FGM

Voxelprint ISS

3D Resin

TECHNICAL PROFILE



ISS INTELLIGENT STABILITY SYSTEM

FGM IMPLANTS

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Voxelprint ISS

Resina 3D

1. INTRODUCTION

3D printing technology has been transforming and redefining practices and procedures in dentistry. With continuous research advancements and increased printing process efficiency, high-performance materials have been developed to further facilitate treatments, making them faster, more esthetic, and longer-lasting [1,2].

Among the range of dental materials, 3D printing composites indicated for long-term prostheses have undergone relatively recent development[3]. Since their introduction to the market, the use of these materials in definitive prostheses has been expanding, supported by a growing number of scientific studies demonstrating their durability and performance. Advances in materials, digital tools, and additive manufacturing technologies have improved clinical outcomes and the longevity of restorations[1], as a result, many professionals have integrated the chairside workflow into their clinical routine, an approach that enhances the patient's experience while reducing material consumption, clinical time and treatment costs.

FGM Dental Group, a pioneer in the development and research of dental materials in Brazil, maintaining its legacy of innovation, introduces to the market the Voxelprint Ceramic 3D printing composite, an intelligent (r)evolution in printed composites for long-term single-unit prostheses. This launch raises the standards of esthetics, versatility, stability, and strength, offering additional features to better meet the diverse requirements of modern dental treatments.

We invite you to learn more about the benefits and technical specifications of Voxelprint Ceramic in the following pages. Discover how this material opens new horizons in the dental restoration and prosthetic industry and how we can take the next step together in the development of 3D printing.



Photo: Dr. Luis Fernando Bessel

2. PRODUCT DESCRIPTION

Voxelprint Ceramic is a biocompatible light-curing dental composite, indicated for the fabrication of definitive dental prostheses through additive manufacturing (3D printing) using equipment with LCD (Liquid Crystal Display) or DLP (Digital Light Processing) printing technology, operating at a wavelength of 385 nm or 405 nm.

The material contains approximately 60% (by weight) of inorganic fillers based on silanized glass-ceramic materials in its composition and features the exclusive ISS ("Intelligent Stability System") technology, which provides high shade stability and excellent rheological properties. Additionally, it exhibits high flexural strength and abrasion resistance, making it ideal for the fabrication of long-term single crowns, inlays, onlays, veneers, and implant-supported crowns. Designed for the fabrication of wear-resistant restorations, capable of withstanding occlusal forces, it remains smooth in contact with the opposing teeth, resulting in more durable and comfortable functional restorations for the patient.

Voxelprint Ceramic is a radiopaque material, allowing for easy assessment and identification through radiographic examinations. With unique optical characteristics, it offers three translucency options, ensuring versatility of use, high shine, and surface smoothness, which preserve its esthetic properties.

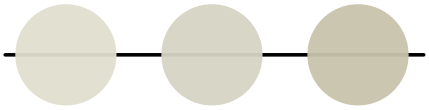
2.1 SHADE AND TRANSLUCENCY SYSTEM

To cover a wide range of clinical situations, the versatile shade system of Voxelprint Ceramic is available in 5 shades compatible with the VITA CLASSICAL® shade guide, along with a bleach tone. The system is the first in the market to include three translucency levels: LT, which has low translucency; MT, which has medium translucency; and HT, which has high translucency, offering 11 work possibilities. The balanced composition of pigments and light refractive index provides the material with esthetic versatility and optical properties that result in extremely natural prostheses. Additionally, it is possible to "characterize" the printed pieces using light-curing dyes or pigments.

HT (HIGH TRANSLUCENCY)

BLEACH B1

MT (MEDIUM TRANSLUCENCY)

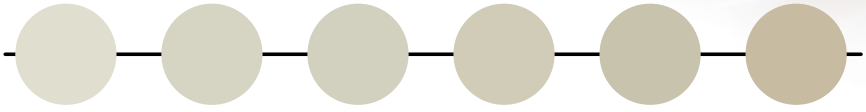


BLEACH B1 A2



Photo: Dr. Marcelo Giordani

LT (LOW TRANSLUCENCY)



BLEACH B1 B2 A1 A2 A3

*Check the available presentations in your country.

3. BASIC COMPOSITION

Silanized radiopaque glass particles (57-63%), methacrylic monomers (35-45%), stabilizers (<2%), photoinitiator system (<2%), and pigments (<1%).

4. MAIN CHARACTERISTICS



HIGH FILLER CONTENT: Contains a high level of inorganic fillers evenly and uniformly distributed within the polymeric matrix, the perfect balance that results in a composite with excellent esthetic and mechanical characteristics.



MECHANICAL STRENGTH: Exhibits high flexural strength and flexural modulus, resulting clinically in greater structural integrity, increased durability, and functionality of the printed prosthetic piece, additionally, the balance between hardness and flexural modulus provides resilience to the material, preventing wear on the opposing tooth



SHADE STABILITY: Due to the exclusive ISS ("Intelligent Stability System") technology, which combines an efficient photoinitiator system, a high filler percentage, and the homogeneous distribution of particles, Voxelprint Ceramic offers excellent shade stability in all aspects.



MINIMAL SEDIMENTATION: The product exhibits minimal sedimentation in the printing VAT, ensuring easy handling, stability and appropriate rheological properties for efficient and precise printing.



ESTHETIC VERSATILITY: With three translucency levels, it enables the clinician to address a wide range of clinical cases, from minimally invasive prostheses to full crowns on teeth or implants.



HIGH SHINE: Excellent shine and surface smoothness, with polishing easily achieved using finishing and polishing systems for composites. Easy characterization with light-curing makeup and pigments, providing highly esthetic and natural pieces.



FLUORESCENCE: Balanced fluorescence with natural teeth, maintaining stability under different lighting conditions.



RADIOPACITY: With radiopaque characteristics, it allows for control and identification of the material in radiographic exams for evaluation and monitoring.



PRINTING SPEED: Integrated into a digital workflow, it provides optimized clinical time, with fast printing and curing times, offering excellent cost-effectiveness for the patient, dentist, and dental prosthesis Technician.

5. PROPERTIES

5.1 MICROSTRUCTURAL AND INORGANIC CONSTITUENT CONTENT ANALYSIS

The microstructural evaluation of composite resins plays a crucial role in understanding the behavior and performance of these materials. The microstructure, that is, the internal organization at a microscopic scale, directly influences the mechanical, physical and chemical properties of the composites, impacting their durability, esthetics, and biocompatibility.

In this test, 3 different manufacturers of composites indicated for printed definitive restoration of shade (Bleach) were selected: (A) Voxelprint Ceramic, (B) Competitor 1, (C) Competitor 2. For this evaluation, rectangular test specimens (15 x 5 x 3 mm) were printed as shown in figure 01, positioned horizontally relative to the printing bed, using a printer (Creality, Halot Sky). The test specimens were printed with a layer thickness of 0.10 mm.

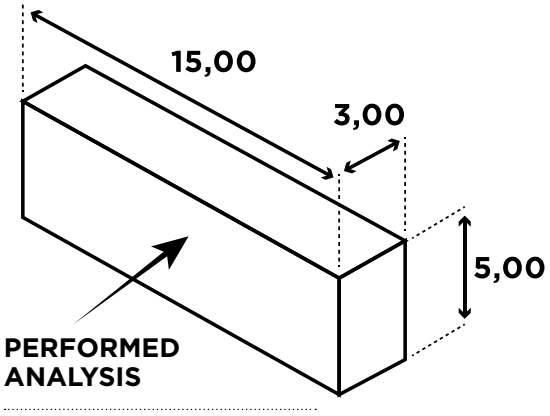


Figure 01: Geometry of the test specimens for microstructural evaluation and illustration of the direction of the analysis performed.

After printing, the samples were removed from the printing bed. Then, using a gauze dampened with 96% alcohol, the test specimens were cleaned. After cleaning with alcohol, the samples were dried using an air jet for 1 minute. The post-curing of the test specimens was performed using a curing chamber (Creality, UW-02) where the test specimens were post-cured for 30 minutes. After the curing step, the samples were sanded, using metallographic sandpaper with a 600-grit size and polished with polishing paste (Diamond Excel Ultrafine - FGM Dental Group) and a felt disk (Diamond Flex – FGM Dental Group), followed by a final cleaning using a felt disk without polishing paste.

Before performing the microstructural analysis, the test specimens were metallized to obtain an image with better definition.

The microstructural analysis was performed using a field emission scanning electron microscope (FE-SEM-Zeiss Gemini) with an attached EDS probe. The images were captured using the EDS probe, with a magnification of 500X. Image 01 shows the results obtained.

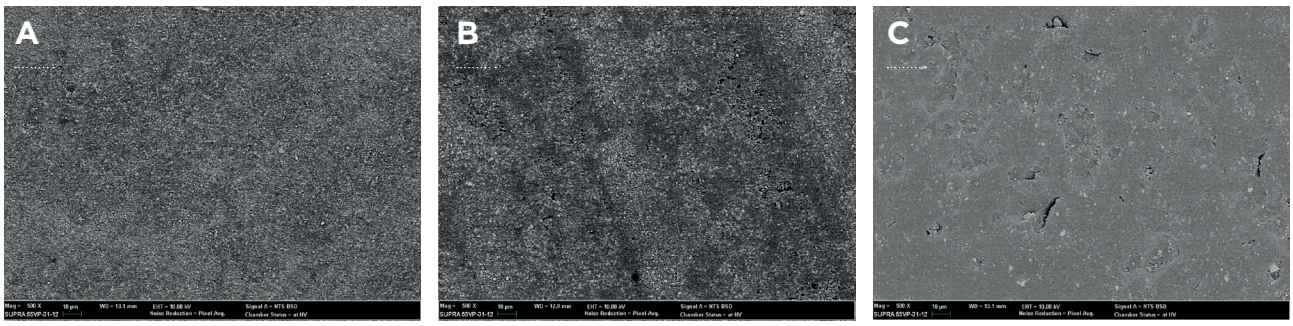


Image 01: Image 01: Scanning electron microscope (FE-SEM) image with a magnification of 500x, showing the microstructure of the materials. (A) VOXELPRINT CERAMIC, (B) Competitor 1, (C) Competitor 2.

Source: Prof. Dr. Rodrigo Reis / Universidade Estácio de Sá/Idomed – RJ

As it can be seen in Image 01, there is a significant difference in the quantity and distribution of the glass-ceramic fillers, depending on the material. The fillers can be observed as the lighter spots in the images.

A portion of the cured samples from each composite was used for thermogravimetric analysis, aimed at characterizing the amount of inorganic constituents. The thermogravimetry equipment consists of a high-precision balance that continuously monitors the sample's mass during heating. The mass loss over time is recorded on a graph called a thermogram.

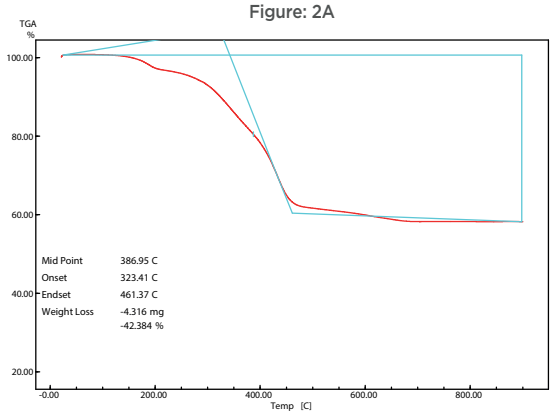
From the cured sample, a quantity of 12 mg was extracted for each composite and placed in a device of a thermogravimetric analysis equipment (Shimadzu,TGA-50). The tests were performed at a heating rate of 10 °C/min, up to a temperature of 900 °C, a temperature considered sufficient for all organic constituents to be calcined, eliminating them from the remaining material in the equipment device, leaving only the inorganic constituents. The percentage of inorganic constituents is calculated according to the following equation:

% inorganic = 100 - Mass loss.

Figures 2A, 2B, and 2C show the graphs of the results obtained from the thermogravimetric tests.

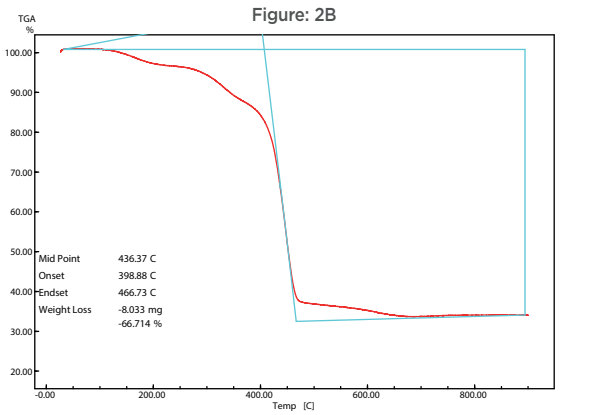
It is possible to observe that VoxelPrint Ceramic composite (image 01 A) presents better distribution, as well as a higher content of inorganic elements (glass-ceramic fillers in their majority) in the samples analyzed, an aspect evidenced in the microstructural analysis as well as in the evaluation of inorganic constituents via thermogravimetry (Figures 2A, 2B, and 2C). This quantity directly impacts the physical properties of the composite, providing greater esthetics, durability, abrasion resistance, and mechanical properties.

Figure: 2A



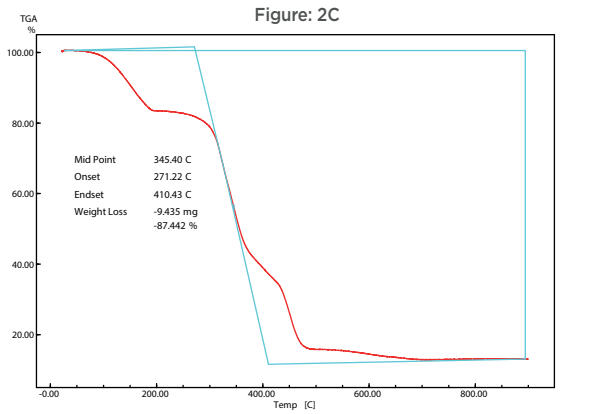
Voxelprint Ceramic
57.8% of inorganic fillers

Figure: 2B



Competitor A
33.3% of inorganic fillers

Figure: 2C



Competitor B
12.6% of inorganic fillers

Figures 2A, 2B, AND 2C: Thermograms of the different composites tested, showing the mass loss results obtained.

Source: Prof. Dr. Rodrigo Reis / Universidade Estácio de Sá/Idomed – RJ

5.2 **FLEXURAL STRENGTH**

Flexural strength is a mechanical property that allows for the evaluation of a composite's resistance to fracture. It is one of the properties that demonstrate the quality of the composite formed after curing, resulting from the important relationship between the polymer matrix, the fillers used and the capability of the photoinitiators in converting monomers into polymer[4].

In this test, 3 different manufacturers of composite indicated for printed definitive restoration of shade (Bleach) were selected: (A) Voxelprint Ceramic, (B) Competitor 1, (C) Competitor 2. For this evaluation, 10 test specimens in bar shape (25 x 2 x 2 mm) were printed as shown in figure 02, positioned vertically relative to the printing bed, using a printer (Creality, Halot SKY). The test specimens were printed with a layer thickness of 0.10 mm.

After printing, the samples were removed from the printing bed. Then, using a gauze dampened with 96% alcohol, the test specimens were cleaned. After cleaning with alcohol, the samples were dried using an air jet for 1 minute. The post-curing of the test specimens was performed using a curing chamber (Creality, UW-02) where the test specimens were post-cured for 30 minutes, and then stored in deionized water (24 hours at 37º C).

The tests were performed according to the configuration shown in figure 03, using a universal mechanical testing machine (EMIC DL-2000), coupled with a 50 kgf load cell and a deflectometer to measure the deformation of the test specimen, applying a speed of 1 mm/min until fracture. The flexural strength and flexural modulus values were recorded. This test followed the recommendations of ISO 10477.

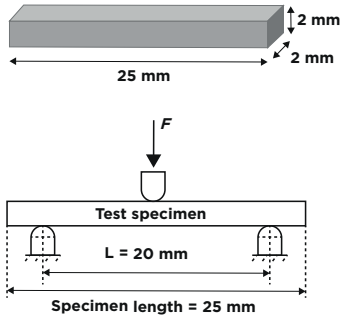
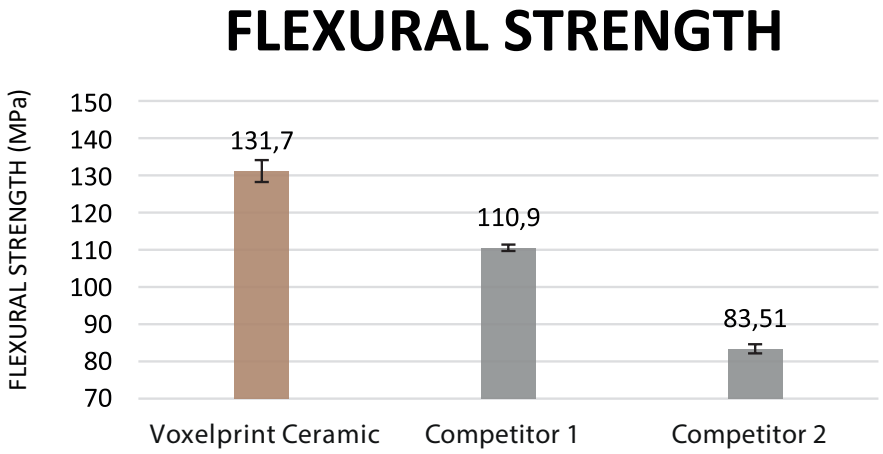


Figure 03: Geometry of the test specimens for the flexural test, and setup for conducting the flexural strength test.



Graph 1. Three-point bending strength (mean and standard deviation in MPa) of different composites (n=10).

Source: Prof. Dr. Rodrigo Reis / Universidade Estácio de Sá/Idomed – RJ

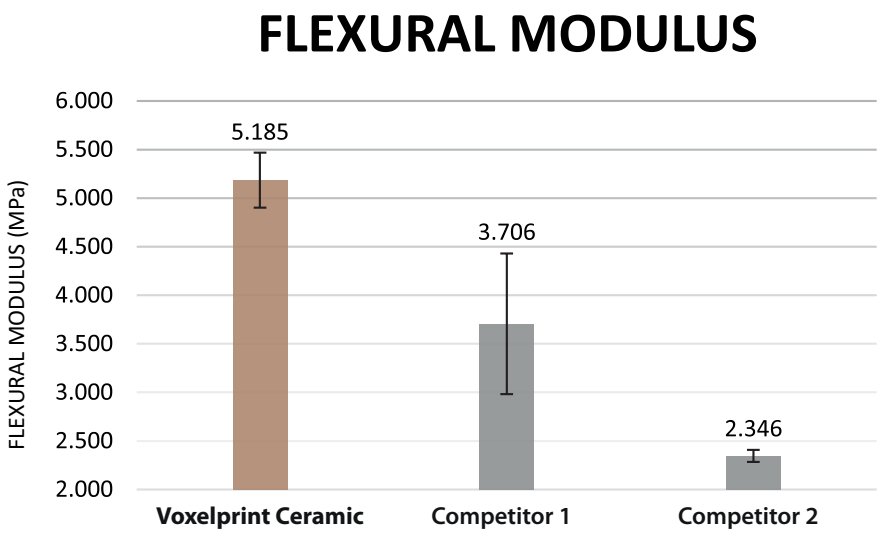
The result of Graph 01 shows that Voxelprint Ceramic achieved excellent flexural strength, surpassing the products already available on the market (Competitor 1 and Competitor 2). This result demonstrates a greater ability to withstand applied flexural forces, a fundamental characteristic for restorations to maintain their structural integrity and functionality over time.

5.3 **FLEXURAL MODULUS**

The flexural modulus, also known as the modulus of elasticity in bending, is a mechanical property that describes the stiffness of a material when subjected to bending. It represents the relationship between the applied stress during the flexural test and the resulting elastic deformation. The flexural modulus is a measure of the material's stiffness and is often used to compare the flexural strength of different materials[4].

Just like flexural strength, the flexural modulus reflects the intrinsic property of a material to withstand the pressure imposed by masticatory forces.

The same test specimens used for flexural strength were also used for the evaluation of the flexural modulus. For this, in each sample during the flexural test, the software of the universal testing machine (EMIC DL - 2000) captures the stress and deformation at each loading point. The data obtained from the straight portion of the stress versus deformation curve were used to calculate the flexural modulus.



Graph 2: Flexural modulus (mean and standard deviation in MPa) of different 3D printing composites (n=10).

Source: Prof. Dr. Rodrigo Reis / Universidade Estácio de Sá/Idomed – RJ

The result of Graph 2 demonstrates that VOXELPRINT Ceramic presents a higher flexural modulus compared to the main competitors (Competitor 1 and Competitor 2). This characteristic indicates that the material is stiffer and less likely to deform under load, which may result in better performance and a longer lifespan.

5.4 **VICKERS MICROHARDNESS (HV)**

The evaluation of Vickers microhardness provides information about the material's resistance to wear and abrasion. A higher microhardness value indicates greater resistance to these conditions, a desirable characteristic in materials for permanent restorations.

In this test, 3 different manufacturers of composites indicated for printed definitive restoration were selected, of shade (Bleach), as shown in Graph 03, being Voxelprint Ceramic, competitor 1 and competitor 2.

For each type of composite selected, 5 test specimens were printed, in disk shape, according to the dimensions presented in Figure 04, positioned vertically relative to the printing bed, using a printer (Creality - Halot SKY). The test specimens were printed with a layer thickness of 0.10 mm.

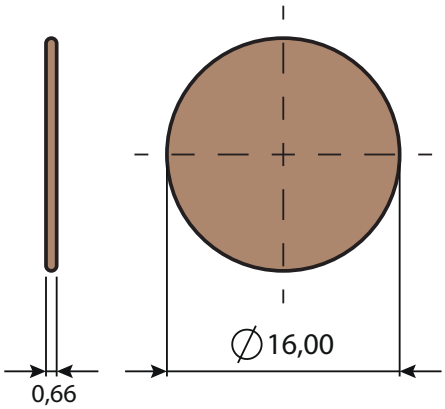


Figure 04: Geometry of the disk-shaped test specimen for Vickers microhardness evaluation.

After printing, the samples were removed from the printing bed. Then, using a gauze dampened with 96% alcohol, the test specimens were cleaned. After cleaning with alcohol, the samples were dried using an air jet for 1 minute. Then, the test specimens were post-cured for 30 minutes, using a curing chamber (Creality, UW-02).

The samples were sanded, using metallographic sandpaper with a 600-grit size and polished with polishing paste (Diamond Excel Ultrafine - FGM Dental Group) and a felt disk (Diamond Flex – FGM Dental Group), followed by a final cleaning using a clean felt disk without polishing paste.

The Vickers microhardness test was performed using a digital microhardness tester (Panambra Zwick, MV2000A). This test involves the use of a diamond indenter, shaped like a small pyramid, which, through the application of a force (0.98 N was used for this test), creates an indentation on the material's surface. With the help of a microscope attached to the microhardness tester, the diagonals of the indentation left on the material are measured, as shown in Figure 05.

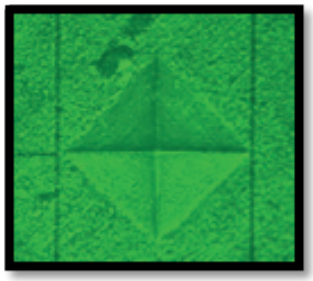
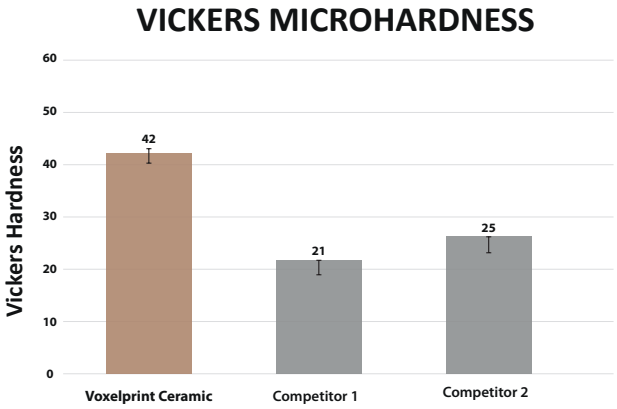


Figure 05: Measurement of one of the diagonals of the indentation made on one of the tested materials.



Graph 03: Microhardness HV of different 3D printing composites.

Source: Prof. Dr. Rodrigo Reis / Universidade Estácio de Sá/Idomed – RJ

The result of Graph 03 demonstrates that the Voxelprint Ceramic composite showed a much higher Vickers Hardness (HV) compared to the main competitors. This characteristic indicates that the material has greater resistance to wear and abrasion, which contributes to the longevity of the restoration, reducing the need for frequent repairs or replacements, additionally, it maintains its shape and shine over time, ensuring a more durable esthetic finishing.

5.5 **SHADE STABILITY**

Post-curing shade stability

The shade stability of a composite refers to the material's ability to maintain its original shade over time, even when exposed to factors such as light, heat, humidity, and chemicals. This characteristic is especially important in esthetic applications, such as dental restorations, where appearance is crucial. In this test, 3 different composite manufacturers indicated for printed definitive restoration were selected, of shade (Bleach), Voxelprint Ceramic, Competitor 1, and Competitor 2.

For each type of composite selected, 3 test specimens were printed, in a disk shape, according to the dimensions presented in Figure 06, positioned vertically relative to the printing bed, using a printer (Creality- Halot SKY). The test specimens were printed with a layer thickness of 0.10 mm.

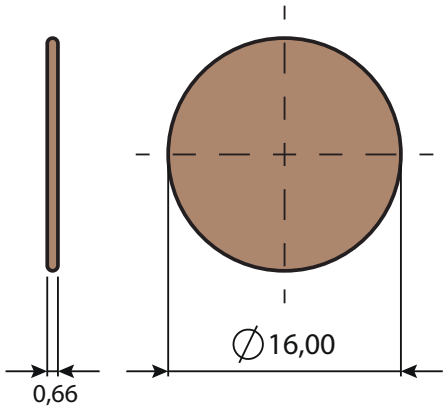


Figure 06: Geometry of the test specimens for shade evaluation.

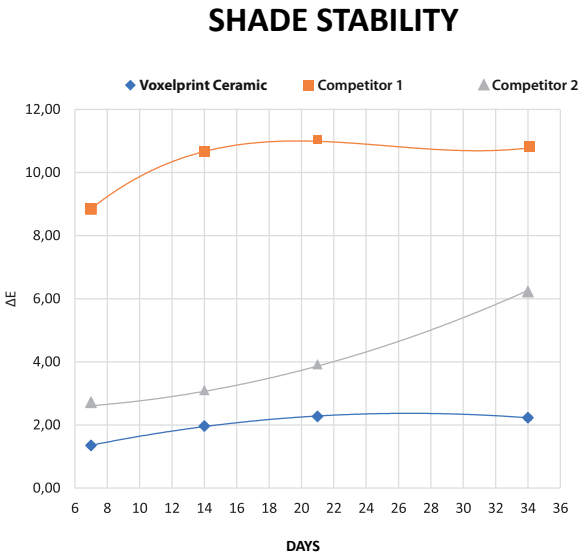
After printing, the samples were removed from the printing bed. Then, using a gauze dampened with 96% alcohol, the test specimens were cleaned. After cleaning with alcohol, the samples were dried using an air jet for 1 minute and polished with polishing paste (Diamond Excel Ultrafine - FGM Dental Group) and a felt disk (Diamond Flex – FGM Dental Group), followed by a final cleaning using a clean felt disk without polishing paste. The post-curing of the test specimens was performed using a curing chamber (Creality, UW-02) where the test specimens were post-cured for 30 minutes.

The test specimens were stored in deionized water for 24 hours for immediate shade measurement using an X-Rite SP62 spectrophotometer, in the CIE L*a*b scale, as shown in images A, B, and C. Then, the test specimens were placed in a small container with deionized water and exposed to sunlight. Shade measurements were taken at 7, 14, 21, and 34 days of sun exposure, to evaluate shade variation.



Images A, B, and C: Spectrophotometry equipment used for shade measurement of the test specimens.

To compare the shade with the initial standard, the Delta E value was calculated. The comparison was performed on the same test specimen. The obtained values represent an average calculated from the 3 test specimens manufactured for the same composite and sun exposure time.



Graph 04: Shade variation graph at 7, 14, 21, and 34 days.

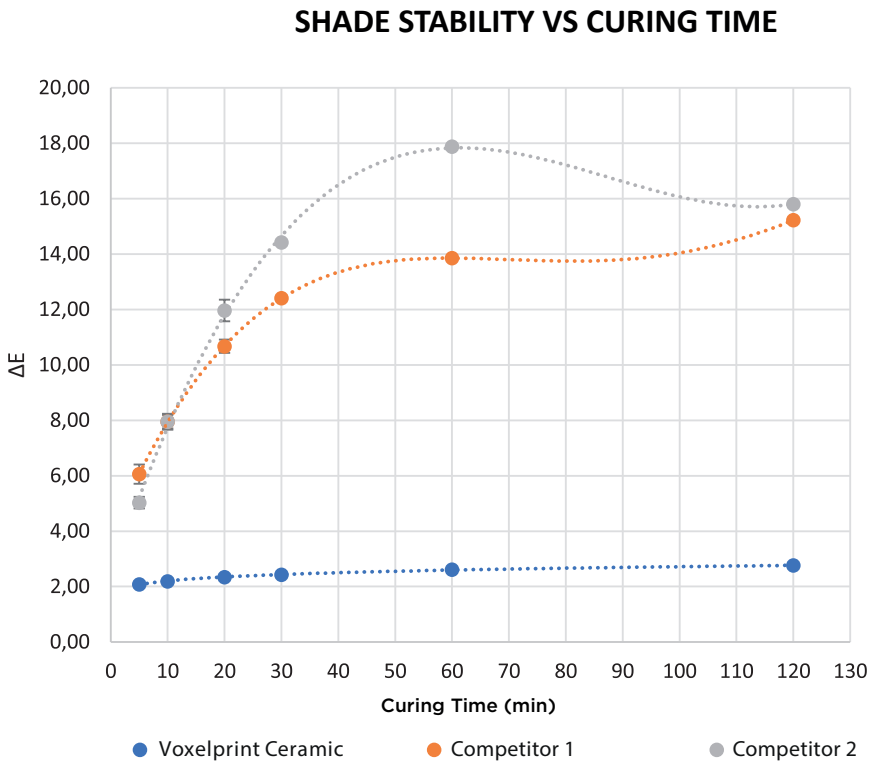
Source: Prof. Dr. Rodrigo Reis / Universidade Estácio de Sá/ Idomed – RJ

VoxelPrint Ceramic exhibited the lowest shade variation among the main competitors, demonstrating the material's chromatic stability when exposed to sunlight over the evaluated periods. The total shade change is expressed by the Delta E parameter, which quantifies the difference between the initial and final shades. A Delta E value below 3.0 is considered to indicate good shade stability, meaning the change is imperceptible to the naked eye. Values above 3.0 may be perceived as a shade deviation, which can compromise the composite's esthetics[5].

Shade stability depending on curing time

Using the same methodology described above, shade stability depending on curing time was evaluated. An initial shade measurement was performed for each test specimen, using the X-Rite SP62 spectrophotometer in the CIE L*a*b scale. Then, the test specimens were post-cured using a curing chamber (Creality, model UW-02) with the following times: 5, 10, 20, 30, 60, and 120 minutes.

The comparison is always performed on the same test specimen. The obtained values represent an average calculated from the 3 test specimens manufactured with the same composite and curing time.



Graph 05: Delta E variation graph depending on curing time

Source: Prof. Dr. Rodrigo Reis / Universidade Estácio de Sá/Idomed – RJ

The results presented in Graph 05 show that the VoxelPrint Ceramic material exhibits superior shade stability compared to the competitors, with a Delta E below 3, even after 2 hours of post-curing. The competitors displayed significant shade variation, with a Delta E above 14 after 2 hours of curing, meaning they are more sensitive to shade variation during the post-curing stage. For practical purposes, if the user does not properly configure the post-curing equipment in the case of competitor products, the shade may substantially deviate from the shade guide declared by the manufacturer.

5.6 **RADIOPACITY**

Radiopacity is essential to ensure that composites can be properly monitored and evaluated for material integrity and marginal adaptation. In this test, 3 different composite manufacturers indicated for printed definitive restoration were selected, with the same shade (Bleach), being Voxelprint Ceramic, Competitor 1, and Competitor 2.

For each type of composite selected, 3 test specimens were printed, in a disk shape, according to the dimensions presented in Figure 07 (following the specifications described in ISO 4049), positioned vertically relative to the printing bed, using a printer (Creality model Halot SKY). The test specimens were printed with a layer thickness of 0.10 mm.

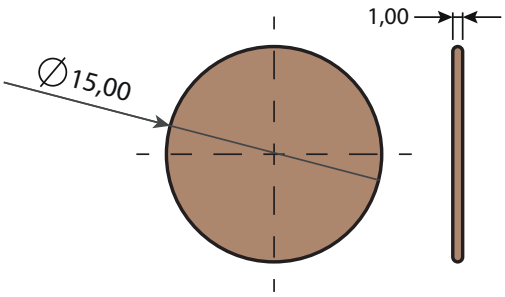


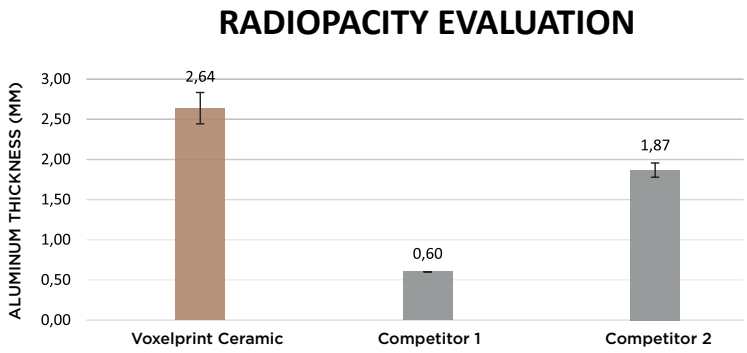
Figure 07: Geometry of the test specimens for radiopacity degree evaluation.

After printing, the samples were removed from the printing bed. Then, using a gauze dampened with 96% alcohol, the test specimens were cleaned. After cleaning with alcohol, the samples were dried using compressed air. Then, the test specimens were post-cured for 30 minutes, using a curing chamber (Creality, model UW-02).

For this test, a graded aluminum scale with 10 different thicknesses is used, with a 1 mm increment for each thickness (1 to 10 mm). This scale serves as a standard to be radiographed along with the sample.

The samples were radiographed using a digital X-ray machine. Along with the aluminum scale, the test specimens were positioned at a distance of 350 ± 50 mm from the radiation emitter, then the exposure time was adjusted until a clear image was produced on the equipment's software.

Subsequently, the image was exported to Adobe Photoshop (Adobe), where the darkest scale was defined as 0, while the lightest scale was defined as 255. In this way, optical density values were measured for each step of the scale and for the specimen under study. Then, a graph was generated in Microsoft Excel (Microsoft) relating the optical density of the aluminum scale (Y-axis) to its thickness (X-axis), so, a linear regression was performed, obtaining a first-degree equation. The optical density data of the samples were assigned as the Y value in the equation, the value of "X" was then determined, corresponding to a direct equivalence of the aluminum scale thickness.



Graph 06: Radiopacity evaluation graph.

Source: Prof. Dr. Rodrigo Reis / Universidade Estácio de Sá/Idomed – RJ

Voxelprint exhibited superior radiopacity compared to the main competitors. According to ISO 4049 standards, this result demonstrates that the composite has a radiographic visibility equivalent to a 2.64 mm thickness of aluminum. This indicates that the composite is sufficiently radiopaque to be clearly identified in radiographic images, allowing dentists to assess the presence and integrity of restorations.

5.7 **CYTOTOXICITY**

The cytotoxicity of a product is determined by the percentage of cells that remain viable after exposure to the extract. A test item is considered cytotoxic if the cell viability resulting from 24 hours of exposure of the cells to the extract is below 70%.

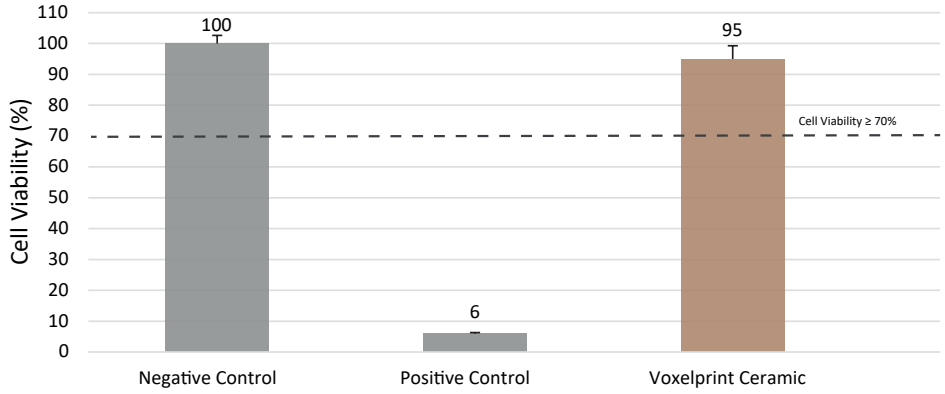
In this study the extract of the test item Voxelprint Ceramic was used and compared with the extracts of the positive and negative control samples. To ensure the validity of the study, the extraction vehicle (cell control), as well as a negative (polyethylene – non-cytotoxic) and a positive (latex – cytotoxic) control were tested.

The reference groups (negative and positive controls) and the test group were subjected to the extraction process for 72 hours. The test item did not alter the physicochemical properties of the extraction vehicle.

The extract obtained from the test item and control samples was applied directly to the cell monolayer, a mammalian cell culture – L929 mouse fibroblasts, and left for 24 hours. After the exposure period MTS/PMS was added for 120 minutes. The MTS/PMS dye is incorporated into the cells, producing a specific color, detected by the spectrophotometer at a wavelength of 490 nm. The intensity of the color resulting from cellular incorporation will be proportionally equal to the number of viable cells in the culture.

According to Graph 07, after the experimental period the cells exposed to the extract of the test item Voxelprint Ceramic showed cell viability above 70%. Based on the method adopted for the study, the test item was considered non-cytotoxic.

The study was conducted in accordance with the standards: ISO 10993-5:2009 and ISO 10993-12:2021, which are intended for the determination of the biocompatibility of medical devices.



Graph 07: Cell viability obtained for the items, Voxelprint Ceramic, positive control, and negative control, demonstrating that above 70%, according to the method adopted for the study, the test item (Voxelprint Ceramic) was considered non-cytotoxic.

Source: The information above is based on a scientific cytotoxicity study of Voxelprint Ceramic conducted by: Medlab Produtos Diagnósticos LTDA, Brazil.

6. CLINICAL CASE

Author: Dr. Marcelo Giordani

Main complaint: Smile esthetics







1 | Initial appearance showing wear and unsatisfactory restorations.
2 | Intraoral view of the upper arch.
3 | Intraoral view after prosthetic preparations for veneers and crowns

4 | Printed pieces with Voxelprint Ceramic composite in Bleach-HT shade, positioned on the model.
5 | Try-in of the veneers and crowns in the mouth.







6 | Immediate appearance after cementation of the prosthetic pieces



7 | Lateral view of the upper arch after cementation



8 | Frontal view and final appearance of the smile

7. REFERENCES

1- Daghrery A. Shade Stability, Gloss Retention, and Surface Roughness of 3D-Printed versus Indirect Prefabricated Veneers. J Funct Biomater. 2023 Sep 28;14(10):492. doi: 10.3390/jfb14100492.

2 - Temizci T, Bozoğulları HN. Effect of thermocycling on the mechanical properties of permanent composite-based CA-D-CAM restorative materials produced by additive and subtractive manufacturing techniques. BMC Oral Health. 2024 Mar 14;24(1):334. doi: 10.1186/s12903-024-04016-z.

3 - Sahin Z, Ozer NE, Yıkıcı C, Kılıçarslan MA. Mechanical Characteristics of Composite Resins Produced by Additive and Subtractive Manufacturing. Eur J Prosthodont Restor Dent. 2023 Aug 31;31(3):278-285. doi: 10.1922/EJPRD_2478Sahin08.

4 - Phillips RW, Anusavice KJ (1998). Propriedades mecânicas dos materiais dentários In: Phillips RW, Anusavice KJ.

5- Paravina RD, Ghinea R, Herrera LJ, Bona AD, Igiel C, Linninger M, Sakai M, Takahashi H, Tashkandi E, Perez Mdel M. Shade difference thresholds in dentistry. J Esthet Restor Dent. 2015 Mar-Apr;27 Suppl 1:S1-9. doi: 10.1111/jerd.12149. Epub 2015 Apr 17

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