ORIGINAL RESEARCH PAPER

Dental Science

COMPARATIVE EVALUATION OF SHADE SELECTION BY POST GRADUATE STUDENTS WITH BLUE LIGHT BLOCKING SPECTACLES AND WITHOUT SPECTACLES UNDER NATURAL LIGHTING CONDITION

KEY WORDS:

Dr. Shruti D Matale, Postgraduate student, (Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India

Dr. Jaykumar R. Gade* Gade, Professor, (Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India*Corresponding Author

Dr. Rutuja A. Deshmukh Postgraduate student, (Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India

ABSTRACT

Accurate shade selection in esthetic dentistry depends on proper lighting and color perception. This cross-sectional study evaluated shade selection accuracy with and without blue light blocking (BBL) spectacles among 20 postgraduate dental students under natural daylight conditions. Participants demonstrated significantly lower accuracy with BBL spectacles (56%) compared to without spectacles (90%) ($p < 0.05$). Within the study limitations, BBL spectacles adversely affected shade matching accuracy.

INTRODUCTION:

Visible light in the wavelength range of 380–500 nm is categorized as blue light and possesses relatively higher energy than longer wavelengths. Excessive exposure to high-energy blue light has been associated with increased scattering and potential phototoxic effects on ocular tissues such as the cornea, lens, and retina [1]. To reduce these harmful effects, blue light blocking lenses (BBLs) have been developed. These lenses selectively filter short-wavelength light using reflective coatings or blue light–absorbing chromophores incorporated within the lens material [1,2]. Although BBLs may improve visual comfort and reduce retinal exposure to blue light, they alter the spectral composition of visible light, often producing a yellowish tint and affecting color perception, contrast sensitivity, and color discrimination [3,4].

In dentistry, accurate shade selection is essential for esthetic success in restorative and prosthodontic procedures. Proper color matching between natural teeth and restorations significantly influences patient satisfaction and clinical outcomes [5,6].Shade selection depends on several factors, including lighting conditions, observer experience, surrounding environment, and visual perception [7–9]. Previous studies have shown that variations in light intensity and quality can significantly influence shade matching accuracy [10–12]. Visual shade selection methods are particularly dependent on human color perception and are therefore prone to subjective variations [13–15].

Principles of color science and the natural variability in tooth color and translucency further complicate the shade selection process [16–20]. Since blue light blocking lenses alter chromatic perception and color discrimination, their use may influence shade matching accuracy. However, limited literature is available regarding the effect of BBL spectacles on dental shade selection.

Therefore, the present study aimed to evaluate and compare shade selection by postgraduate dental students with and without blue light blocking spectacles under natural lighting conditions.

OBJECTIVES:

- To evaluate shade selection by postgraduate students with blue light blocking spectacles under natural lighting conditions.
- To evaluate shade selection by postgraduate students without spectacles under natural lighting conditions.
- To compare shade selection accuracy with and without blue light blocking spectacles.

Primary Hypothesis: There is a statistically significant difference in shade selection with and without blue light blocking spectacles under natural lighting conditions.

Null Hypothesis: There is no statistically significant difference in shade selection with and without blue light blocking spectacles under natural lighting conditions.

MATERIALS AND METHODS

This study was conducted in the Department of Prosthodontics, Crown and Bridge. 20 postgraduate students fulfilling the inclusion criteria and willing to participate were included in the study.

Inclusion criteria: Students without spectacles.
Exclusion criteria: Students with spectacles.
Withdrawal criteria: Non-compliant participants.

Two sets of VITA 3D-Master shade guides were used. From one guide, five shades- 1M2, 2M2, 2L1.5, 3M2, and 4M2 were selected. The identification codes of these shades were concealed using black cellophane tape to eliminate visual bias.

A non-prescription blue light blocking spectacle was used for the study. Each participant was seated near a window under standardized natural daylight conditions. Initially, participants wore the BBL spectacles and matched the concealed shades with the corresponding shades on the second unmodified shade guide. The selected shades were recorded systematically.

After a short interval to minimize visual fatigue and memory bias, the same participants repeated the procedure without spectacles under identical lighting conditions.

The selected shades were compared with the actual shades. A score of "1" was assigned for a correct match and "0" for an incorrect match. Since each participant evaluated five shades, the maximum obtainable score was 5.

RESULTS:

A total of 20 postgraduate students participated in the study. The descriptive data of shade selection are presented in Table 1, participant-wise scores in Table 2, and the mean score, standard deviation, and percentage accuracy in Table 3 and Graph 1. Participants wearing blue light blocking (BBL) spectacles (Group A) demonstrated lower shade matching accuracy compared to those without spectacles (Group B). Group A scores ranged from 2 to 5, whereas Group B

consistently showed higher scores, with most participants achieving the maximum score. The mean score for Group A was 2.8 ± 1.2, corresponding to 56% accuracy, while Group B demonstrated a higher mean score of 4.5 ± 0.7 with 90% accuracy. As the same participants performed shade selection under both conditions, the data were paired in nature. A paired t-test revealed a statistically significant difference between the groups ($p < 0.05$); therefore, the null hypothesis was rejected.

DISCUSSION

Shade selection is a crucial aspect of esthetic dentistry, directly influencing the success of restorative and prosthodontic treatments. Accurate shade matching depends on several factors, including lighting conditions, observer perception, and visual interpretation [5–7]. The present study evaluated the effect of blue light blocking (BBL) spectacles on shade selection accuracy under natural lighting conditions. The findings demonstrated significantly higher shade matching accuracy without BBL spectacles compared to with spectacles. Participants wearing BBL spectacles exhibited reduced accuracy and greater variability in shade selection.

This reduction in accuracy may be attributed to the optical properties of BBLs, which selectively filter short-wavelength blue light and shift the transmitted spectrum toward longer wavelengths, producing a yellowish tint [1–4]. Such spectral alterations can affect color perception, contrast sensitivity, and color discrimination, thereby influencing tasks requiring precise color evaluation.

Previous studies by Barna et al [7], Dagg et al [8], and Knezovi Zlatari et al [9] emphasized the importance of lighting conditions in accurate shade selection. Furthermore, Yu et al [1], Alzahran et al [3], and Baldasso et al [4] reported that blue light filtering can alter chromaticity, reduce contrast sensitivity, and impair color discrimination, supporting the findings of the present study.

Therefore, the findings of the present study suggest that blue light blocking spectacles can adversely influence shade selection by altering visual color perception. Since accurate shade matching is essential for achieving optimal esthetic outcomes in restorative dentistry, clinicians should exercise caution while using BBL spectacles during clinical shade selection procedures.

Limitations

The sample size was relatively small, and only five shades were evaluated. In addition, the study was conducted under natural daylight conditions, which may show minor variations despite standardization. Further studies with larger sample sizes, different lighting conditions, and digital shade analysis systems are recommended.

CONCLUSION

Within the limitations of the present study, shade selection accuracy was significantly higher without blue light blocking spectacles compared to with spectacles under natural lighting conditions. The use of BBL spectacles resulted in reduced accuracy and greater variability in shade matching, indicating that they adversely affect color perception and may not be reliable during clinical shade selection procedures.

Table 1: Descriptive data of each group

Sr. No.	Group A (With BBL Spectacle)	Group B (Without BBL Spectacle)	Actual Shade	Match (A)	Match (B)
1	2M2	1M2	1M2	0	1
2	2M2	2M2	2M2	1	1
3	2M2	2L1.5	2L1.5	0	1
4	3M2	3M2	3M2	1	1
5	3M2	4M2	4M2	0	1
6	2M2	1M2	1M2	0	1
7	3M2	2M2	2M2	0	1
8	2L1.5	2L1.5	2L1.5	1	1
9	3M2	3M2	3M2	1	1
10	4M2	4M2	4M2	1	1
11	2M2	1M2	1M2	0	1
12	2M2	2M2	2M2	1	1
13	3M2	2L1.5	2L1.5	0	1
14	4M2	3M2	3M2	0	1
15	3M2	4M2	4M2	0	1
16	2M2	1M2	1M2	0	1
17	2L1.5	2L1.5	2L1.5	1	1
18	3M2	3M2	3M2	1	1
19	4M2	4M2	4M2	1	1
20	2M2	2M2	2M2	1	1

BBL: Blue Light Blocking

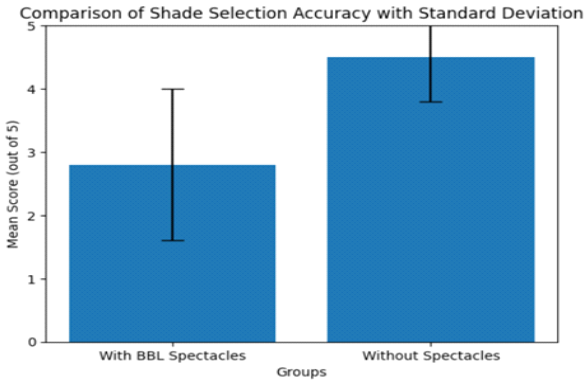
Table 2: Participant wise score

Participant	Group A Score	Group B Score
1	2	5
2	4	5
3	2	5
4	4	5
5	2	5
6	2	5
7	2	5
8	4	5
9	4	5
10	5	5
11	2	5
12	4	5

Table 3:

Group	Mean Score (out of 5)	Standard Deviation (SD)	Accuracy (%)
Group A (With BBL Spectacles)	2.8	1.2	56%
Group B (Without Spectacles)	4.5	0.7	90%

Graph 1: Bar graph representing mean shade matching scores (± SD).



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