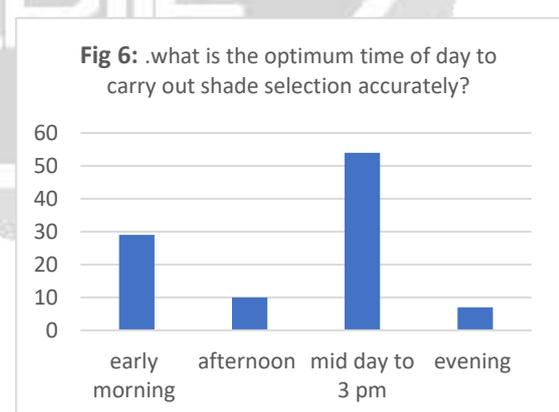
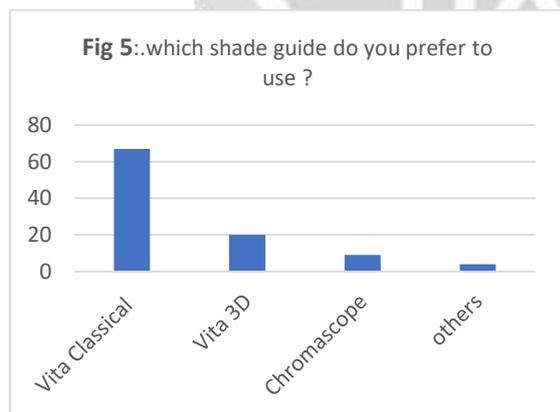
**RESULTS:**



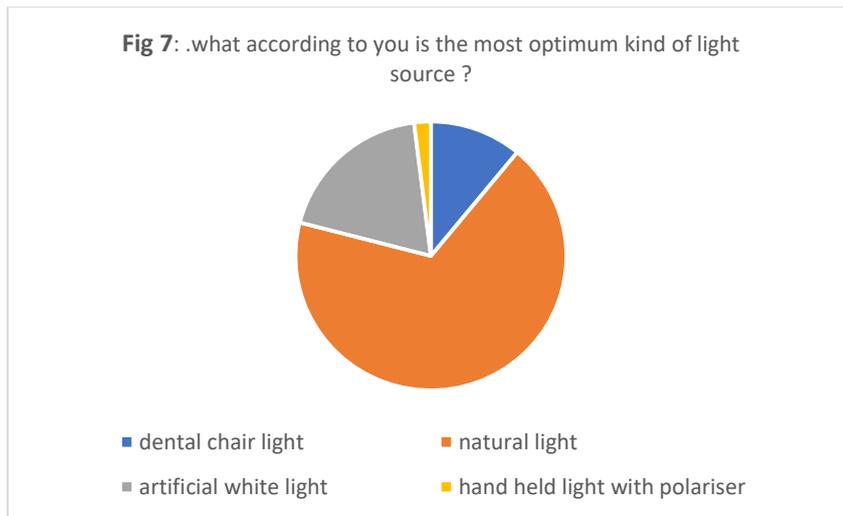
About 67% of the study population use ceramic over composite for better aesthetics purposes, out of which around 70 % of the population prefer Emax crowns when aesthetics is a concern.



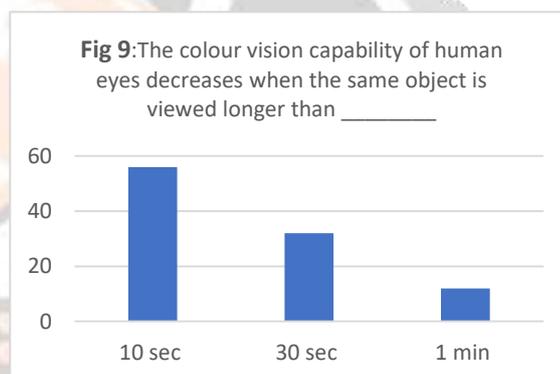
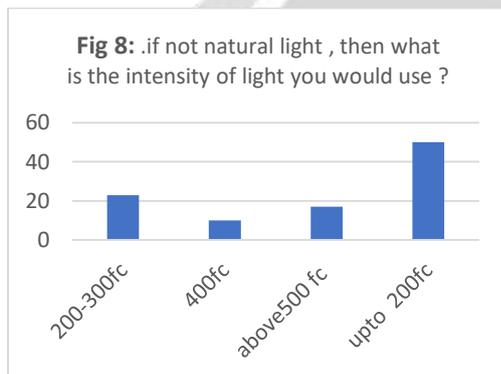
From the study population, about 89% of the results agree that shade selection should be done before tooth preparation. Out of which 56% of the students use manual shade tabs to carry out the process of shade selection.



Vita classical is the most commonly used shade guide, about 67% of the students prefer this shade guide. About 54% of the study population carry out shade selection from Mid-day to 3PM for accurate shade matching.



The most optimum kind of light for accurate shade selection according to 68% of the study population is natural light followed by artificial white light [19%]



Around 50% of the study population suggest that if not natural light then the luminosity apt for the artificial light being used is up to 200ft candles. Contrary to belief, about 56% of the study population are aware that the colour vision capability of human eyes decreases when the same object is viewed longer than 10 secs.

**DISCUSSION:**

The results of the present study demonstrated that the knowledge, awareness and perception regarding the role of different light sources in shade selection of ceramic among the study population is adequate theoretically . Although, more the clinical experience better is ones shade matching capacity. As is known shade matching by visual means is subjective, it is one of the most common prosthodontic procedures performed. [8] To reduce variability, daylight

Has been suggested to be the most appropriate type of lighting for matching shades. However, it is not always possible to choose shades during the day, nor is the quality of daylight consistent. However, in the present study, 68% of the study population would prefer to use natural light for the process of shade selection. [Fig: 7] The appearance of teeth is mostly determined by how light interacts with its curved and varied surface. The perimeter shape and the morphology of the buccal surface have the greatest effect on the appearance of teeth because they determine how the majority of light is reflected. [9] An observer only sees an object when light comes from that object. [10] Reflective surfaces of the tooth will not return significant light to our eyes if they are not perpendicular to our eyes, even if the tooth surfaces are highly polished.

One of the variables to be considered for the selection of colour is the light source used. The ideal light source is natural light occurring between mid-day and 3 PM for accurate colour comparison. Northern exposure sunlight that is slightly overcast is considered preferable. This can be referred to as standard daylight, which occurs at about 5500 K [11]. The time of day, time of year and weather conditions affect the colour of sunlight; consequently, standard daylight is rarely available. Early morning and evening light is redder compared with daytime? In the present study, [Fig: 6] about 54% of the study population choose to perform shade selection from mid-day to 3PM. If the light source changes, then the light reflected from an object, changes too, in which case a different colour is perceived. The absence of ideal conditions has led to the use of artificial lighting for colour matching. [12] Other researches state that the shade matching scores were better when done under a commercially available light correcting source than under natural daylight. The colour rendering index (CRI) , on using artificial light should remain above 90 for accurate shade selection .Similarly from the results, about 73% of the population agrees that the artificial light used should have a CRI of 90. Research by Degg et al has shown that if light from its source changes(e.g. Sunlight under a cover of clouds), it also changes the light reflected from the object, in which case the actual colour perceived by the eye is different.[13,14]

In spite of daylight standardization, the fact remains that sunlight is available only during the day time. Therefore, it is unreliable for dental shade selection purposes because that requires a stable light source in the form of an illuminate. This is where the artificial light steps inartificial light is almost universally used in dental surgeries. It can be incandescent (which emits higher concentration of yellow light) or fluorescent (which emits higher concentrations of blue light waves). Neither of these is pure white light. The only artificial light suitable for reproducing the standardized northern daylight is a D65 light source. Unfortunately, the D65 lamps are very expensive and not readily manufactured on a commercial level. [15]

In support of the results obtained , [Fig :8] more than 50% of the population is aware that the ideal luminosity to be used for artificial light should be around 150-200ft-candles , Morel A et al says that the ideal luminosity for dental shade matching is 75 to 250 ft.-candles. To have 150ft-candles intensity in the operatory at the level of the dental chair, ten to twelve four foot bulbs would be needed in a 10x10 ft. Room with 8-foot ceilings. The diffusion panels covering your fluorescent bulbs are necessary also because they screen out wavelengths. As they age, the panels change what wavelengths they absorb. [16] The best diffusers are those that don't filter out any wavelengths of the spectrum, preferably the egg crate type. Using ten to twelve colour corrected bulbs on the ceiling will yield more light in the operatory than what would be considered comfortable. There are portable high quality light units such as the videnttm light which are ideal. Shade matching with photography lessens but does not obviate the need for special lighting. The proper shade tabs still need to be selected. Shade tabs from any vendor are helpful. Ideally practitioners should have the same shade guide the laboratory uses, but if not, the tab can be shared while the restoration is being completed.] The Vita classic shade guide (Vita Zahnfabrik, Bad Säckingen, Germany), at this time, is used by about 90% of practitioners. [17] In accordance to this , [Fig :5] reveals that about 67% of the study population still use the Vita classic shade guide .This guide unfortunately represents a minority of the natural teeth and unnaturally brightened teeth to be matched.

There is hope that a non-proprietary, universal, full-spectrum guide will be available in the not-too-distant future that the dental material manufacturing industry will adopt. [18] Better shade tab systems that cover more of the hue and value spectrums, such as the Vitapan shade guide, are currently on the market; however, Vita- pan is tied to a proprietary porcelain system. The current mechanical shade-assessing systems based on colorimeters, spectrophotometers will not rival the results achieved when the practitioner/technician team utilize well-drawn shade maps and quality multi-image photography. [19]

### **Conclusion:**

In conclusion, based on the results obtained awareness among the dental undergraduates about the significance of different light sources in the process of shade matching is present, but the efficiency of selecting shade in the proper environment and available light sources comes with experience. The significance of different light sources and the different variations of the colour under different light sources is an important characteristic to be remembered during shade selection. Therefore, proper knowledge and practise should become a part of the study syllabus of the dental undergraduate students .One must always remember that dealing with colour perception is subjective and patient satisfaction is of the utmost importance.

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