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Single Shade Composite-Camouflage Like A Chameleon: A Case Series

[1]Simran Utwal , [2]Manu Bansal, [3]Gargee Karmveer, [4]Diksha Verma, [5]Saurabh Kamble
[1,3,4,5]PG Student, [2]Professor,
[1,2,3]Department of Conservative Dentistry and Endodontics,
[4]Department of Prosthodontics,
[5]Department of Oral And Maxillofacial Surgery,
Jaipur Dental College, Jaipur, Rajasthan,India

***Corresponding Author:**
Simran Utwal
PG Student, Department of Conservative Dentistry and Endodontics ,
Jaipur Dental College, Jaipur, Rajasthan,India

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Abstract

Objective:
The aim of this study is to describe the use of single shade composite in clinical cases with caries in posterior teeth.

Material and method:
In class1 caries, it was excavated then tooth surfaces were etched with prime etching gel, bonding was carried out with gluma 5 and composite vittra APS was placed.

Result: The material was able to adjust the colour of the tooth

Conclusion:
The material does not require shade selection and, therefore, makes it faster to complete restorative procedures, increases the productivity of the professional and reduces the stock of composite shades.

Keywords: single shade composite, smart monochromatic composite, chameleon effect, colour shifting ability

Introduction

Composite restorative materials represent a notable achievement in modern biomaterials research, as they emulate the appearance and function of biological tissue by serving as substitutes.[1]. Over the past five decades since their introduction, these resins have experienced continuous refinement and adjustments to improve their qualities as an esthetic restorative material.[2]. In the pursuit of seamlessly blending restorations, numerous composite systems offer a diverse range of shades to effectively match various teeth.[3]. The shade of a tooth is influenced by a combination of extrinsic stains that adhere to the enamel surface and its intrinsic shade, which arises from the interaction of light with the structures of the tooth.[4]. Consistently achieving accurate shade selection requires a thorough comprehension of the optical features of teeth, including aspects such as color and translucency, and an awareness of how they differ from restorative materials. Nevertheless, the pivotal consideration in determining the most natural-looking restoration lies in understanding the optical properties specific to the composite material [5]. A desirable benchmark entails the creation of advanced restorative materials that exhibit properties closely resembling those found in natural tooth structures.[6]. The interplay of optical processes within dentin and enamel, involving diffusion, scattering, absorption, and light reflection, contributes to the overall color of teeth. The complex characteristics of optical phenomena present challenges for practitioners

aiming to accurately replicate the color of teeth through the use of direct resin composites. An initially accurate shade selection does not guarantee a final restoration that is acceptably matched [7].

Correct shade selection is crucial for successful aesthetic restorations, and mismatched restorations may occur due to improper shade selection. Single shade composite is also called as "smart monochromatic composite". It possesses distinctive characteristics that are based on "smart chromatic technology." Smart monochromatic composite is a one-shade material that is specified to match entirely 16 VITA Classical shades (VITA North America, Yorba Linda, CA) [8]. It has excellent color-matching ability for all shades [9].

Light scattering in composite materials is influenced by the size and quantity of internal particles [10]. The incorporation of silica particles into a resin matrix technology enables the material to mimic the shade of the adjacent tooth structure, thereby minimizing the required number of shades in practical applications and reducing overhead costs. Such systems also alleviate the challenges associated with inventory management and the tracking of expiration dates for numerous composite types and shades.

This study aimed to evaluate the efficacy of a single-shade composite and assess its suitability for routine clinical use.

Materials And Method Case I

A 20 year old female patient reported to department of conservative dentistry and endodontics and complained of black stains on her upper right back tooth. An intraoral examination revealed Class I caries with 16. Radiographic examination revealed a radiolucent area suggesting dentinal caries with no pulp involvement. Consequently, it was decided to rebuild the decayed area with the composite.

Treatment

The tooth with isolated with a rubber dam (GDC Dental dam kit, India) (figure 1) .the tooth was thoroughly cleansed and the decayed area was excavated and cavity was prepared, followed by the procedure discussed above (figure 2).

Case II

A 26 year old female patient reported to department of conservative dentistry and endodontics and complained of black stains on her upper left back tooth region. There was no relevant medical history. Intraoral examination revealed Class 1 carious lesion in 26.

Radiographic examination revealed a radiolucent area suggesting dentinal caries with no pulp involvement. Consequently, it was decided to rebuild the decayed area with the composite.

Treatment

The tooth with isolated with a rubber dam (GDC Dental dam kit, India) (figure 3) .the tooth was thoroughly cleansed and the decayed area was excavated and cavity was prepared, followed by the procedure discussed below (figure 4).

Case III

A 50 year old female patient reported to department of conservative dentistry and endodontics and complained of black stains on her lower right back region of the jaw. There was no relevant medical history. Intraoral examination revealed Class 2 carious lesion in 45. Radiographic examination revealed a radiolucent area suggesting dentinal caries with no pulpal involvement. Consequently, it was decided to rebuild the decayed area with the composite.

Treatment

The tooth with isolated with a rubber dam (GDC Dental dam kit, India) & the tooth was thoroughly cleansed and the decayed area was excavated and cavity was prepared (figure 5), followed by the procedure discussed below (figure 6).

Case IV

A 42 year old male patient reported to department of conservative dentistry and endodontics and complained of pain in his lower right back region of the jaw. There was no relevant medical history. Intraoral examination revealed Class 1 carious lesion in 46. Radiographic examination revealed a radiolucent area suggesting dentinal caries with pulpal involvement. Consequently, it was decided to perform root canal treatment and rebuild the missing tooth structure with composite.

Treatment

The tooth with isolated with a rubber dam (GDC Dental dam kit, India (figure 7), tooth was thoroughly

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cleansed and the decayed area was excavated and, root canal treatment was performed and completed in single sitting and then followed by the procedure discussed below (figure 8).

After excavating the caries, the tooth surface was first etched with 37% phosphoric acid gel (Prime Dental, India)(figure 9) for 15 secs, after that the tooth was rinsed and dried with a 3- way syringe, followed by application of bonding agent (Gluma Bond 5, Kulzer)(Figure 10), air thinned and light-cured for 20 secs. After that, single shade composite (VITTRA APS UNIQUE, FGM, Joinville, SP, Brazil)(figure 11) was placed with Teflon coated instrument to restore the tooth followed by curing each increment for 20 secs.

Discussion

Owing to advancements in adhesive technologies and composite resin materials, there has been a substantial increase in the utilization of resin composites for aesthetic restoration procedures over the last two decades. Among the latest innovations in this field is the introduction of smart monochromatic composites, which is expected to offer exceptional aesthetics and polishability essential for restorations, along with the outstanding wear resistance and strength necessary for posterior teeth.

It has distinctive features that are based on "smart chromatic technology." These resins exhibit chameleon effect, it is an aesthetic property that enables the restorative material to match the color of its surroundings that is controlled by the size of its filler particles. It has no extra dyes or pigments, whereas fillers itself produce red-to-yellow structural color that matches the surrounding tooth color. Color is the light wavelength that enters into our eyes.

Human teeth naturally fall within the red-to-yellow color range. In this composite, the material incorporates uniformly sized, spherical filler particles. These particles modulate the transmitted light across the red-to-yellow spectrum, ensuring a harmonious match with the color of adjacent teeth in patients [11]

They are composites with improved ability to shift their color toward adjacent tooth structures can facilitate restorative procedures. The “color shifting” or “color adjustment potential” (CAP) of composite Vittra APS Unique (FGM, Joinville, SP, Brazil) results from both blending effect (visual and subjective perception) and its translucency [12-16].

Vittra APS is comprised of a blend of methacrylate monomers, a photoinitiator composition (APS), co-initiators, stabilizers, and silane. Inactive components include zirconia charge, silica, and pigments. Notably, the unique filler in Vittra APS consists of hybrid nano-fillers [17].

It demonstrates remarkable reflective capacity as Vittra APS Unique accurately replicates the shade of the dental substrate during the polymerization process, achieving flawless mimicry. With the ability to imitate shades ranging from Bleach to D4 using just one composite shade, it eliminates the need for stratification in most cases and supports a straightforward incremental technique without the use of varying degrees of opacity/translucency. Notably, it is BPA-free, aligning with the growing trend to eliminate Bisphenol-A (BPA) from restorative dental products due to its potential interference with the endocrine system, fetal and childhood development, and reproductive health. While the released amount of BPA in saliva from resinous materials is significantly lower than the minimum safe dose, its exclusion ensures a safer choice. Furthermore, it expedites restorative procedures by eliminating the need for shade selection, enhancing professional productivity, and reducing composite shade inventory. Beyond its exceptional shine, polishing, and shade transmission, it boasts high rates of flexural strength and fracture toughness, making it resilient against masticatory forces. With a prolonged working time, efficient photopolymerization, and enhanced mechanical properties, it is compatible with all light-curing devices. This versatile composite is suitable for various restorative cases involving both permanent and deciduous teeth, including direct restorations on anterior and posterior teeth (classes I, II, III, IV, V, and VI).

For extensive Class III and Class IV restorations on anterior teeth, applying a 0.5 mm thin coat of a blocking agent before composite insertion is recommended. Notably, it excels in cases of discoloration by camouflaging the internal portion of the crown and reducing shade matching interference. In comparison with Gluma Bond 5 used in this study, Ambar APS by FGM in Joinville, SP, Brazil, yields

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superior results due to the absence of camphorquinone and a more transparent photoinitiator, as camphorquinone tends to impart a yellowish shade. While the long-term color stability of smart monochromatic composite in the oral cavity raises questions, its promising resistance to aging-induced changes in physical properties is noteworthy. While the color-matching capability of this composite is exceptional for lighter tooth shades, its effectiveness may be somewhat diminished for darker tooth shades.

Additionally, various factors can impact the color stability of the restorative material, including water absorption, the degree of polymerization, individual dietary habits, and surface irregularities in the restoration [18]. The rough surface of the restoration may undergo discoloration due to external factors such as coffee, tea, or red wine [19].

Result

In the present study, the material used could adjust to the shade of surrounding tooth structure. Moreover, literature reveals that a finishing and polishing system incorporating diamond particles results in the least color difference on single-shade composite restorations [20].

Conclusion

This material eliminates the need for meticulous shade selection, streamlining the restorative process for faster completion, enhancing the productivity of dental professionals, and minimizing the inventory of composite shades. These materials boast user-friendly applications and exhibit enhanced mechanical, optical, and wear resistance properties, coupled with superior color stability in comparison to traditional resin composites, thereby offering exceptional aesthetics. However, for these materials to realize their promising potential, further research investigations and thorough case follow-ups are imperative.

Additionally, ongoing experimental studies are required to substantiate their sustained efficacy and continued application in various clinical scenarios.

The efficiency of this material in expediting restorative procedures and simplifying shade selection contributes significantly to the increased productivity of dental professionals. The reduction in the variety of composite shades stored not only streamlines the workflow but also minimizes inventory management complexities. Moreover, the ease of use and improved mechanical, optical, and wear resistance properties, along with superior color stability, distinguish these materials from traditional resin composites, offering practitioners a reliable and aesthetically pleasing solution for a range of dental applications.

However, to fully realize the promising prospects of these materials, it is essential to conduct additional research investigations, including comprehensive case follow-ups, to assess their long-term performance in diverse clinical scenarios. Further experimental studies will help establish a robust foundation for the continued use of these advanced materials in dental practice. Continuous exploration and validation of their properties and applications will not only advance the field but also contribute to the refinement of restorative techniques, ensuring optimal outcomes for both professionals and patients.

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