OMNICHROMA Flow BULK

Technical Report

Ver.1 (2022.2.2.)

Tokuyama Dental

Contents

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1. Introduction

In direct restorations of teeth using resin-based composites, correct shade taking is an important esthetic factor. Due to positional and individual differences in natural teeth, it is necessary to consider what shade of composite is appropriate to restore a cavity in the context of the target tooth and adjacent teeth. To meet this need to restore different shades of teeth, dental manufacturers have developed various composites with different color and/or translucency. However, shade taking increases chair time and is subjective to the individual performing the shade-taking procedure, which is burdensome for both dentists and patients.

To address this issue, TOKUYAMA DENTAL has developed resin-based composites formulated on a "Wide Color Matching" concept, creating shades that can cover a wide range of natural teeth colors to reduce the time investment of shade taking and reduce the amount of composite shades needed in inventory. For example, TOKUYAMA launched ESTELITE® SIGMA QUICK in 2007, and the wide color-matching ability and esthetics of this composite have been recognized by the market [1]. TOKUYAMA has continued to develop composite technologies designed for the simplest shade systems and has succeeded in completing a new brand, OMNICHROMA®, which is the culmination of more than 35 years of research and development efforts. With this new technology (Smart Chromatic technology®), OMNICHROMA® shows good color compatibility with all 16 VITA shades [2].

In recent years, bulk fill type resin composites, such as Dentsply's SDR® Flow, have appeared and are increasing in use in the U.S. and European markets through various manufacturers.

TOKUYAMA DENTAL has developed OMNICHROMA® FLOW BULK through the application of Smart Chromatic Technology® for bulk fill type resin composite. This technical report describes the technical background, features, and material properties of OMNICHROMA® FLOW BULK the newest bulk fill resin composite within the OMNICHROMA® line [3].

2. OMNICHROMA® FLOW BULK Overview

2.1 Material Components

・UDMA, TEGDMA

・Uniform sized supra-nano spherical filler (260 nm spherical SiO_2-ZrO_2)

・Composite filler (include 260 nm spherical SiO_2-ZrO_2)

・Filler loading

69 wt% (55 vol%)

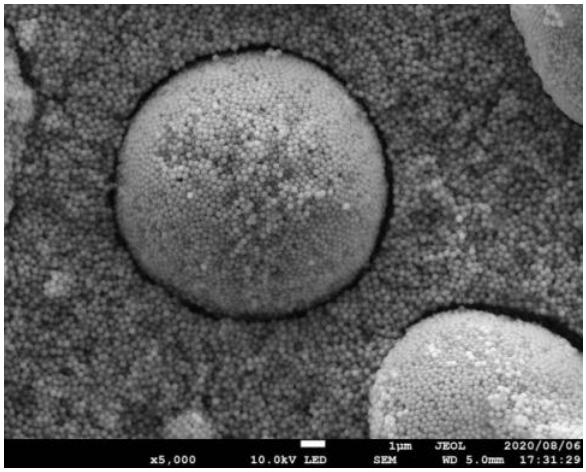


Fig.1 SEM images of the filler in OMNICHROMA® FLOW BULK
at 5,000x magnification

2.2 System

OMNICHROMA® FLOW BULK
OMNICHROMA® BLOCKER FLOW
OMNICHROMA® BLOCKER

* OMNICHROMA® BLOCKER FLOW and OMNICHROMA® BLOCKER are supplementary material designed for use to mask slight staining or metal color, to reconstruct a highly opaque tooth, or to use as a thin layer at the lingual cavity wall of extensive class III and IV restorations when there is limited surrounding dentition. The function of OMNICHROMA® BLOCKER FLOW is to improve shade adaptation and prevents OMNICHROMA® FLOW BULK from picking up the color of the staining, metal or the-darkness of the oral cavity and potentially dropping in value.

As shown in Figure 2a and Figure 16a, OMNICHROMA® FLOW BULK's uncured resin material is opaque-white, making it easy to distinguish between the uncured resin material and tooth structure. After light curing, OMNICHROMA® FLOW BULK adapts to the color of the cavity, giving it a natural appearance.

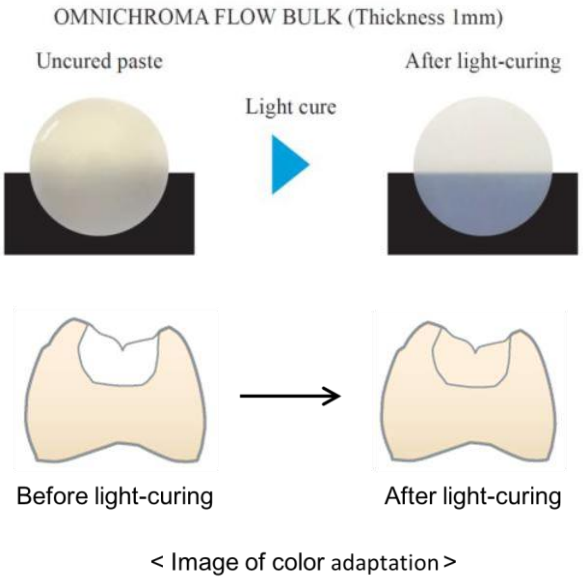


Fig.2a The color of OMNICHROMA® FLOW BULK
before and after light-curing and image of color adaptation.

Use OMNICHROMA® BLOCKER FLOW, OMNICHROMA® BLOCKER or other color masking material before filling with OMNICHROMA® FLOW BULK for direct restoration of extensive Class III and IV cavities with no tooth structure, or for masking discolored teeth. Use opaquer for masking metal. As shown in Figure 2b, OMNICHROMA® BLOCKER or OMNICHROMA® BLOCKER FLOW masks the background color and the color of OMNICHROMA® FLOW BULK adapts to that of OMNICHROMA® FLOW BLOCKER that is A2 opaque shade. When using other color masking material or opaquer, OMNICHROMA® FLOW BULK adapts to the shade of other color masking material or opaquer.

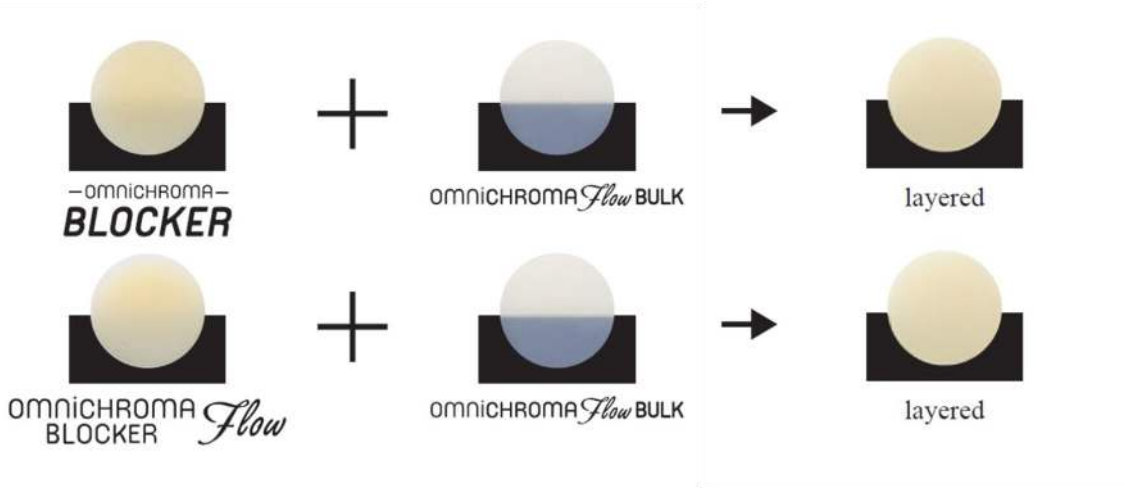


Fig.2b The color of OMNICHROMA® FLOW BULK before and after layering on OMNICHROMA® BLOCKER or OMNICHROMA® BLOCKER FLOW

Figure 2c shows the restoration of discolored tooth. For masking the discoloration, use OMNICHROMA® BLOCKER FLOW, OMNICHROMA® BLOCKER or other color masking materials to mask the discoloration before filling with OMNICHROMA® FLOW BULK. OMNICHROMA® FLOW BULK adapts to the color of the material used.

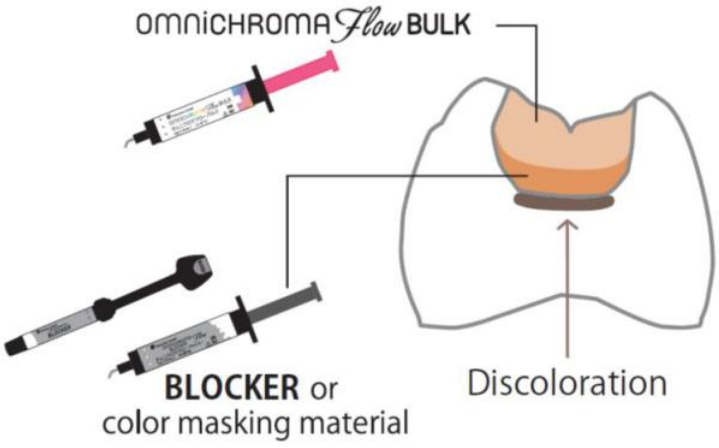


Fig.2c Instruction for restoring discolored teeth.

As shown in Fig 3, the flowability of OMNICHROMA® FLOW BULK is high. So, if you are concerned about creating the tooth anatomy, you can apply OMNICHROMA® after filling OMNICHROMA® FLOW BULK.

Figure 2d shows the restoration of Class I cavity (4mm diameter , 3.5mm depth) of the denture tooth a combination of OMNICHROMA® FLOW BULK with OMNICHROMA®. After applying a bonding agent (TOKUYAMA UNIVERSAL BOND®), OMNICHROMA® FLOW BULK is filled in 3 mm depth and then filled with OMNICHROMA® in 0.5 mm depth (cured at 800 mW / cm^2, for 20 seconds). Then, color difference (ΔE*) of the filled part between before and after filling was evaluated. ΔE* for all three shades is below 3.3 which is an acceptable color match [4]. In addition, natural looking color adaptation for all three shades is visibly confirmed in the Class I restorations combining OMNICHROMA® FLOW BULK with OMNICHROMA®.

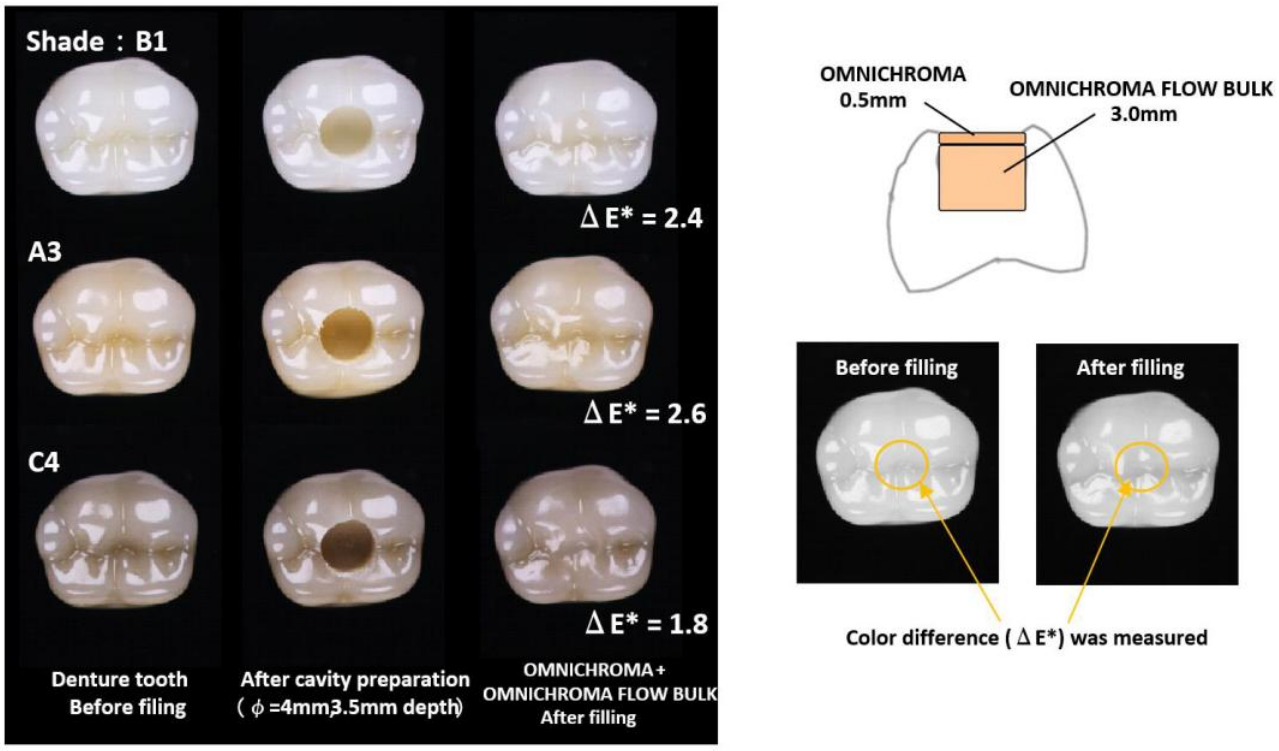


Fig.2d Evaluation of color adaptation by visual inspection and spectrophotometer in layered filling of OMNICHROMA® FLOW BULK with OMNICHROMA®.

2.3 Concept and Features

OMNICHROMA® FLOW BULK has such a wide color-matching range making it possible to esthetically match the 16 VITA classical shades with just one shade of composite. It can be used for bulk-filling up to 3.5 mm at 800 mW / cm^2, for 20 seconds instead of multiple composite layers (Fig.16a). Detailed relationship between curing time and increment depth is shown in Table 2.

No shade taking is necessary, allowing clinicians to minimize chair time, reduce composite inventory, minimize the waste of unused composite shades, and reduce reliance on shade-matching procedures. OMNICHROMA® FLOW BULK also inherits the features of TOKUYAMA's spherical fillers from the ESTELITE® series such as excellent polishability (Fig 18), gloss retention and wear resistance [5-8].

Excellent esthetic properties

- ・Unprecedented color matching (See Fig.16a)
- ・High polishability (See Fig.18)
- ・High stain resistance (See Fig.26)

Applicable for bulk filling

- ・Low polymerization shrinkage among flowable type bulkfill resin composites (See Fig.25)
- ・For about relationship between light intensity, curing time and increment depth of OMNICHROMA FLOW BULK, see table 2.)

2.4 Indications

- Direct anterior and posterior restorations
- Cavity base or liner
- Blocking out cavity undercuts before fabricating indirect restorations
- Repair of porcelain/composite

2.5 Flowability

As shown in Figure 3, there are three types of flowability (High, Medium and Low) for flowable resin composites. OMNICHROMA® FLOW BULK is categorized in the high flow type showing low viscosity and high flowability making it easy for bulk filling application.

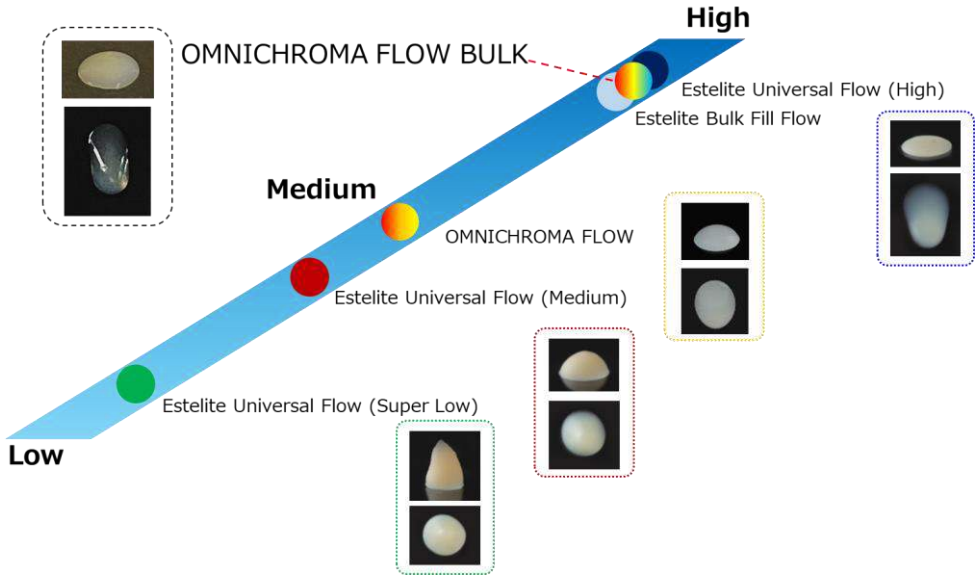


Fig.3 Comparison of flowability

3. Technical Background

3.1 Smart Chromatic Technology®

OMNICHROMA® FLOW BULK exhibits the ultimate wide-range color-matching ability, covering all 16 VITA classical shades with just one shade of composite, thanks to TOKUYAMA's Smart Chromatic Technology® [2, 3]. The Smart Chromatic Technology® is achieved through the uniformly sized 260 nm supra-nano spherical fillers included in OMNICHROMA® FLOW BULK. The scientific background and mechanisms of the Smart Chromatic Technology® are detailed in the following sections.

3.1.1 Color

There are two types of color mixing used to create color for practical purposes: additive and subtractive. Additive color mixing applies to colors produced by light. The three primary colors in additive mixing are red, green, and blue. If all three primary colors are combined, the result is white. Additive mixing is used in television and computer monitors to produce a wide range of colors using only three primary colors. On the other hand, the three primary colors in subtractive mixing are yellow, magenta, and cyan, leading to the CMYK color model widely used in color printing. In subtractive color mixing, the combination of all three primary colors creates black. Subtractive mixing is used to create a variety of colors when printing on paper and when painting by combining multiple ink colors. Subtractive color mixing is typically used for color adjustment of dental composites using pigments or dyes. Figure 4 illustrates additive (left) and subtractive (right) color mixing.

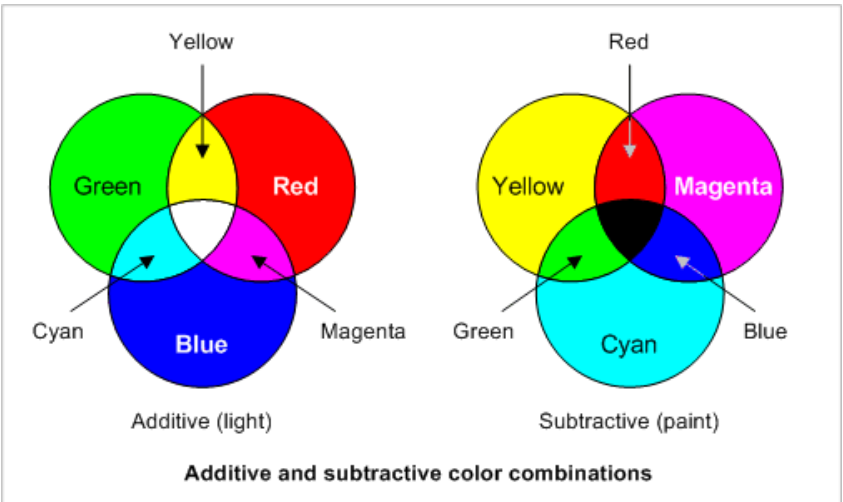


Fig.4 Additive and subtractive color mixing.

3.1.2 Tooth Color

Figure 5 is a Munsell sphere that indicates the complete visible color space. As shown in Figure 6, the range of colors for natural teeth is quite limited and distributed in the narrow range of red to yellow from A1 to D4, with varying degrees of lightness, darkness, and saturation.

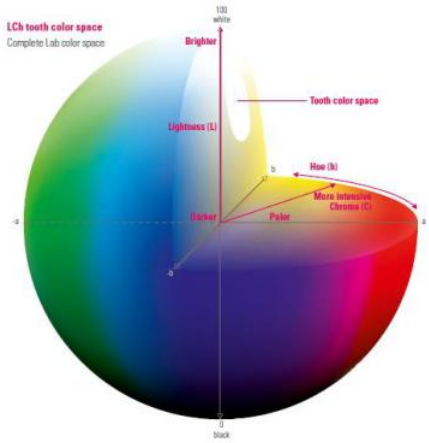


Fig. 5 Munsell sphere.

Fig.6 A1-D4 range of tooth shades.

3.1.3 Mechanism

OMNICHROMA® FLOW BULK is a composite that achieves wide-color matching by generating red-to-yellow structural color equivalent to natural teeth in an additive color mixing system [9-11].

Figures 7 illustrate a color-matching image for conventional composites that utilize the chemical color of added dyes or pigments. In these cases, excellent color match can be achieved if the correct shade is selected. However, the color matching will be poor if shade-taking is performed incorrectly, as the shade-matching ability of typical composites is weak.

Figures 8 illustrate a color-matching image for OMNICHROMA® FLOW BULK. OMNICHROMA® FLOW BULK generates red-to-yellow structural color equivalent to the color elements of a natural tooth. Structural color is expressed only by the physical properties of light (diffraction, refraction, interference, scattering, etc.) without an exchange of light energy. As this red-to-yellow structural color is generated, it combines with the reflected light and color of the surrounding tooth in an additive color mixing process, resulting OMNICHROMA® FLOW BULK's ability to match natural teeth as shown Fig 16a and Fig 16b [3,12]. This use of structural color in combination with an additive color mixing system makes the use of pigments and dyes unnecessary.

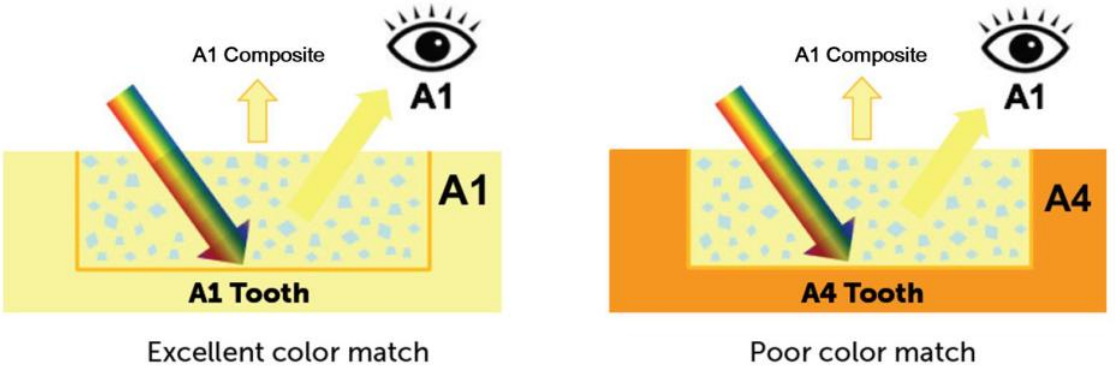


Fig. 7 A1 and A4 tooth restored with A1 shade composite

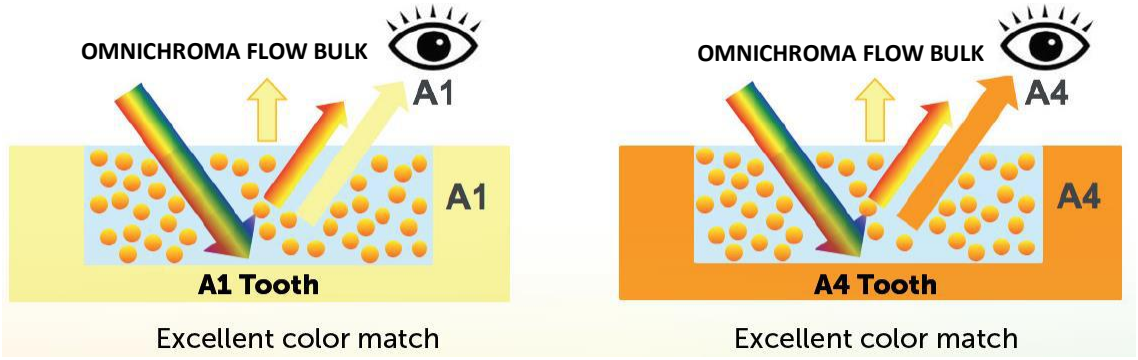


Fig. 8 A1 and A4 tooth restored with OMNICHROMA® FLOW BULK

To express structural color, it is very important that the filler of the composite consists of specific, single-sized spherical particles only. To examine the relationship between particle size and shape and the structural color phenomenon, filler powders of various sizes and shapes were spread out on black and white paper backgrounds. The visible color phenomenon for each filler powder is demonstrated in Figure 9 below. Filler powder itself has no color, as demonstrated by its appearance on a white paper background. White light reflected by the white background is very strong, which is why a structural color phenomenon is not visible on the white background.
On the other hand, 260nm spherical filler shows red to yellow structural color, also 180nm spherical filler shows blue structural color, as shown on black background.

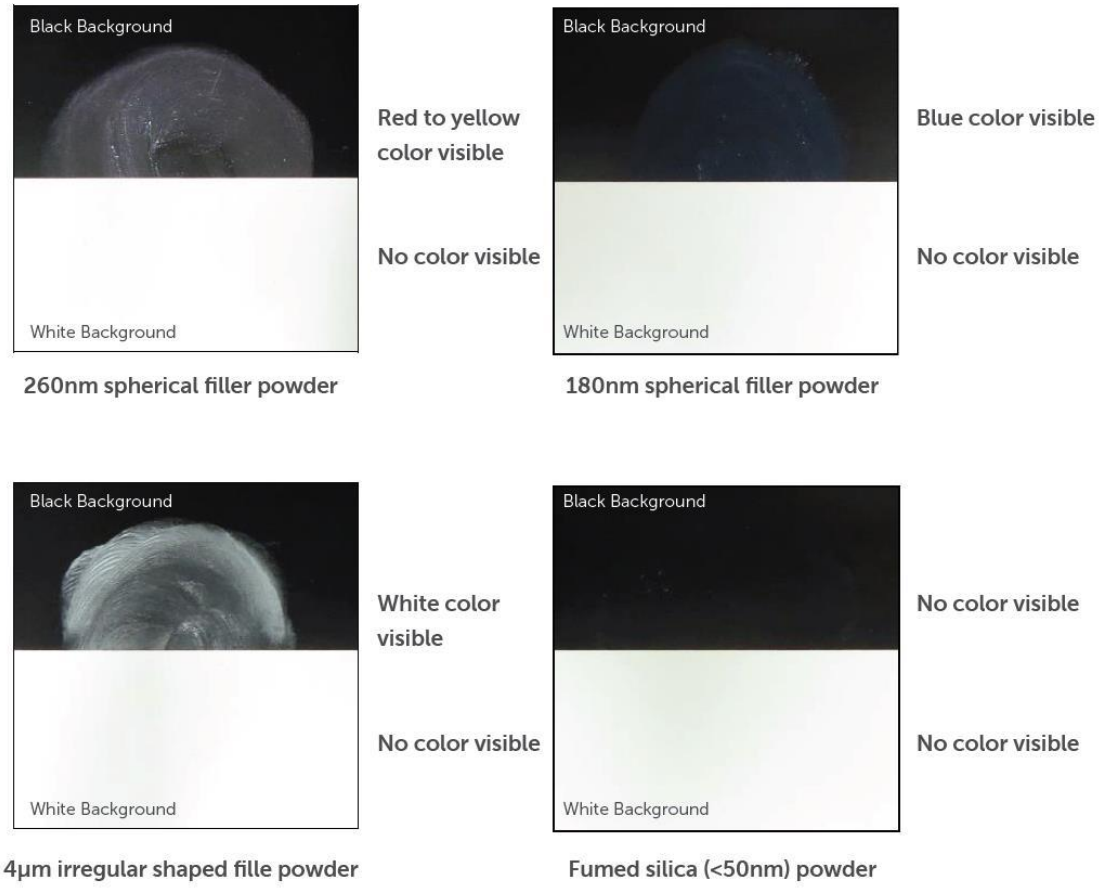


Fig. 9 Relationship between particle size and structural color phenomenon.

The relationship between the size of spherical filler and structural color in a series of resin composites is shown in Figure 10. Experimental resin composites were produced with UDMA/TEGDMA as matrix monomers, camphoquinone/amine as photoinitiator, 65 wt.% of 180, 260, and 300 nm spherical filler respectively.
As demonstrated, TOKUYAMA's research found that a 260nm spherical filler generates the red-to-yellow color necessary to match natural teeth. Variations in the size and shape of the filler material can alter the structural color phenomenon, and ultimately the composite's shade-matching ability. Therefore, OMNICHROMA® FLOW BULK uses 260nm spherical filler (OMNICHROMA® Filler) exclusively [9,10].

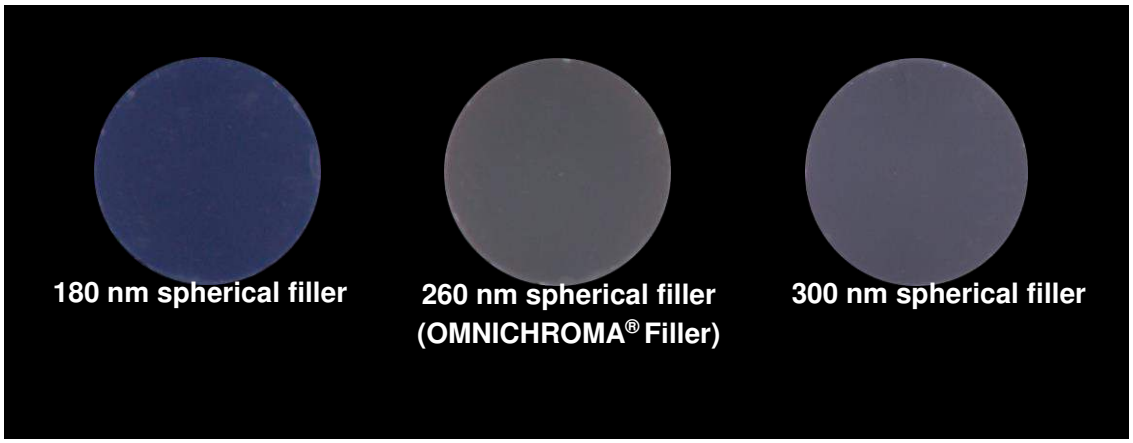


Fig. 10 Color difference of the resin composites consisted of specifically sized spherical fillers on a black background.

3.2 Manufacturing Process

TOKUYAMA DENTAL synthesizes the uniformly sized OMNICHROMA® Fillers (260nm spherical filler) using a special technique called the Sol-Gel Method. Unlike conventional filler manufacturing methods, which involve crushing glass materials until they reach a roughly desirable size, the Sol-Gel Method produces fillers from filler cores in organic solvent and allows the filler to grow gradually from the cores. This method makes it possible to produce uniform spherical fillers (Figure 11).

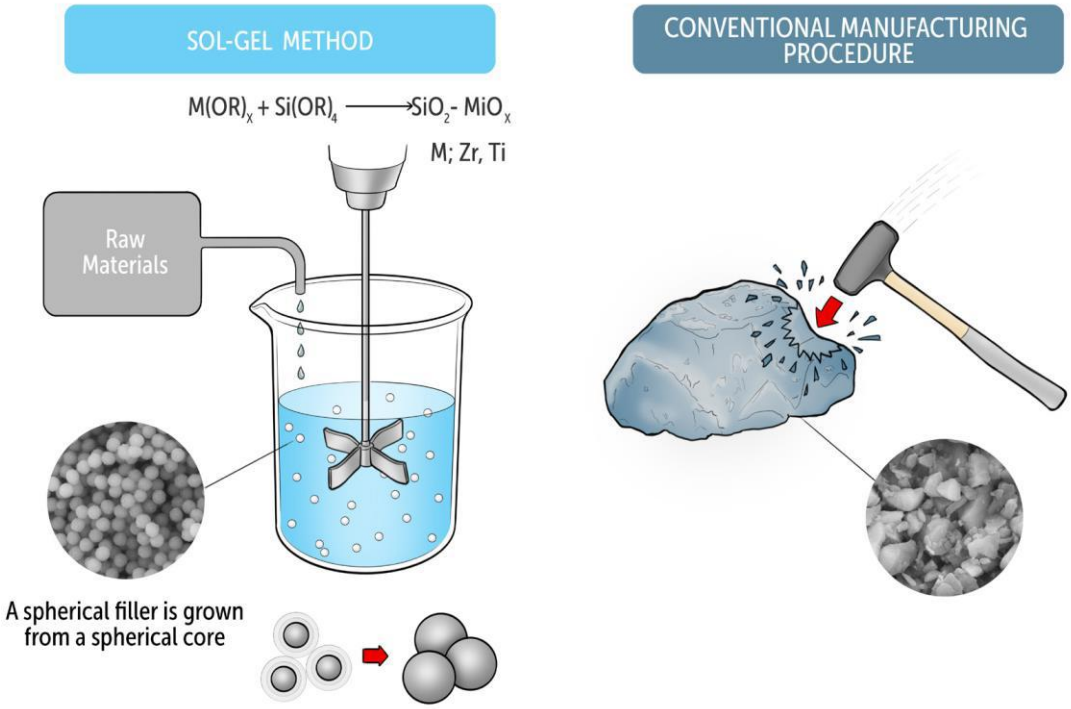


Fig.11 Sol-Gel Method vs conventional filler method.

A key benefit of the Sol-Gel Method is that the filler size can be controlled by adjusting the reaction times. In composite resins, filler size significantly affects the physical characteristics of the cured body and its esthetic aspects. Smaller filler sizes produce a superior surface glossiness but make it difficult to increase filler content. These smaller sized filler particles can lead to drawbacks such as increased polymerization shrinkage and poor physical characteristics such as reduced flexural strength.

Figure 12 shows the correlation between filler particle size, filler content, and compressive strength. The figure illustrates how filler content begins to fall significantly below 100nm but is nearly constant at sizes above that. In addition, it shows maximum compressive strength for particle sizes ranging from 100 to 500nm.

Figure 13 shows the correlation between filler particle size, surface roughness, and hardness. This figure illustrates that surface roughness decreases with particle sizes down to approximately 500nm, but remains constant at sizes below 500nm. Surface hardness reaches the highest value at particle sizes ranging from 100 to 500nm. TOKUYAMA utilized these properties to develop the ideal balance between esthetics and physical characteristics with supra-nano sized particles [13].

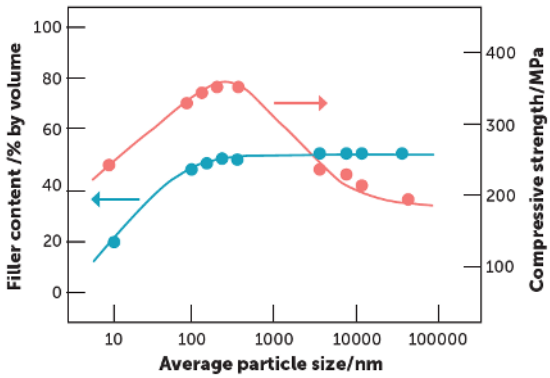


Fig.12 Correlation between particle size, filler content, and compressive strength.

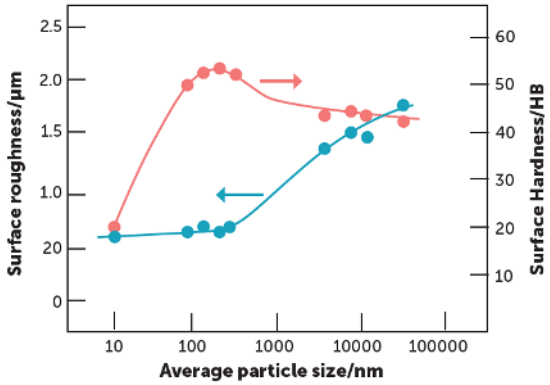


Fig. 13 Correlation between particle size, surface roughness, and surface hardness.

Another key benefit of the Sol-Gel Method is that the refractive index of the filler can be controlled by changing the type and fraction of the additive. To reproduce the semi-translucent quality of natural teeth using composite resins, we must control the difference between the refractive indices of the filler and the organic resin. Composite resins consist of fillers and organic resins containing catalysts. When the refractive indices of both materials are equal, the composite resin appears highly translucent; when the refractive indices differ significantly, the resin appears opaque.

The refractive index of resins tends to change after polymerization, and the refractive index of the cured resin (polymer) tends to be higher than that of the resin (monomer) before curing. This property of refractive indices is demonstrated graphically in Figure 14.

To express excellent color matching (Fig.16a) and more than 3.5mm of increment depth (Table 2), OMNICHROMA® FLOW BULK has been designed to optimize the translucency of the composite body after curing. While appearing opaque-white before curing, OMNICHROMA® FLOW BULK achieves a natural look by transitioning from opaque to semi-translucent after curing (Fig 2a).

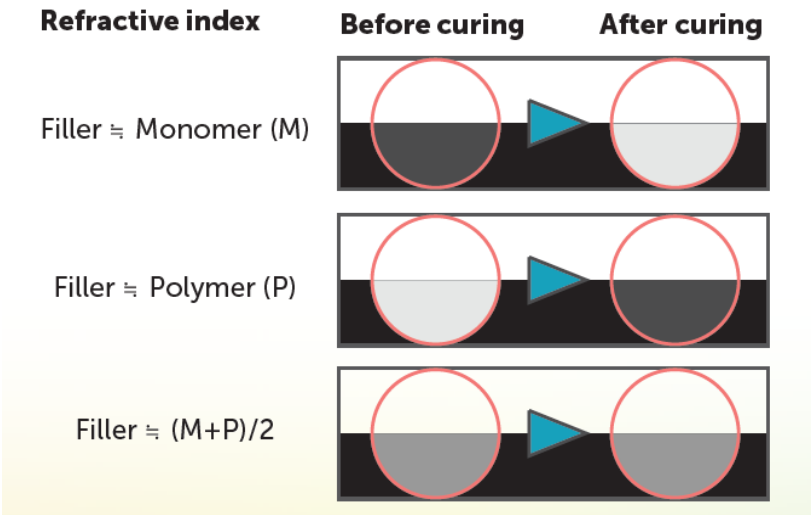
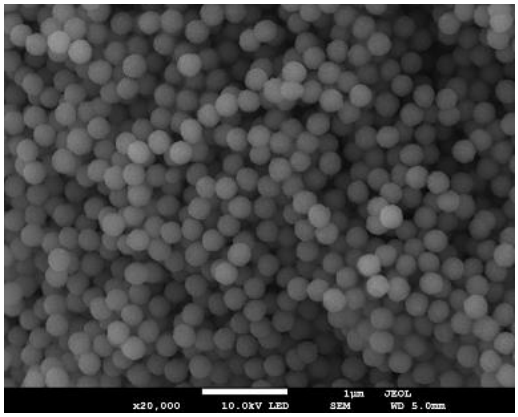


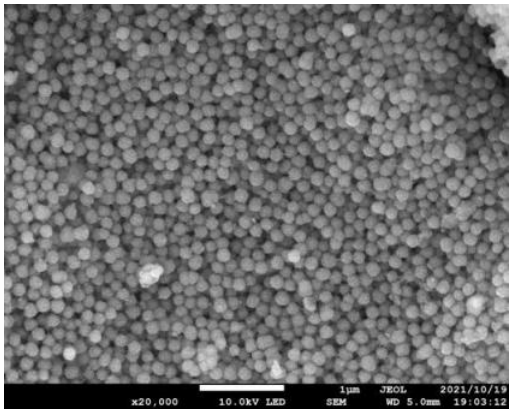
Fig. 14 Relationship with refractive index and translucency.

3.3 Comparisons of Filler Materials

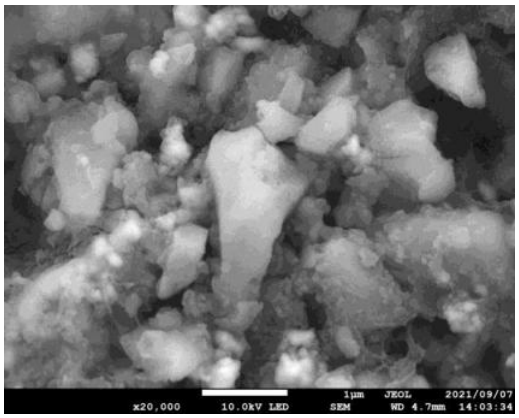
The SEM images (Fig 15, 20,000x magnification) show the fillers used in OMNICHROMA® FLOW BULK and in bulk fill resin composites from other manufacturers. OMNICHROMA® FLOW BULK contains uniformly sized 260nm spherical filler (OMNICHROMA® Filler) to exhibit red to yellow structural color (Fig.15)



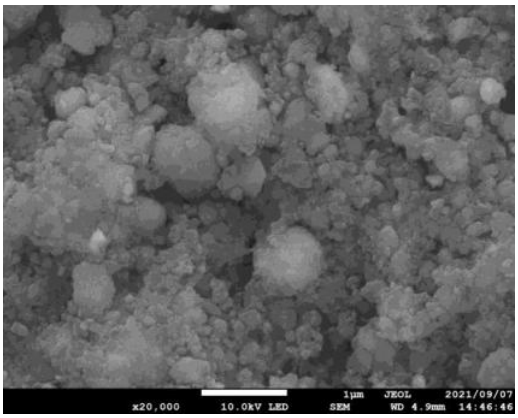
OMNICHROMA® FLOW BULK
(OMNICHROMA® Filler)



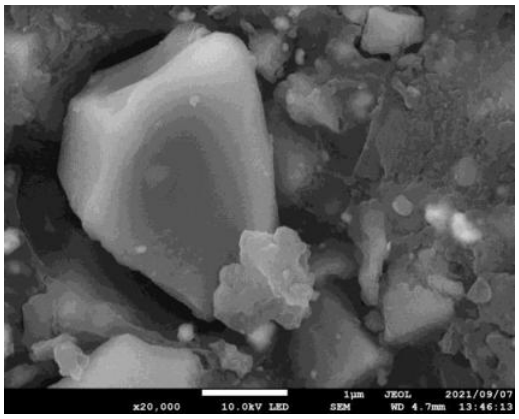
Estelite Bulk Fill Flow



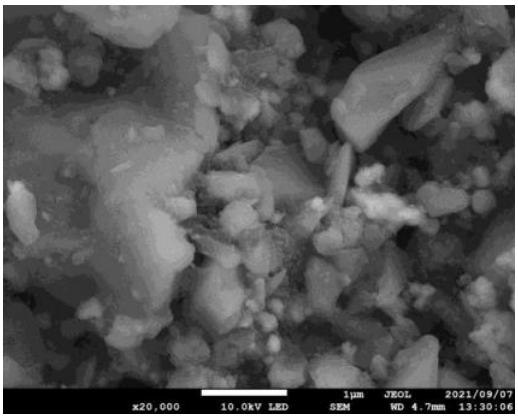
SureFill SDR flow+



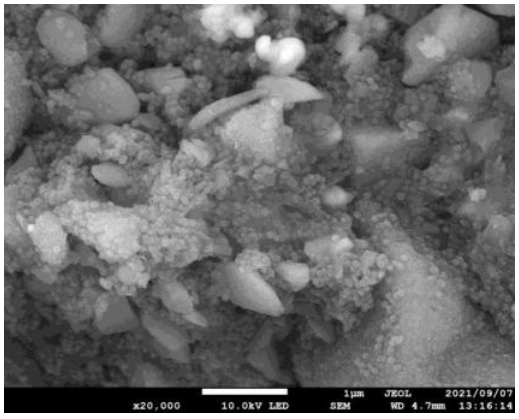
Filtek Bulk Fill Flowable



Tetric Power Flow



bulk EZ



Sonic Fill 3

Fig.15 SEM image of the filler used in resin composite (20,000x magnification).

4. Material Properties

4.1 Color Matching

The color-matching property of OMNICHROMA® FLOW BULK is shown in Figure 16a and 16b. As shown in Figure 16a, artificial composite resin teeth with a cavity size of 4 mm diameter and 3.5 mm depth were filled with OMNICHROMA® FLOW BULK (cured at 800 mW / cm^2, for 20 seconds). In visible evaluation, OMNICHROMA® FLOW BULK showed natural looking color adaptation with all 16 VITA shades of artificial teeth.

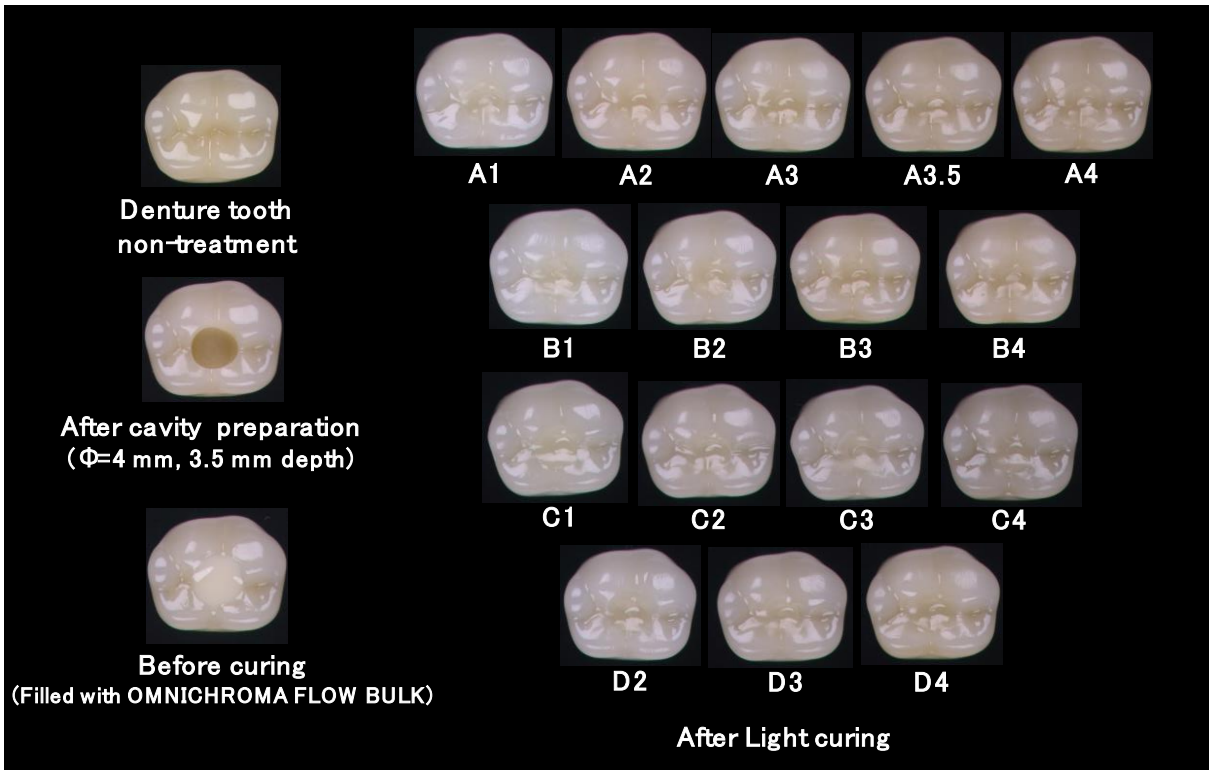


Fig.16a Restoration of Class I cavity with OMNICHROMA® FLOW BULK

Figure 16b shows the result of the evaluation using extracted human teeth. Eight extracted human molars with different shades were selected. Class I cavity with a cavity size of 4 mm diameter and 4 mm depth was made at the center of occlusal surface. After application of a bonding agent (TOKUYAMA UNIVERSAL BOND®), all teeth were restored with OMNICHROMA® FLOW BULK (cured at 800 mW / cm^2, for 30 seconds following table 2). Then, color difference (ΔE*) of the color of filled part compaere to that of nearby natural tooth was evaluated. ΔE* for all eight teeth is below 3.3 which is an acceptable color match [4]. By visual evaluation, OMNICHROMA® FLOW BULK shows natural looking color adaptation to all shades of the extracted teeth in Fig 16b in bulk-filling Class I restoration.

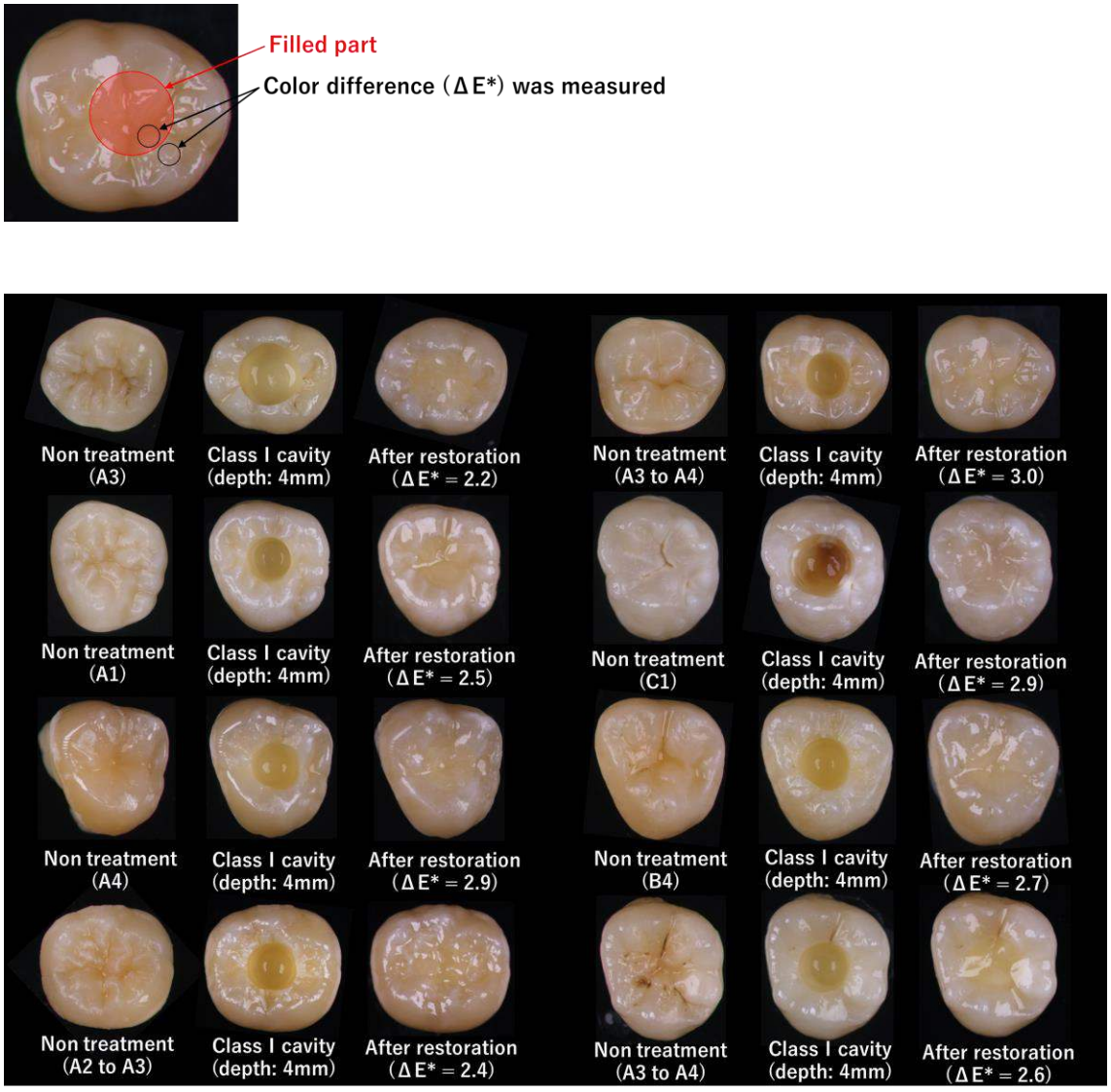


Fig.16b Evaluation of color adaptation to extracted human molars.

4.2 Cavity Adaptation

Cavity adaptation of OMNICHROMA® FLOW BULK to a cylindrical cavity with a cavity size of 4 mm diameter and 4 mm depth was examined. The results are shown in Figure 17. Bovine teeth were used for this evaluation. Because cavity depth was short, 2mm layer of resin composite was filled on the lingual surface of the bovine premolar, then 4mm depth of the cylindrical cavity was prepared. Each bulk fill resin composite was filled after applying each manufacturer's bonding material; OMNICHROMA® FLOW BULK (cured at 800 mW / cm^2, for 30 seconds following table 2) / Tokuyama Universal Bond®, Estelite® Bulk Fill Flow / Tokuyama Universal Bond®, SureFil SDR® flow+ / Prime&Bond active®, Filtek Bulk Fill Flowable / Scotchbond Universal Adhesive, Tetric® Power Flow / Adhese® Universal, Sonic Fill 3 / Opti Bond Universal. After filling, tooth was sectioned along a height plane through the center of the circle on the top surface of the columnar cavity, buff finished, and adhesive surface was observed by laser microscope. Cavity adaptation was evaluated by calculating the bonding ratio (non-gap forming ratio) to total bonding length within the bovine teeth part.

The results in Fig 17a show that the cavity adaptation of Estelite® Bulk Fill Flow, OMNICHROMA® FLOW BULK and SDR® flow+ were more than 85.5%.

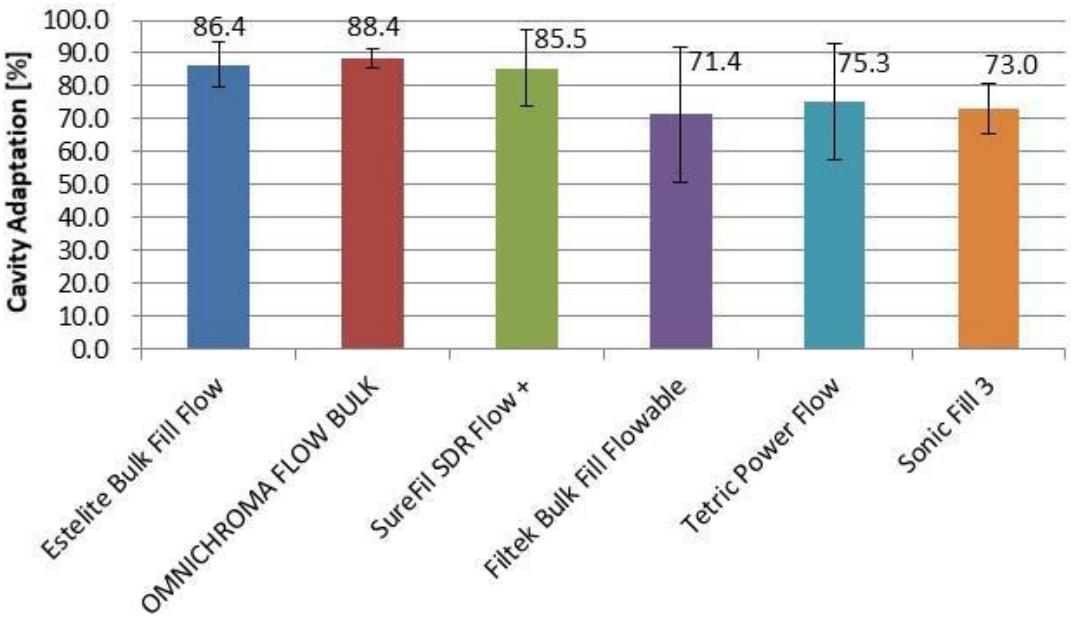


Fig. 17a Cavity adaptation of each bulk fill resin composites.

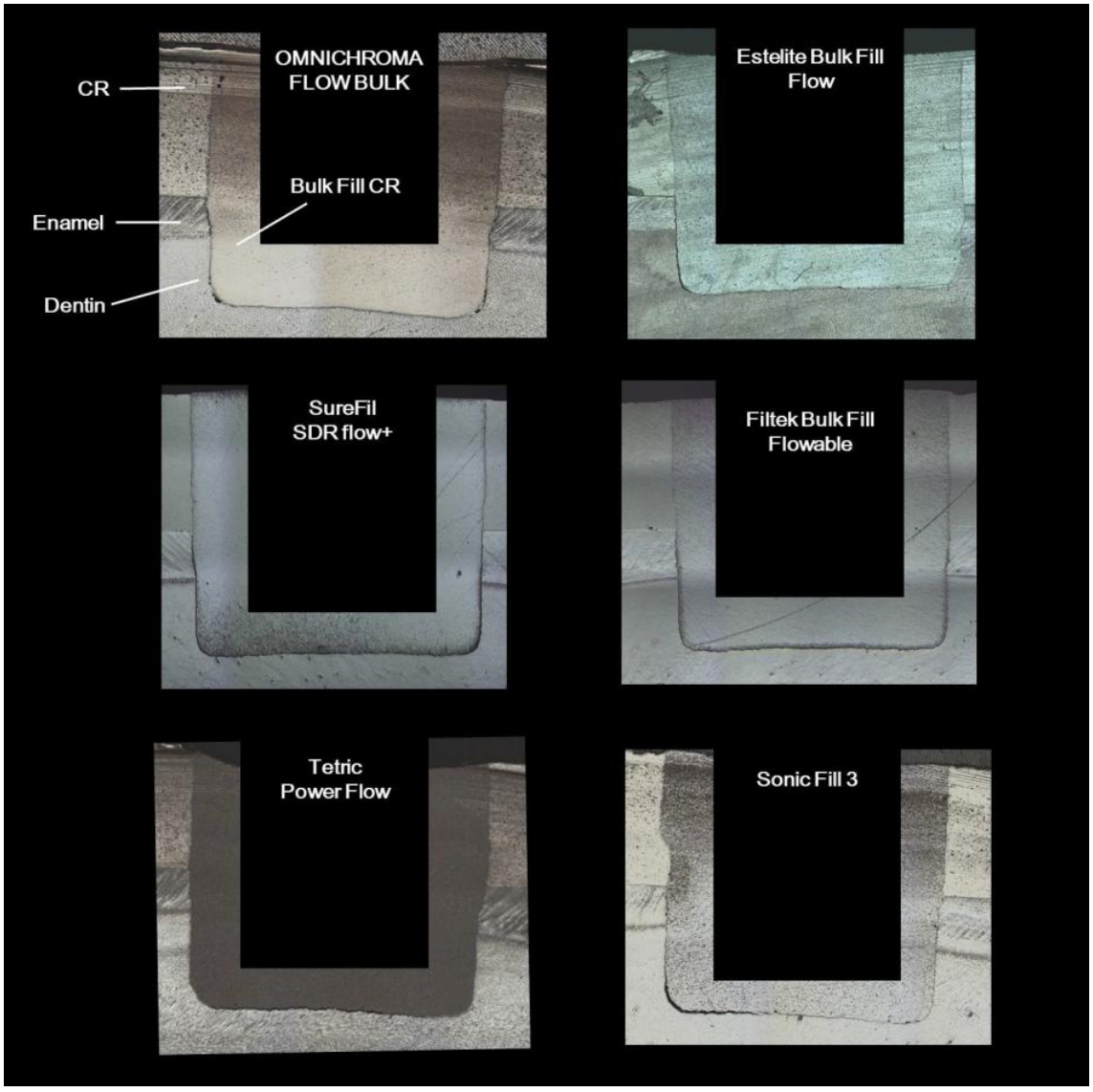


Fig. 17b Typical laser microscope images of each cavity adaptation.

4.3 Polishability

Figure 18 shows surface glossiness after each surface of cured composite was polished with #1500 sandpaper, followed by Sof-Lex™ superfine discs (3M-ESPE) for 60 seconds under running water. Surface glossiness was measured using gloss meter (TC-108D : Tokyo Denshoku Corporation , Japan). The data was statistically analyzed using SPSS (version 21, IBM) with one-way ANOVA ($p<0.05$).

The results show that glossiness of OMNICHROMA® FLOW BULK and Estelite® Bulk Fill Flow after polishing were significantly higher than that of other bulk fill resin composites evaluated in this study, showing easy and fast polishability.

Figure 19 shows relationship between surface glossiness and polishing time. The results show that OMNICHROMA® FLOW BULK has the second highest glossiness at each evaluation time compared with other bulk fill resin composites evaluated in this study.

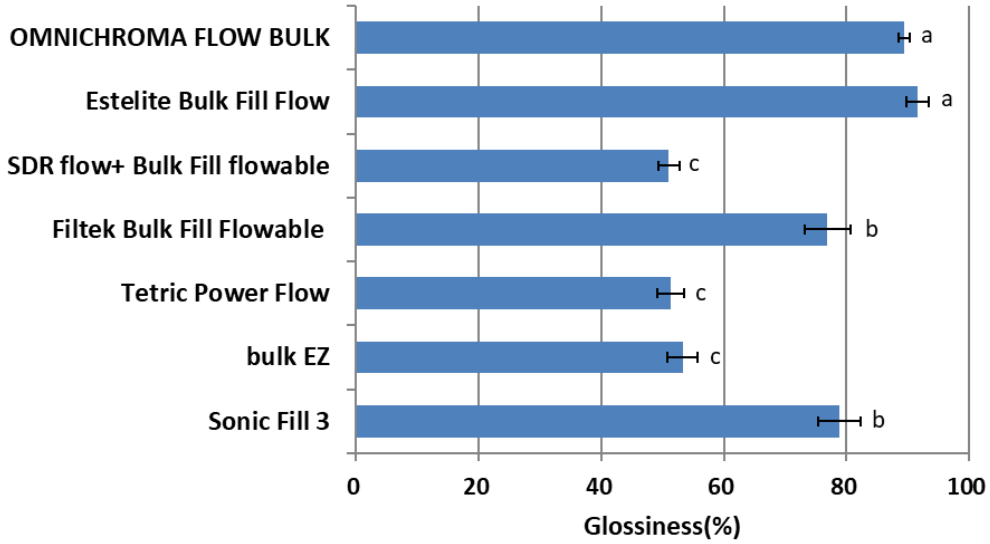


Fig.18 Surface Glossiness.

(Means with the same symbol letter are not significantly different.)

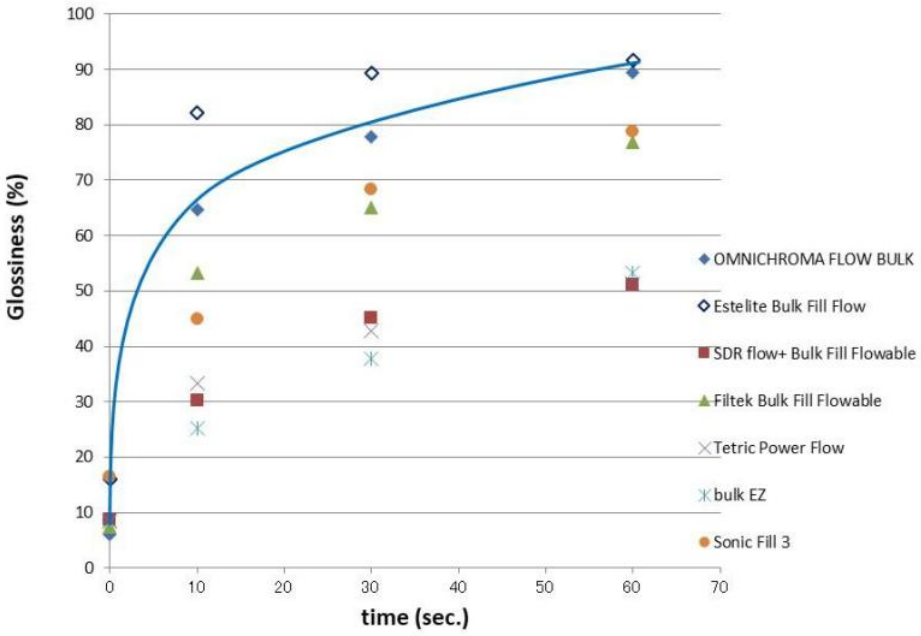


Fig.19 Relationship of surface glossiness and polishing time.

4.4 Strength

Figure 20 shows the flexural strength and Figure 21 shows the compressive strength of OMNICHROMA® FLOW BULK and other commercially available bulk fill resin composites.

Flexural strength was determined according to ISO 4049 : 2019. using universal testing machine (AG-1: Shimadzu Corporation, Japan).

Cylindrical specimens (4mm diameter, 3mm thickness) for compressive strength test were cured according to the manufacturer's recommendation using light-curing unit (LCT, Kerr, 800mW/cm^2). After polymerization, all specimens were stored in water at 37 degree Celsius for 24 hours, and compressive strength was measured using universal testing machine (AG-1 : Shimadzu Corporation, Japan). Compressive strength was calculated using the following equation: Compressive strength (MPa) = $4P / \pi * D^2$ (P: test force, D: test specimen diameter).

The data was statistically analyzed using SPSS (version 21, IBM) with one-way ANOVA ($p<0.05$).

The flexural strength of OMNICHROMA® FLOW BULK showed no significant difference compared with SDR® flow+, Filtek Bulk Fill Flowable, Tetric® Power Flow and BULK EZ in this study.

The compressive strength of OMNICHROMA® FLOW BULK is the highest among commercially available bulk fill resin composites in this study.

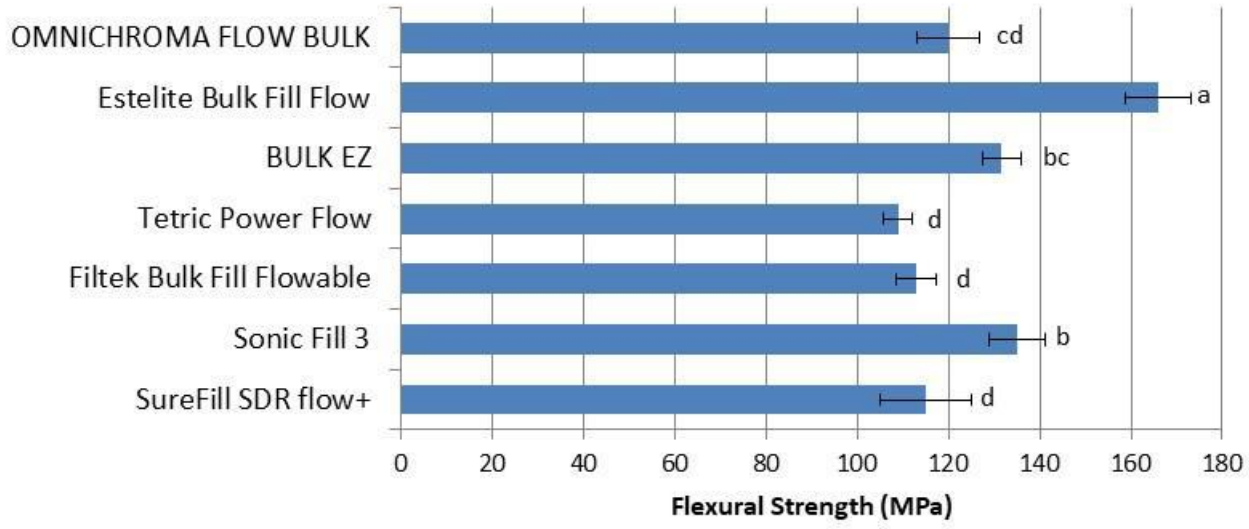


Fig.20 Flexural Strength (MPa).

(Means with the same symbol letter are not significantly different.)

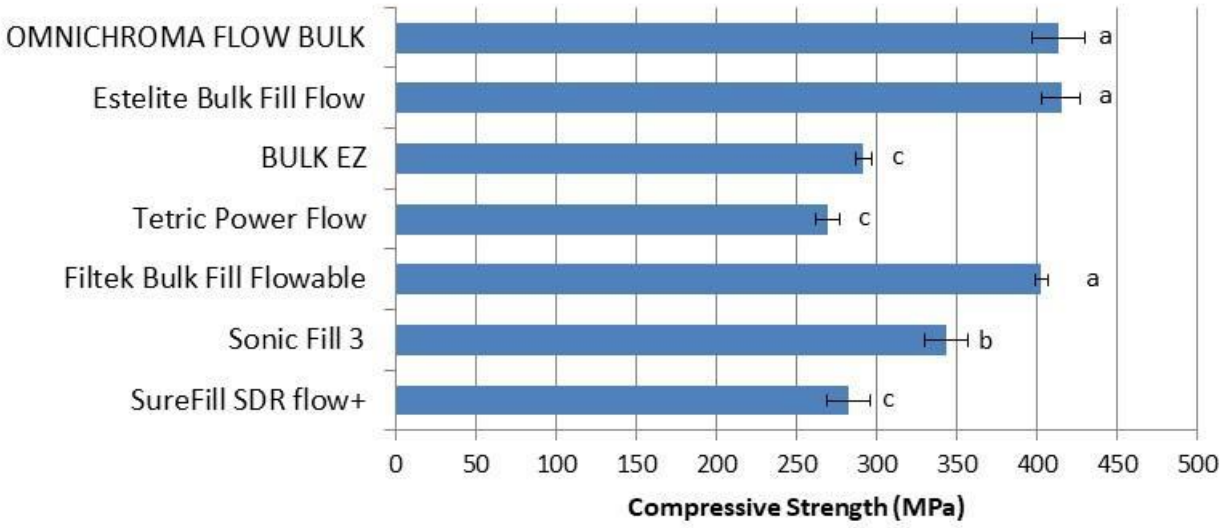


Fig.21 Compressive Strength (MPa).

(Means with the same symbol letter are not significantly different.)

4.5 Polymerization Shrinkage (%linear)

Using the method illustrated in Figure 24 below, TOKUYAMA measured the polymerization shrinkage of OMICHROMA® FLOW BULK and other bulk fill resin composites. This method can measure shrinkage in the cavity floor when the resin composite is placed into a cavity and exposed to curing light in a clinical procedure. This method permits evaluation of shrinkage under conditions close to those encountered in real clinical settings.

Figure 25 shows the linear polymerization shrinkage of OMICHROMA® FLOW BULK and other commercially available bulk fill resin composites after three minutes of curing light exposure. The data was statistically analyzed using SPSS (version 21, IBM) with one-way ANOVA ($p<0.05$).

The linear polymerization shrinkage of OMNICHROMA® FLOW BULK showed no significant difference compared with Tetric® Power Flow and significantly lower shrinkage than that of SDR® flow+ and Filtek Bulk Fill Flowable in this study.

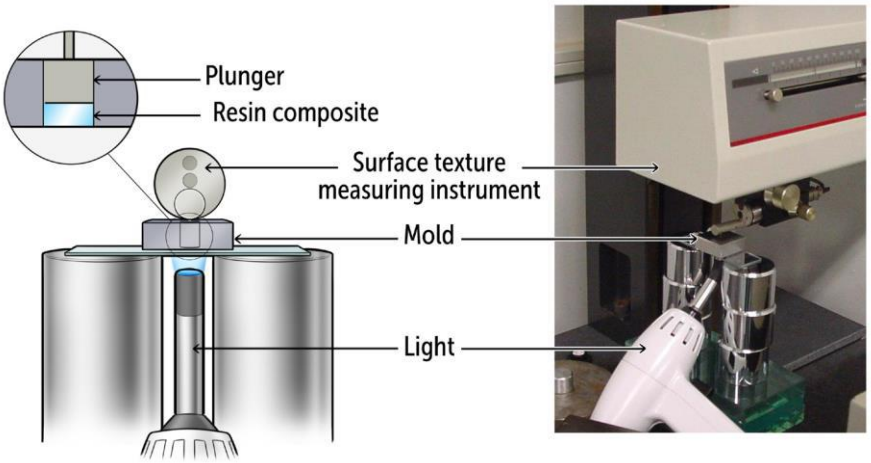


Fig.24 Method of polymerization shrinkage testing.

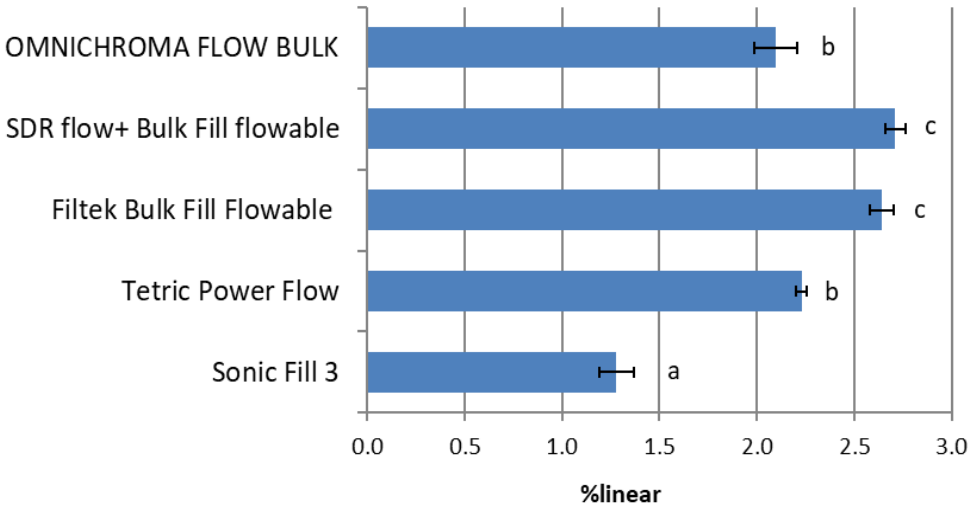


Fig.25　Polymerization Shrinkage (%linear).
(Means with the same symbol letter are not significantly different.)

4.6 Staining Resistance

If the composite resin stains more rapidly than the dentition, the resin becomes less esthetically effective. To account for this, we examined the degree of staining by evaluating the color change between before and after storage in coffee (immersed for 24 hours at 80° C). Color was measured using spectrophotometer (TC-1800MKⅡ : Tokyo Denshoku Corporation , Japan). The stain resistance results are shown in Figure 26. The data was statistically analyzed using SPSS (version 21, IBM) with one-way ANOVA ($p<0.05$).

The extent of staining for OMNICHROMA® FLOW BULK after soaking in coffee was the lowest among commercially available bulk fill resin composites in this study.

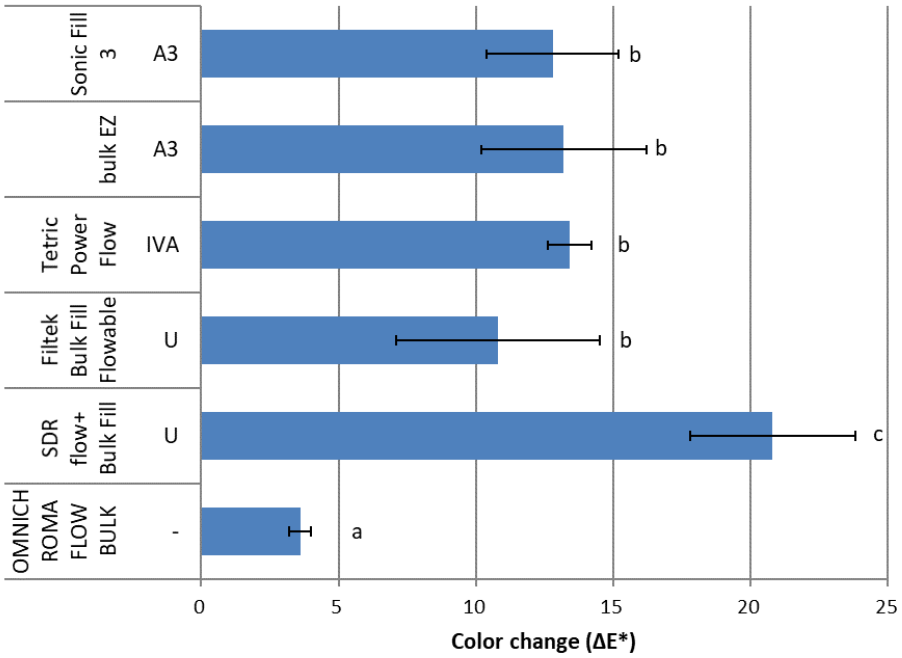


Fig.26 Stain Resistance (ΔE*).

(Means with the same symbol letter are not significantly different.)

4.7 Radiopacity

Generally, radiopacity is determined by the composition of the inorganic filler and the composite's filler content. The radiopacity of a resin composite increases with the amount of high atomic number elements at higher filler content. However, fillers containing large amounts of high atomic number elements tend to have large refractive indices resulting in difficulty in controlling transparency of the resin composite.

The specimens (15 mm in diameter, 1mm in thickness) for radiopacity test were cured according to the manufacturer's recommendation using light-curing unit (LCT, Kerr, 800mW/cm^2). Radiographs of each specimens were taken together with aluminum step wedge using a soft x-ray irradiator (OMC-6010 : Omic corporation , Japan). The radiopacity was calculated as the equivalent thickness of aluminum.

Table.1 shows the radiopacity of commercially available composite resins.

Table.1 Radiopacity of resin composites.

Resin composite	Radiopacity (Al%)
OMNICHROMA FLOW BULK	164
Estelite Bulk Fill Flow	170
Bulk EZ	262
Tetric Power Flow	352
Filtek Bulk Fill flowable	266
SDR flow+ Bulk Fill Flow	327
Sonic Fill 3	286

4.8 Increment Depth

Generally, bulk fill resin composites can be applied to deeper cavities than conventional resin composites. Therefore, higher increment depth is required.
The increment depth was determined in accordance with “depth of cure” of ISO 4049. The height of the cylinder of cured material was measured and divided by two.
Table.2 show relationship between light intensity, curing time and increment depth. OMNICHROMA FLOW BULK is designed to be cured by either a halogen or LED curing-light with a wavelength of 400-500 nm. OMNICHROMA FLOW BULK enables a 3.5mm increment depth by light-curing for 20 seconds with Halogen or LED light-curing unit (light intensity: 800mW/cm^2 or more, wavelength: 400-500nm). Be sure to light-cure OMNICHROMA FLOW BULK and check the time needed for complete hardening of OMNICHROMA FLOW BULK with your light-curing unit before performing the bonding procedure. The following table summarizes the relationship between curing time and increment depth. The longer irradiation time and the higher light intensity, the greater increment depth can be obtained.

Table.2 Relationship between light intensity, curing time and increment depth of OMNICHROMA FLOW BULK.

Light type	Intensity (mW/cm^2)	Curing time (seconds)	Increment depth (mm)
Halogen	600	30	3.7
	800	20	3.6
		30	4.1
LED	800	20	3.5
		30	3.9
	900	20	3.5
		30	4.0
	1000	20	3.6
		30	4.1
	1200	20	3.7
		30	4.2

5. Summary

OMNICHROMA® FLOW BULK is an innovative resin composite utilizing a single-shade system that inherits and improves upon the features of TOKUYAMA's spherical fillers [1-12]. OMNICHROMA®'s Smart Chromatic Technology® is the first of its kind to take advantage of structural color technology in composite dentistry [1-3].

OMNICHROMA® FLOW BULK can be used for bulk-filling without multiple composite layers and shows good color compatibility with all 16 VITA shades, simplifying the restorative procedure, and reducing the potential waste of unused composite in the process.

6. References

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