



## Introduction

Dental anxiety can play an important role when treating a child and might hinder a child from obtaining necessary treatment. Children suffering from dental anxiety are often associated with less frequent dental visits and higher caries rate. Additionally, the range of children with dental anxiety ranges from 5% to 20% based on a review (Seligman, 2017). Several behavior management techniques have been developed in order to help with dental anxiety and patient's cooperation in the dental chair such as the use of weighted blankets, aromatherapy, and even the incorporation of color.

Color has been known to have an influence on an individual's emotion and mood. While the preference of color can be subjective, studies involving children have shown that the color associated with positive emotion in both anxious and non-anxious individual was yellow (Bubna, 2017 and Umamaheshwari, 2013). On the other hand, the colors associated with sadness were black and red (Bubna, 2017). In another study in which a dentist wore different colors gowns and gloves the results showed that there was a significant difference in the oxygen saturation and pulse rate. Overall, it was concluded that colors like yellow can help reduce anxiety while black can enhance anxiety (Karmakar, 2018).

While there are several studies focusing on a child's color preference when associating it with a certain emotion, there are few studies that focus on color and how it affects a patient's anxiety during dental treatment. Therefore, the aim of this study is to see whether introducing color in the dental office during treatment can have an impact on the patient's anxiety by assessing heart rate and using the Venham's Picture Test (VPT). VPT consist of 8 pairs of drawing and each pair includes one anxious and one non anxious person. Patients are asked to point to the picture that best represents how they feel. If a child points to the anxious person then he/she will be given one point for each anxious figured selected. On the other hand if a child points to the non anxious person then the score will be 0. Higher scores indicate more anxious children.



Glasses used in study

## Study Objectives

- 1) Assess how introducing specific colors during treatment impacts a patient's heart rate throughout treatment compared to no color.
- 2) Demonstrate that the use of the color yellow can help reduce a patient's anxiety and improve overall cooperation.

## Methods

### Subjects

Twenty patients aged 4-11 years old were the participants of this study.

### Patient Selection

**Inclusion Criteria:** Children between the ages of 4-11 years of age with no significant medical history, ASA I, no medications, or allergies undergoing Class I or Class II restorative treatment on at least two teeth in the same quadrant.

**Exclusion Criteria:** Children under the age of 3 or above the age of 11 with any significant medical history, with previous negative dental experience, who do not keep their eyes open during treatment and who do not require local anesthesia for dental treatment.

### Data Collection

Patients between 4-11 years of age were recruited at the pediatric dental clinics

Patient were randomly divided into the following four groups:

1. Group I: Children assigned clear lens glasses (control)
2. Group II: Children assigned yellow lens glasses
3. Group III: Children receiving blue lens glasses
4. Group IV: Children assigned black lens glasses

Patients were chosen based on exclusion and inclusion criteria. Each child was assigned to a control versus intervention group based on a coin toss. If the coin landed on heads than the child was assigned to the control group and if the coin landed on tails the child was part of the intervention group. The color of the glasses were chosen by the investigator in the following order: yellow, blue, black. For instance, if the first child seen used the yellow glasses, then the next child was given the blue glasses.

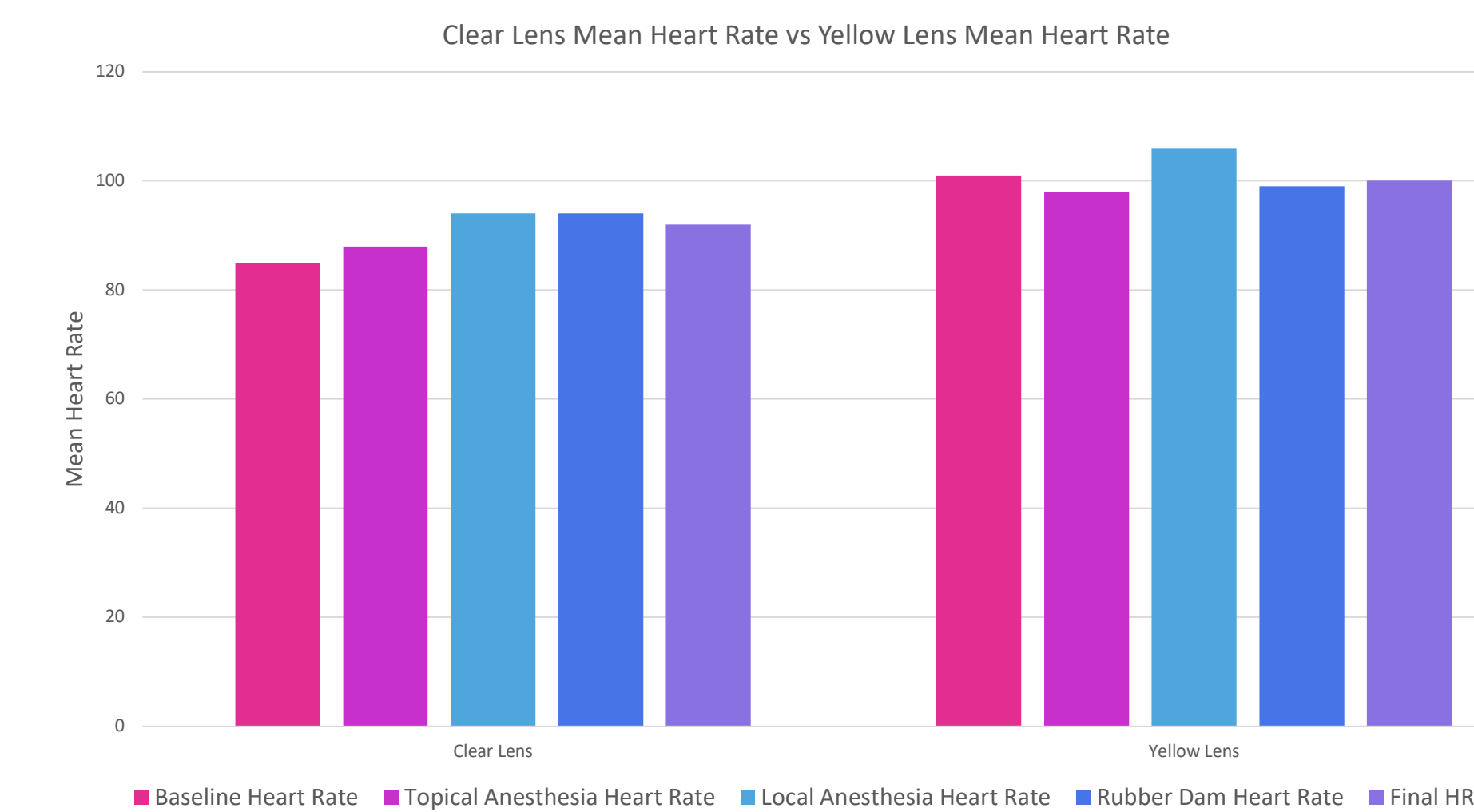
The dental treatment consisted of class I and II restorations on at least two teeth in the same quadrant. The child was shown the VPT before and after the procedure. Additionally, children were asked how frequent (always, sometimes, never) they keep their eyes open during dental treatment. Once the patient was seated the initial heart rate was recorded as a baseline. The heart rate was also collected during the application of topical anesthesia, local anesthesia, and when rubber dam was placed. Once the procedure began the heart rate was collected every 5 minutes until the end of the procedure.

### Statistical Analyses

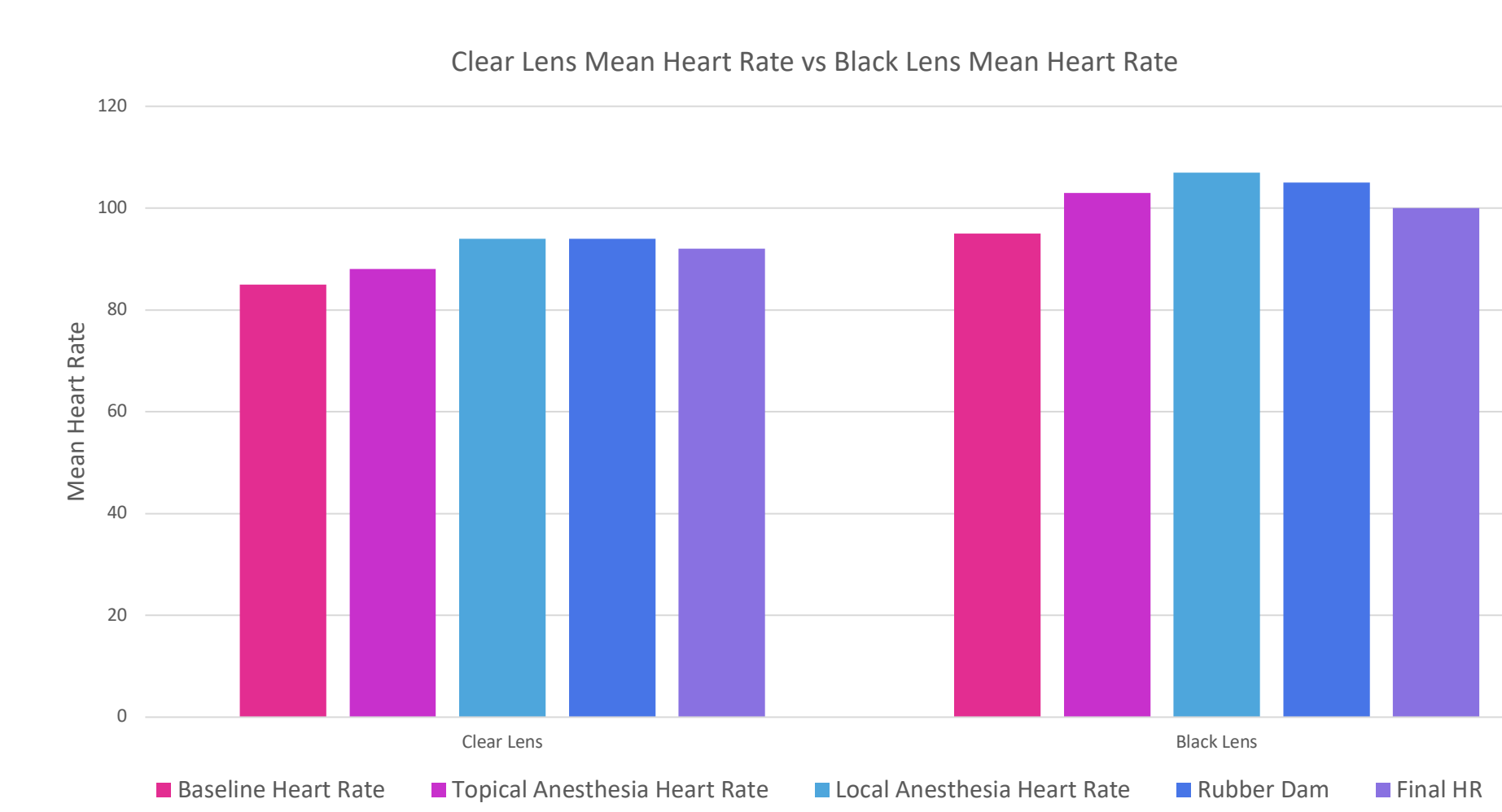
The statistical method used to compare the difference in heart rate and VPT scores in both the control and intervention groups was analysis of variance (ANOVA).

## Results

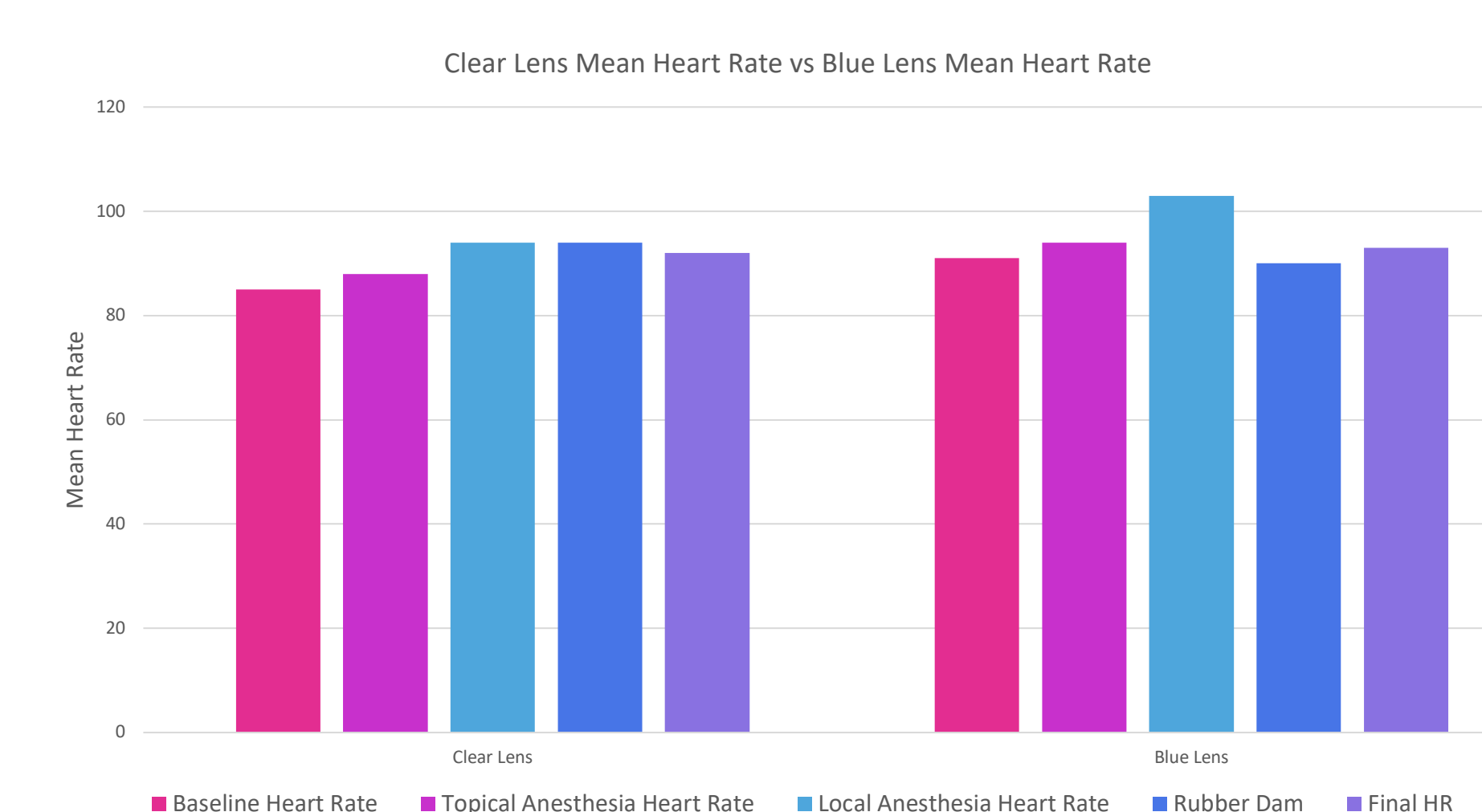
### 1. Clear Lens Mean Heart Rate vs Yellow Lens Mean Heart Rate



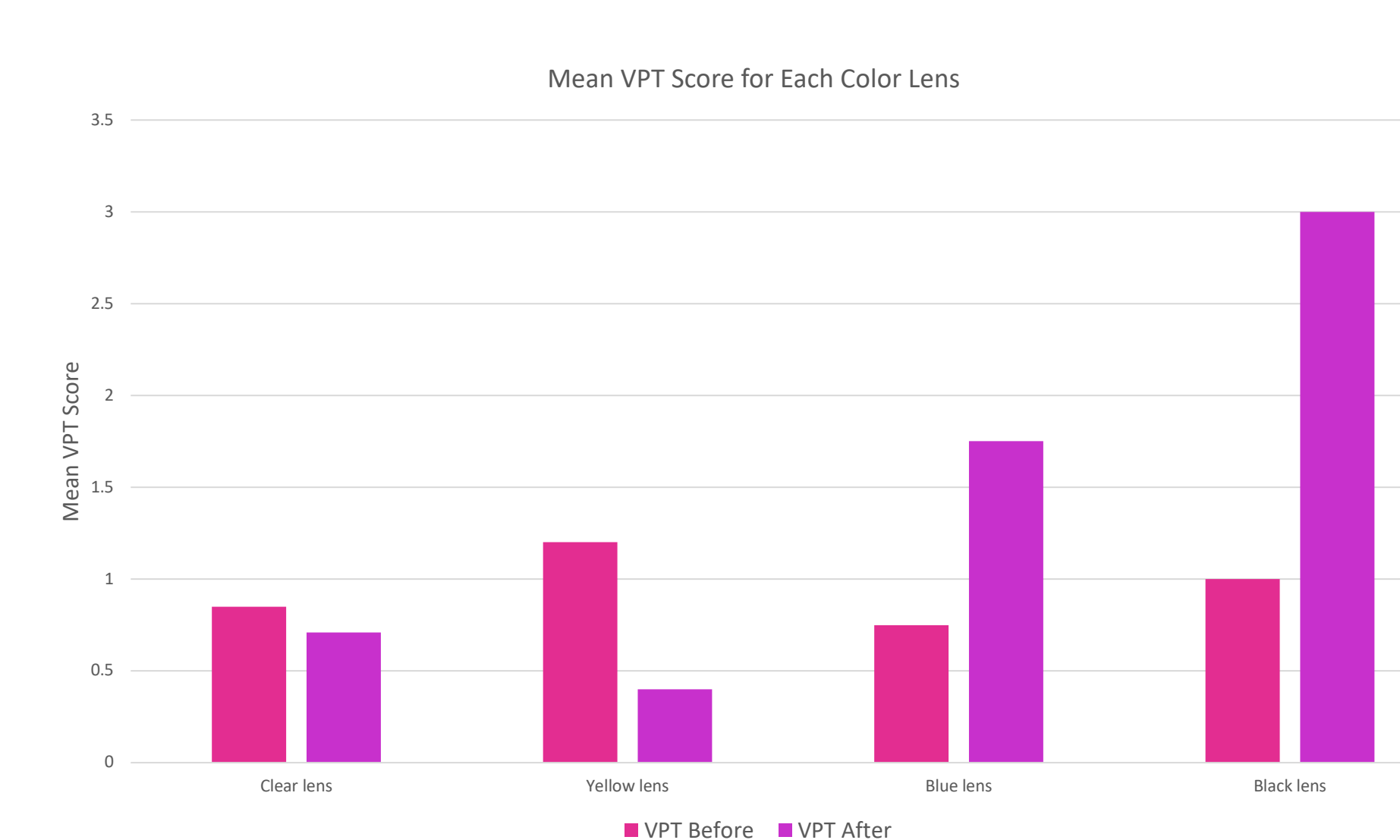
### 2. Clear Lens Mean Heart Rate vs Black Lens Mean Heart Rate



### 3. Clear Lens Mean Heart Rate vs Blue Lens Mean Heart Rate



### 4. Mean VPT Score for Each Color Lens



## Discussion

- The difference in mean heart rate between the control group (clear lens) and the group that was assigned to use yellow lens was not statistically significant ( $P>0.05$ ) for each variable tested (figure 1).
- While the mean heart rate for each variable in the group assigned to the black lens was higher than the mean heart rate in the control group as seen in Figure 2 the results were also not statistically significant ( $P>0.05$ ).
- Additionally, there was no statistical difference for all variables tested between the mean heart rate in the control group (clear lens) and the blue color lens group (figure 3).
- Meanwhile the mean VPT score before and after for each color lens compared to the control group showed no statistical significance ( $P>0.05$ ).
- While there was no significant difference in mean VPT scores there was a decrease in the mean VPT score after the procedure in the yellow lens. For instance the mean VPT score before in the yellow lens was 1.2 and after it was 0.4. The mean VPT score after the procedure in the yellow group was also lower than in the control group (figure 4).
- On the other hand, there was an increase in the mean VPT score after treatment in the black lens group. In addition, the mean VPT score after treatment in the black group was higher than in the control group (figure 4).

## Conclusions

- Research has shown that color can influence behavior and that specific colors are associated with certain emotions. While the results in this study were not statistically significant it can be due to the small sample size. Future studies should be done with larger sample size and longer duration to further investigate the use of color as a behavior management method. Moreover, new behavior management techniques are always developing and it is critical to continue researching how to reduce dental anxiety and make patients more comfortable in the dental chair.

## Study Limitations

- Limited number of participants
- Short duration of the study
- Different age groups have different ranges of heart rates
- Unable to accurately assess if patient kept eyes opened throughout entire procedure
- Uneven number of participants in each group

## References

- Bubna K, Hegde S, Rao D. Role of Colors in Pediatric Dental Practices. *J Clin Pediatr Dent.* 2017;41(3):193-198. doi: 10.17796/1053-4628-41.3.193. PMID: 28422592.
- Karmakar S, Mathur S, Sachdev V. A game of colours, changing emotions in children: a pilot study. *Eur Arch Paediatr Dent.* 2019 Aug;20(4):377-381. doi: 10.1007/s40368-018-0403-3. Epub
- Seligman LD, Hovey JD, Chacon K, Ollendick TH. Dental anxiety: An understudied problem in youth. *Clin Psychol Rev.* 2017 Jul;55:25-40. doi: 10.1016/j.cpr.2017.04.004. Epub 2017 Apr 19. PMID: 28478271.
- Umamaheshwari N, Asokan S, Kumaran TS. Child friendly colors in a pediatric dental practice. *J Indian Soc Pedod Prev Dent.* 2013 Oct-Dec;31(4):225-8. doi: 10.4103/0970-4388.121817. PMID: 24262394.