

# SMART MONOCHROMATIC COMPOSITES

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**Abstract-** The field of bonded aesthetic restorations has advanced during the course of the 20th and 21st centuries. Dentist's preference for the smart monochromatic shade of composite is currently on the rise because it eliminates the need for a variety of composite shades, reduces the amount of wasted composite shade, shortens chair side intervals, put an end to the need for shade selection. Tokuyama Dental released OMNICHROMA, a novel and intriguing product, to the market in 2019. As it is placed, it is commonly known to absorb the color of the neighboring tooth structure. Consequently, a number of properties are explained in the literature currently under publication.

## INTRODUCTION:

Denture bases have been made of methacrylate-based resin since 1930, which has been heat-cured to solidify it. German researchers later in the 1940s devised the cold curing technique, which directly cures resin in the mouth cavity. Subsequently, pre-polymerized beads were added to the resin, successfully reducing shrinkage to 3.5%; however, the main disadvantage of these methacrylate resins remained shrinkage. Subsequently, Dr. Bowen created dimethacrylate, sometimes known as BisGMA or "Bowen's Resin," by substituting methacrylate for epoxy resin. This resin substitute has been in use since 1960.[1] A composite is a three-dimensional material made up of two or more chemically different materials that together have better qualities than any one of the constituent parts.[2] The usage of composite materials for direct fillings will expand due to patient demands for more aesthetically pleasing restorations.[3] Dental and material scientists are particularly interested in developing dental materials with lower polymerization shrinkage (PS), better depth of cure or degree of conversion, better mechanical characteristics, and enhanced aesthetics.[1] A person can have exceedingly conservative and aesthetically pleasing restorations with resin composite. Composites were previously recommended as a material just for anterior restorations; however, fillers in conjunction with acid etching and their good compatibility with tooth structure made them worthwhile for posterior restorations as well as anterior ones.[4]

## HISTORY OF RESIN COMPOSITES:

The early 1970s saw the development of macrofilled composites. The earliest commercially successful composite resins were Adaptic (Dentsply Sirona) and Concise (3M). Their fillers were large and had an average particle size between 0 and 5µm. Because of the filler particles' hardness and large size, the surface texture is rough which cause the occlusal contact region to wear down and plaque to accumulate. They are advised in pressure-bearing regions, such as large cavities in Class III and IV and Class I and II.[4]

Microfilled composites were created in the 1980s. Durafill VS (Kulzer) and Renamel (Cosmedent) were the commercially popular resin composites, with typical particle sizes ranging from 0.04 to 0.4 µm. Because of the small particle size that makes resin composite resistant to stains, debris, and plaque, they have a polished and smooth surface texture.[2]

In the 1990s, hybrid composites were developed. Because an inorganic phase reinforces the organic phase, they get their name. Because these hybrids are composed of various glass types and contain fumed silica with a size of 0.04µm, they were difficult to polish. It has reduced polymerization shrinkage, good wear and abrasion resistance, and excellent polishing and texturing qualities. For both anterior and posterior restorations, they are appropriate.[4]

Following the year 2000, Tetric EvoCeram (Ivoclar Vivadent) and Filtek Supreme Plus (3 M) were created, which are nanofilled and nanohybrid composites with typical particle sizes ranging from 5 to 75 nm. They demonstrated enhanced physical characteristics similar to the initial hybrid resin composites.[2]

By the 2010s, Bulk-fill composites were developed. They offer a deeper cure depth of up to 4 mm and reduced polymerization shrinkage. Dentsply Sirona's SureFil SDR Flow was the first flowable bulkfill composite, however it was only utilized as a foundation for restorations.[2]

Other spherical-particle-based composites have been introduced in 2018; two of them are Harmonize (KaVo Kerr) and Brilliant Everglow (COLTENE). Harmonize is based on "crosslinks of spherical silica and zirconia particles together with positive and negative charges," whereas Brilliant Everglow is described as a "all-round" substance with dual shade compules.[5]

A number of materials that defy the recent 20 years' tendencies in restorative dentistry are being introduced in 2019. Tokuyama Universal Bond (Tokuyama Dental America) is the first agent that is genuinely universal and can bond to almost anything. This comprises materials in the self-etch, total-etch, and selective-etch modes that are direct, indirect, light-cure, self-cure, and dual-cure.[5]

Prior to restoring an anterior composite, bleaching is frequently advised since studies have shown that certain foods, beverages, and lifestyle choices, such as smoking, might include pigments that induce intrinsic or extrinsic staining of composite materials. On composites, bleaching can remove established stains and restore the original hue.[4]

**The Contemporary Change:** The wavelength of light that reaches our eyes is called color. The color of human teeth ranges from red to yellow.[2]

One of the first shade matching composites that has become very popular recently is called OMNICHROMA. It has a special quality that stems from "smart chromatic technology." By regulating the size of its filler particles, it is able to capture the structural color of its surroundings.[4]

There are two types of color producing phenomenon:

**Chemical color:** The material's molecules reflect certain wavelengths. It is the most prevalent hue that is visible to us. Today's common composites rely on the added chemical color of pigments and dyes.[4]

**Structural color:** Rarely, the material's structure might strengthen or weaken various wavelengths. The use of structural color as the primary color mechanism in composite dentistry was pioneered by OMNICHROMA.[4][6]



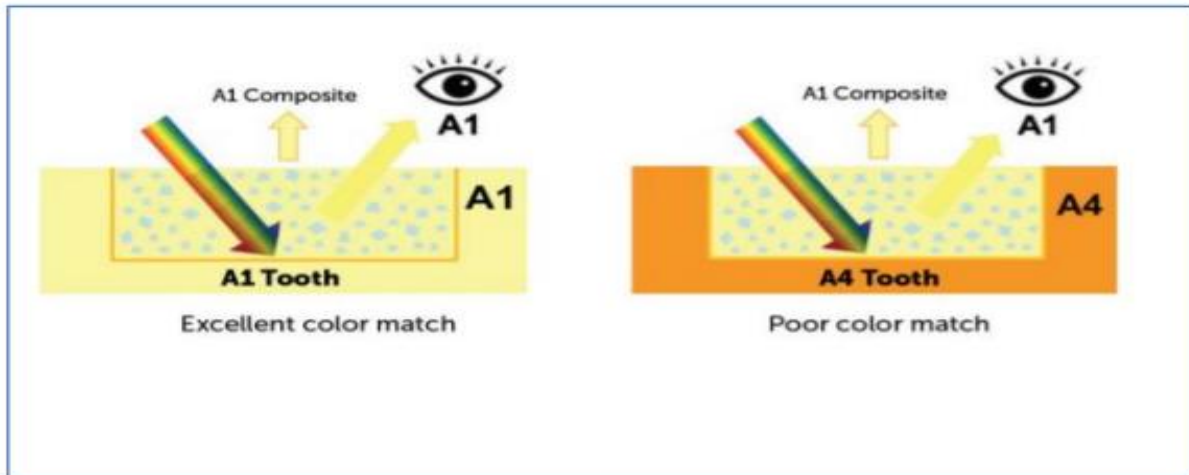
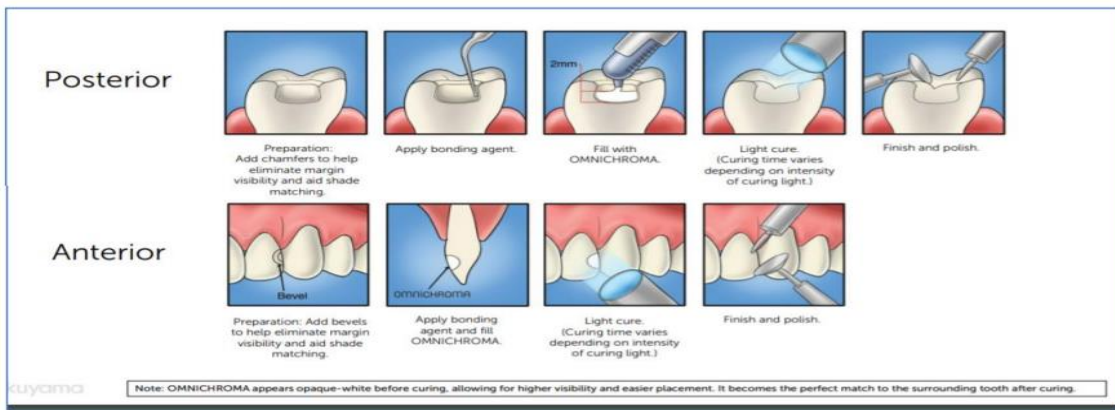
Because OMNICHROMA eliminates the necessity for shade selection, it may also save dentist's time. A recent survey found that 52% of physicians matches the shade during restorative operations for 30 to 60 seconds. The amount of time saved can be substantial when taking into account the typical number of restorations a clinician completes in a year and using an average of one minute. In essence, the rehabilitative process can be streamlined by using OMNICHROMA.[7] Better polishing ability, greater flexural and compressive strength, ease of handling, clinically satisfying results, and resistance to ambient light are some of the key attributes of smart monochromatic composite. It has very little wear on the adjacent tooth structure and composite. An opaque-white paste version of smart monochromatic composite is available, which makes the material easier for physicians to see while manipulating and placing. The material is equally distributed among adjacent teeth before a light source is applied to aid in the curing process. To provide a superior marginal seal, a chamfered margin is recommended. [2]

**Components of OMNICHROMA:** [4] Fillers- uniform sized spherical shaped supra- nano spherical filler (260nm SiO<sub>2</sub> -ZrO<sub>2</sub>)

Monomers -UDMA/TEGDMA with filler loading 79wt% (68vol%).

**Indications:** It is indicated for direct anterior and posterior restorations, direct bonded composite veneer, diastema closure and repair of porcelain/composite.[8]

**Clinical procedure:**[4]



S.No	Smart monochromatic composite	Manufacturer	Country	Weblink
1	OMNICHROMA®	Tokuyama Dental	Japan	<a href="https://www.tokuyama-us.com/omnichroma-dental-composite/">https://www.tokuyama-us.com/omnichroma-dental-composite/</a>
2	SpheriChrome	Oxford Scientific	Germany	<a href="https://oxfordscientificna.com/2022/02/spherichrome-a-new-shade-adaptive-composite-material/">https://oxfordscientificna.com/2022/02/spherichrome-a-new-shade-adaptive-composite-material/</a>
3	Vittra APS unique	FGM Dental Group	Brazil	<a href="https://fgmdentalgroup.com/international/aesthetics-products/vittra-aps-unique">https://fgmdentalgroup.com/international/aesthetics-products/vittra-aps-unique</a>
4	ONEshade	Olident	Poland	<a href="http://olident.com/en/composites/oneshade-3/">http://olident.com/en/composites/oneshade-3/</a>
5	CLEARFIL MAJESTY™ ES-2 UNIVERSAL	Kuraray Noritake Dental Inc	Japan	<a href="https://kuraraydental.com/product/clearfil-majesty-es-2-universal/">https://kuraraydental.com/product/clearfil-majesty-es-2-universal/</a>
6	Filtek™ Universal Restorative	3 M	USA	<a href="https://www.3m.com/3M/en_US/dental-us/products/restoratives/filtek-universal-restorative/">https://www.3m.com/3M/en_US/dental-us/products/restoratives/filtek-universal-restorative/</a>
7	Admira Fusion x-tra®	VOCO	Germany	<a href="https://www.voco.dental/us/products/direct-restoration/nano-ormocer/admira-fusion-x-tra.aspx">https://www.voco.dental/us/products/direct-restoration/nano-ormocer/admira-fusion-x-tra.aspx</a>
8	Solare X	GC	Japan	<a href="https://www.gcindiadental.com/products/composite-restoratives/solare-x/">https://www.gcindiadental.com/products/composite-restoratives/solare-x/</a>
9	Venus Diamond/Pearl One Shade®	Kulzer	Germany	<a href="https://www.kulzer.com/en/en/products/venus-diamond-pearl-one-shade.html">https://www.kulzer.com/en/en/products/venus-diamond-pearl-one-shade.html</a>
10	Zen Chroma Universal	President Dental	Germany	<a href="https://www.presidentdental.com/product_details/PRESIDENT_DENTAL_ZENCHROMA_Universal_Composit">https://www.presidentdental.com/product_details/PRESIDENT_DENTAL_ZENCHROMA_Universal_Composit</a>

Before curing, it appears opaque-white; after curing, it perfectly matches the surrounding tooth. [4]

For posterior teeth with Class I and II restorations, just one shade is needed to match the hue. Before inserting the smart monochromatic composite, a blocking agent in the form of a 0.5 mm thin coat may be used in cases of substantial Class III and Class IV restorations on anterior teeth.[4] Specifically, it conceals the interior part of the crown in cases of discoloration. Furthermore, it also lessens the interference caused by shade-matching.[2]

#### Properties of OMNICHROMA:[4]

1. Excellent polishability.
2. The flexural strength is average or at higher levels.
3. Compared to the majority of commercially available resins, the compressive strength is higher.
4. Its wear and abrasion levels are lower.
5. It shows less shrinkage from polymerization.
6. It is color stable and resistant to stains.
7. It provides enough time to work on practically all restorative operations.
8. The radiopacity is average and sufficient for prognosis and observations, with an average value.

#### Key Characteristics:

##### Shade-Matching Ability:

Smart monochromatic composites have the capability to change color According to the adjacent dentition. They can enhance the appearance of the restoration by decreasing the dependency on shade guides. It was revealed that smart monochromatic material had no pigments and dyes, so its color properties are dependent solely on the physical properties of light. It has excellent color-matching ability for all shades.[2]

##### Masking Ability of Single-Shade Composite:

When treating badly discoloured tooth structure with no or few remaining surrounding tooth structure remnants, one-shade resin composite is used as a blocking/masking material for Class III and Class IV restorations.

A small layer of 0.5mm is applied before applying Omnichroma.

This mask reduces the interference caused by discoloration in shade matching and helps to conceal the internally discoloured portion of the tooth structure. [2]

#### Esthetic Properties and Effect of Bleaching on Surface Roughness:

Restorations with rough surfaces promote plaque buildup, staining, and gingival irritation, all of which lead to the eventual development of secondary caries. In addition, resin composite filling materials are adversely affected by teeth bleaching.

The organic matrix complex of resin composites can deteriorate and become rough on the surface when bleaching agents with peroxides are applied in the bleaching process. [2]

#### Mechanical Properties and Curing Depth:

The following parameters can be used to evaluate the mechanical properties of resin composites: fatigue, hardness, strength, elastic modulus, fracture toughness, edge strength (chipping), and tooth wear. The right amount of curing can lead to the best possible qualities.

On the other hand, poor curing leads to restoration failure. [2]

#### LIMITATIONS: [2]

1. The smart monochromatic composite's long-term color stability in the oral cavity is doubtful.
2. The impact of aging on the physical characteristics of smart monochromatic composite is promising.
3. When matching teeth with lighter shades, the smart monochromatic composite's color matching ability is outstanding; but, when matching teeth with darker shades, it is not as good.

#### CONCLUSION: [9]

Many notable composite restorations have been introduced into practice by doctors worldwide during the many decades that have seen improvements in esthetic restorations.

But OMNICHROMA, a shade-matching composite, functions as one of the most fascinating advancements in the last few years. As a result, the dentist will be able to save both money and time. In order to determine whether OMNICHROMA will live up to the high hopes that have been raised and also because of the limitations that it has, more research and case follow-ups will be required in the future.

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