Perception of Esthetic Attractiveness and Acceptability of Colored Composite Filling amongst 3–12 Years Old Children: An Observational Study

Aishwarya Jain¹, Anshula Neeraj Deshpande², Koodakandi Somanna Poonacha³, Bhavna H Dave⁴, Yash S Shah⁵, Vaibhavee Shah⁶

Abstract
Objective: The purpose of the study was to assess the preference of colored restorative material based on gender and age-groups in 3–12-year-old children.
Materials and method: A Survey was conducted, where children were divided into three groups depending on Age, Group A (3–6 years) Group B (7–9 years) Group C (10–12 years). Class 1 cavity preparation followed by different colored composite restorations of FLUO and PEARL JEN-RAINBOW were done on typodont. All the preferences were recorded according to ranking and visual analog scale.
Result: Overall ratings showed difference in preferences of all age-groups. It was difficult to rely on the results revealed by evaluating overall ranking, further it was evaluated based on different age-groups and showed significant difference. For overall preferences recorded using visual analog scale was only significant for one color, pearl white (p=0.018).
Conclusion: The findings of this survey suggest that great diversity in preferences was observed not only among gender but even different age-groups.
Keywords: Behavior therapy, Composite resins, Color, Dental caries, Motivation.

Introduction
Dental caries is the most common disease that occurs in children and needs earliest care once it is identified. Traditionally, the options for restoration were considerably limited for both patient and dental surgeons. Today, various solutions are developed based on different factors, such as exposure to minimal intervention and increased demands for esthetic treatment options for dental caries treatments.¹

In 1844, the only available option was amalgam. Amalgams have a known quality with long-proven history and research. They have been proven more economical for the dentist and the patient. Nevertheless, the patient’s esthetic needs were not sufficient, and there was also evidence of mercury toxicity and gingival and buccal mucosa tattoos.²

In recent years, esthetically suitable materials have been developed and gradually improved, in particular, in terms of their physical properties. Composite resins, glass ionomers, resin modified glass ionomers, and compomers are the materials of choice in the form of direct filling. GICs were introduced in 1972. They are classical water-based cements, fluoride releasing and esthetically acceptable, hence has been popular in restorative dentistry.³

RL Bowen in the early 50’s has developed composite that has grown over the years. Compomer is a plastic material, formed by polyacids. Compomer is primarily made of composite resin (90%). Initially, they were light-cured and hydrophilic in nature which makes it fairly simple to manage and ideal for preparation.³ In present world, there are only a few reports in the dental literature that examine for patients’ preferences and choices for colored ligatures and elastics used in orthodontic treatment. The participation of child in dental treatment also helps in behavior management.¹ When child is given the opportunity to choose the restorative material based on color it gives a feel of having control over the treatment being done on him/her, which helps in cognitive behaviour management.⁴

As stated in literature, children are an important part of the child/dentist/parent triad, considering their choices helps in positive attitude of the child toward the treatment. There are various researches conducted in young population to know their preferences in various streams of dentistry for choosing dental products or materials. Preferences of children regarding colored pit and fissure sealant, orthodontics appliances, elastics, brackets were previously studied to acquire better cooperation of a child.¹ ⁵ ⁶ Daniel K. Walton in 2010⁶ evaluated preferences...
and acceptability of orthodontic appliances in children and adolescents using images of colored ligature, elastics. Ross Fishman, Marcio Guelmann, Enrique Bimstein in 2006 studied children’s preference for posterior restorations. Photographs of amalgam, composite, colored compomer and stainless-steel crowns were used in study by Sophiya Juliet, Deepa Gurunathan in 2019 to assess behavior of child after placement of colored restorative material.

Considering this, restorative dentistry have come up with variant colors of restoration in children this has led to phenomenal growth in pediatric dentistry. An important aspect of restorative treatment is to enhance patients’ expectations and requirements. Subjective assessment questionnaires and interview methods have been introduced in studies for the evaluation of a patient’s preferences using scales and rankings. Dr. Rensis introduced Likert Scale in 1932. His optimum goal was to develop a means of measuring psychological attitudes in a “scientific” way. Likert has multiple categories from which respondents choose to indicate their opinions, attitudes, or feelings about a particular issue. It investigates individual at different aspects such as motivation, anxiety, and self-confidence. It a personality-based scale, which can help child express freely about their preferences.

Newer materials are available in market in wide range of colors (fluo and pearl) that children can find appealing and may opt for it. As, the material is expensive a clinician may not be able to stock all of the colors without knowing its utility in practice. Therefore, it is of vital importance for the dentist to be able to define what exactly the patient requires. Based on this research question aim of the present study was to determine how children perceive the esthetic attractiveness and acceptability of different colored composite filling at different ages and between the genders.

**Materials and Methods**

**Study Design**

The study sample consisted of 259 subjects from 3–12 years of age including 47.1% male and 52.9% female. They further bifurcated as Group A (3–6 years), Group B (7–9 years), Group C (10–12 years). The subjects were selected from patients referred to Department of Pediatric and Preventive Dentistry, during 6 months of 2019. The approval for the following survey was given by the Institutional Ethical Committee. (SVIEC/EC/ON/DENT/SRP/19109).

The subjects gave written informed consent to the survey procedures were included in the study. Children with intellectual disability and developmental disorders were excluded from the study as they won’t be determinant in selecting the most suitable color according to them.

The research was designed where the typodont of primary dentition was stimulated so that children would imagine the presence of each color in their own oral cavity and also have specific choices when answering the questionnaire. Class 1 cavity preparations were made on Typodont and were further restored with different colors of Fluo Jen Rainbow (JenDental, Ukraine) and Pearl Jen Rainbow (JenDental, Ukraine) colored flowable composite. These Jen rainbow colors include: 4 Fluorescent Jen Rainbow (JenDental, Ukraine) colors and 6 Pearl tint Jen Rainbow (JenDental, Ukraine) colors which was recorded by the investigator as shown in (Fig. 1).

**Analysis of Preferences**

Interpretation of the preferences must be defended by both theory and empirical evidence, Hence calibration of these preferences were evaluated on the basis of a Likert scale. These scales are more reliable in children as they are used for measuring psychological attitudes. To determine reliable preferences of children between
Colored Restorative Material Preference in 3–12 Years Old Children

The subjects were asked to rate each color using following questions, “how good do you think this color look?” on answering, their level of affinity towards the individual color were gauged.

Statistical Analysis
All analysis was performed using the SPSS software. Kruskal Wallis Test was used for three different age-groups between preferences. Mann Whitney Test was use to analyze the preferences between different of each group.

Results
The results of the overall ranking are enumerated in Figure 4, where this figure defines the percentage of ranks given by children to each color.

Fig. 3: Visual analog scale used for recording color preferences of participants
colored. It signifies the overall preferences of the children so that to obtain most liked and least liked color. On assessing the graph, we found that fluo green color (18%) was most liked (Ranked 1) by all the three age groups. Fluo orange (17%) was ranked 2 and Fluo purple was ranked 3 (22%).

On assessing pearl white (38%) was least liked (Ranked 10) by all the age groups. Attention-grabbing part of the result was Pearl blue color (16%), this was most and least liked by all age groups. These variances in choices allowed us to further tabulate the preferences according to different age groups as shown in Figure 5 (Group A- 3–6 years), Figure 6 (Group B- 7–9 years), Figure 7 (Group C- 10–12 years).

The preferences were further evaluated on the basis of age group and gender. Here Group A revealed that pearl pink (39%) was adopted by female and pearl blue color (54%) by male in Group A (3–6 years) (Fig. 5).

The preferences were further evaluated on the basis of age group and gender. Here Group B revealed that clear red (33%) was
adopted by female and pearl blue color (33%) by male in Group B (7–9 years) (Fig. 6).

The preferences were further evaluated on the basis of age group and gender. Here Group C revealed that pearl white (38%) was generally adopted by female and fluo green (36%) by male in Group C (10–12 years) (Fig. 7).

The preferences made by children were also recorded on the basis of visual analog scale for each color, where children were asked to rate colors on the scale of very bad till very good. All the data obtained was tabulated for evaluating overall visual analog scale.

Results displayed that only pearl white color showed significant difference by all age groups and both the genders (Table 1).

The preferences reported on the overall dimension which includes all age groups and both genders. The results showed that the entire population has picked variant colors and findings correlated with Pearl Blue color was startling as it was most liked and least liked by all age groups children. Therefore, the researchers further classified the results age-wise, in order to explain more clearly. All age-groups made a significant difference in preferences. Apparently different color tastes, inferred from Figures 5 to 7; were shown by different age groups. Such findings were in accordance with Daniel K. Walton et al (2010) analysis in which they integrated images of orthodontic devices, formed braces, and colored and discolored transparent elastomeric connections into a computer-based system. Different subjects from age groups scored each picture for attractiveness and acceptability. They concluded that children's orthodontic appliance preferences vary by age and gender.

From the survey, we comprehend that a few colors which are preferred by all the different age groups and be bought by clinicians, which will also help in lowering the overall purchasing cost. The results of study done by Anum Tariq et al. (2017) also concluded that patient preference for must be kept in mind when maintaining Orthodontic inventory. He evaluated the color preference of patients receiving elastic ligatures in orthodontic treatment by a questionnaire. A statistically significant difference was found between males and females (p = 0.006) while no association of with age could be found.

## Discussion

Composite restorations are widely accepted among the population owing to its esthetic compatibility. Recently, these materials are modified by adding colours to make it more appealing and attractive especially for pediatric patients. Furthermore, the ability to choose the color of composite not only comforted the children, but also encouraged them to take an ongoing interest in their dental health.

### Preferences Evaluated Based on Ranking

The preferences reported on the overall dimension which includes all age groups and both genders. The results showed that the entire population has picked variant colors and findings correlated with Pearl Blue color was startling as it was most liked and least liked by all age groups children. Therefore, the researchers further classified the results age-wise, in order to explain more clearly. All age-groups made a significant difference in preferences. Apparently different color tastes, inferred from Figures 5 to 7; were shown by different age groups. Such findings were in accordance with Daniel K. Walton et al (2010) analysis in which they integrated images of orthodontic devices, formed braces, and colored and discolored transparent elastomeric connections into a computer-based system. Different subjects from age groups scored each picture for attractiveness and acceptability. They concluded that children's orthodontic appliance preferences vary by age and gender.

Conferring to the results of the present study, it revealed that children of Group A (3–6 years) and Group B (6–9 years) did not prefer Pearl white color (Fig. 5 and 6). They were more inclined towards colored restorative fillings. Hence, clinicians should then use these colors to inspire them to undergo effective treatment, because children are anxious and refuse dental care. Sophiya Juliet and Deepa Gurunathan (2013) concluded that the colored restoration is effective motivational tool for the children which ultimately benefits better cooperation. In their study, 48 Children of 3–7 years of age with occlusal caries were included and they gave better improvement in the behaviour.

Conferring to the results of present study pearl pink and clear red was preferred by females aged from 3–9 years, but females from Group C (10–12 years) favored pearl white color. As the age advances color choices shift more towards esthetic.

From the survey, we comprehend that a few colors which are preferred by all the different age groups and be bought by clinicians, which will also help in lowering the overall purchasing cost. The results of study done by Anum Tariq et al. (2017) also concluded that patient preference for must be kept in mind when maintaining Orthodontic inventory. He evaluated the color preference of patients receiving elastic ligatures in orthodontic treatment by a questionnaire. A statistically significant difference was found between males and females (p = 0.006) while no association of with age could be found.

### Table 1: Color preferences for restorative material of entire population in percentage on the basis of visual analog scale (VAS)

| Color          | Gender | Very bad N (%) | Bad N (%) | Neither good nor bad (%) | Good N (%) | Very good N (%) | Total | p-value |
|----------------|--------|----------------|-----------|--------------------------|------------|-----------------|-------|---------|
| Fluo Green     | M      | 2(0.7)         | 1(0.3)    | 6(2.3)                   | 12(4.6)    | 70(27)          | 91    | 0.928   |
|                | F      | 3(1.1)         | 2(0.7)    | 10(3.8)                  | 25(9.6)    | 128(49.4)       | 168   |         |
| Fluo Purple    | M      | 3(1.1)         | 4(1.5)    | 17(6.5)                  | 33(12.7)   | 34(13.1)        | 91    | 0.255   |
|                | F      | 2(0.7)         | 11(4.2)   | 17(6.5)                  | 69(26.6)   | 69(26.6)        | 168   |         |
| Fluo Lime      | M      | 1(0.3)         | 4(1.5)    | 20(7.7)                  | 18(7.0)    | 66(25.4)        | 91    | 0.795   |
|                | F      | 3(1.1)         | 4(1.5)    | 12(4.6)                  | 27(10.4)   | 122(47.1)       | 168   |         |
| Fluo Orange    | M      | 9(3.4)         | 3(1.1)    | 12(4.6)                  | 44(17)     | 23(8.8)         | 91    | 0.691   |
|                | F      | 20(7.7)        | 3(1.1)    | 27(10.4)                 | 76(29.3)   | 42(16.2)        | 168   |         |
| Pearl Green    | M      | 7(2.7)         | 7(2.7)    | 16(6.1)                  | 33(12.7)   | 28(10.8)        | 91    | 0.806   |
|                | F      | 11(4.2)        | 17(6.5)   | 27(10.4)                 | 55(21.2)   | 58(22.3)        | 168   |         |
| Pearl golden   | M      | 6(2.3)         | 7(2.7)    | 15(5.7)                  | 38(14.6)   | 25(9.6)         | 91    | 0.763   |
|                | F      | 7(2.7)         | 18(7.0)   | 38(14.6)                 | 58(22.4)   | 47(18.1)        | 168   |         |
| Pearl White    | M      | 17(6.5)        | 19(7.3)   | 22(8.4)                  | 14(5.4)    | 19(7.3)         | 91    | 0.018   |
|                | F      | 54(20.8)       | 48(18.5)  | 19(7.3)                  | 16(6.1)    | 31(11.9)        | 168   |         |
| Pearl clear red| M      | 20(7.7)        | 9(3.4)    | 15(5.7)                  | 34(13.1)   | 31(11.9)        | 91    | 0.07    |
|                | F      | 6(2.3)         | 6(2.3)    | 20(7.7)                  | 60(23.1)   | 76(29.3)        | 168   |         |
| Pearl pink     | M      | 6(2.3)         | 4(1.5)    | 14(5.4)                  | 27(10.4)   | 40(15.4)        | 91    | 0.055   |
|                | F      | 8(3.1)         | 7(2.7)    | 12(4.6)                  | 44(17)     | 97(37.4)        | 168   |         |
| Pearl blue     | M      | 1(0.3)         | 1(0.3)    | 10(3.8)                  | 18(7.0)    | 61(23.5)        | 91    | 0.963   |
|                | F      | 4(1.5)         | 7(2.7)    | 8(3.1)                   | 31(12)     | 118(45.5)       | 168   |         |
Preferences Evaluated on the Basis of Visual Analog Scale

As mentioned above, the findings of this study were addressed on the basis of visual analog scale. Each participant was asked to rate each color individually, and the results revealed that only pearl white color showed significant difference.

From the following result we can also determine that, when young children were asked to rank the preferences, it was simpler for them to select the colors, while it was harder for them to consider when asked to rate or color. Difference of choices were seen while ranking and rating the color for younger age group of children, because the IQ or maturity is not enough to be so sure while ranking and rating colors. According to the results, ranking colors was more significant or reliable the rating in them as each color is fascinating for them. As the age advances the choices made by children are clearer so ranking and rating was easy was there. The colors which they ranked least likely were the same colors to which they rated very bad or bad on VAS scale and vice versa.

The scales used in the present study, investigators concluded that ranking the colors was easier and more reliable in 3–9 years of children, wherein ranking and rating was reliable only for 10–13 years’ age of children.

Conclusion

Study provides insight regarding choices for colors by children in different age-groups and gender, and accordingly clinicians can update their materials in dental office.

Based on the results it can be concluded that:
• Children’s preferences for restorative material differ by age and gender.
• In Group A and B, females preferred colors in the pink-red tones while males preferred pearl blue color.
• In Group C, females preferred more pearl white esthetic color and males preferred brighter or neon green fluo colors.
• Evaluation done by two different Likert scales also revealed difference in the preferences of younger children, wherein older children it remained same.
• Clinicians can buy restricted colors that will also resolve their function and cost efficiency.

References

1. Walton DK, Fields HW, Johnston WM, et al. Orthodontic appliance preferences of children and adolescents. Am J Orthodont Dentofacial Orthoped 2010(Dec 1); 138(S):698-6e1. DOI: 10.1016/j.ajodo.2010.06.012
2. Fishman R, Guellmann M, Bimstein E. Children’s selection of posterior restorative materials. J Clin Ped Dent 2007(Sep 1); 31(1):1-4. DOI: 10.17796/jcpd.31.1.ng712836&m04v5j5
3. Yoonis E, Kukletová M. Tooth-colored dental restorative materials in primary dentition. Scr Med 2009; 82(2):108-4.
4. Ertugrul F, Cogulu D, Özdemir Y, et al. Comparison of conventional versus colored composites for class II restorations in primary molars: a 12-month clinical study. Medical Principles and Practice 2010; 19(2):148-152. DOI: org/10.1159/000273077
5. The Use of Colored Compomers as Fillings in Deciduous Teeth, Dentistry Today, 01 October 2005.
6. Tariq A, Najam Z, Ahmed U, Aslam A. Color preferences of patients receiving elastic ligatures in fixed orthodontic treatment. Pak Orthodont J 2017(Dec 30); 9(2):83-86 https://doi.org/10.7860/jcdr/2021/45908.14408
7. Juliet S, Gurunathan D. Behavior assessment of children after placing colored restorative material: a randomized controlled trial. Int J Pedodont Rehabil 2017(Jul 1); 2(2):66. https://doi.org/10.4103/ijpr.ijpr_4_17
8. Nemoto T, Beglar D. Likert-scale questionnaires. InJALT 2013 Conference Proceedings 2014 (pp. 1–8).
9. Yamane, Taro. 1967. Statistics: An Introductory Analysis, 2nd Ed., New York:Harper and Row. https://doi.org/10.1177/0013164646402400434