

HUGE

PMMA BLOCK Product Research Report

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Materials Co.
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Introduction

This report aims to provide an in-deep analysis of the many core selling points of PMMA Block to provide a solid and powerful basis for the promotion of the product. Based on detailed data analysis and empirical research, this report will demonstrate the significant benefits of PMMA Block in terms of rich functionality, beautiful color, excellent performance and strong durability completely.

First, from a **comprehensive** perspective, PMMA Block demonstrates strong design compatibility and a wide range of application areas. As a kind of high performance dental repair material, it is widely used in many fields such as denture repair, denture diagnosis and disease treatment. At the same time, it meets ISO22112(synthetic resin teeth), ISO10477 (temporary crown and bridge), ISO20795-1 (denture base resin) and other international standards, as a unique quality protection barrier. PMMA Block can also be compatible with a variety of engraving equipment on the market. This allows the dentist or technician to flexibly respond to a variety of complex restoration needs during the process.

Secondly, in terms of **strong** performance, the high strength and high wear-resistance of PMMA Block make it able to resist various abrasions in daily life, thus extending the life of the repaired denture. After 10,000 rigorous cold and hot cycle tests, the strength of the product can still be maintained above 100Mpa. In addition, PMMA Block also has good biocompatibility. It can help to reduce the occurrence of allergic reactions and inflammation and bring a more comfortable experience for patients.

In terms of color **aesthetics**, PMMA Block offers wide choices of colors and highly accurate color reproduction. This allows the repaired denture to be perfectly integrated into the patient's oral environment, achieving a natural and beautiful effect. Its unique nano-materials give the material a strong opalescent color, showing chameleon-like color changes under different backgrounds, further enhancing the aesthetics. In addition, the color stability of PMMA Block is also excellent. After prolonged used, it can still maintain the color, eliminating patients' concerns about color changes caused by aging materials.

In terms of **durability**, PMMA Block has similar wear-resistance to DCL resin teeth. At the same time, its ultra-low water absorption and low dissolution value proved the high stability of the material. Even under the action of 70N bite force, after 2.4 million times of chewing simulation, it can still maintain the shape integrity, and no fracture phenomenon. It is equivalent to the clinical use time of up to 10 years.

In summary, the CAD/CAM PMMA Block has demonstrated significant advantages in terms of comprehensive functionality, beautiful color, excellent performance and durability, making HUGE PMMA the ideal choice in the field of dental restoration.



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PMMA BLOCK Product Research

1. Overview of PMMA BLOCK features

Comprehensive

▶ Product Name:

PMMA BLOCK

▶ Structure composition:

PMMA Block is mainly made of polymethyl methacrylate (PMMA) and methyl methacrylate (MMA). A small amount of pigment is added.

PMMA Block is a CAD/CAM series of products with diversified and personalized specifications and colors. It can match various types of dental cutting equipment used in the market, and provide a choice of different structures and color effects such as single layer, transparent and multi-layer gradient.

▶ Intended use

The main use is to make movable or temporary dental structures such as crowns and Bridges suitable for the use of CAD/CAM cutting techniques. Indications for use: temporary anterior and posterior crowns, temporary anterior and posterior Bridges, implant guides, movable dentures, movable structures for therapeutic restoration (night molar occlusal pads, occlusal splints or occlusal guides)

- ✓ Temporary crown and bridge (A1-D4, BL1-BL4, A0 recommended, single- or multi-layer gradient options available)
- ✓ Dentition for removable dentures (A1-D4, BL1-BL4, A0 recommended, single- or multi-layer gradient options available)
- ✓ Removable denture base (recommended 2S, 3S, 2ST, 3ST, Pink, Brown)
- ✓ Integrated removable denture (any combination of base color and dentition color is recommended, such as 2SA1,3STA2, etc.)
- ✓ Diagnostic dentures (A1-D4, BL1-BL4, A0 recommended, single- or multi-layer gradient options available)
- ✓ Overlay implant denture (recommended any combination of base color and dentition color, such as 2SA1,3STA2, etc.)
- ✓ Immediate loading (A1-D4, BL1-BL4, A0 recommended, single- or multi-layer gradient options available)
- ✓ Planting guide (Clear recommended)
- ✓ Occlusal splint (Clear, Red, Orange, Blue recommended)
- ✓ Casting applications, such as casting models as steel brackets (Clear recommended)



▶ **Product reference standard**

- ① ISO 10477:2018(E) Dentistry -Polymer-based crown and veneering materials
- ②ISO 22112:2017Dentistry — Artificial teeth for dental prostheses
- ②ISO20795-1:2013Dentistry — Base polymers Part 1: Denture base polymer
- ④YY/T0826-2011 牙科临时聚合物基冠桥材料
- ⑤JIS6518：2011 アクリル系歯冠用レジン（Dental acrylic resins for crown and bridge）

International multi-standard quality-control methods across categories are adopted to meet the quality control standards of synthetic resin teeth, temporary crown and bridges, denture base resins and other products. By this approach HUGE PMMA Block have established a quality protection barrier. It also ensures the quality stability of products with the highest standard requirements.

▶ **Operational principle**

Based on STL and other types of files designed by CAD, PMMA Block uses dental cutting equipment (dry cut or wet cut) to produce different shapes of crown, bridge, denture, base, implant guide or night molars jaw pad and other products with different functions. After polishing, it is applied to the mouth to improve the oral condition.

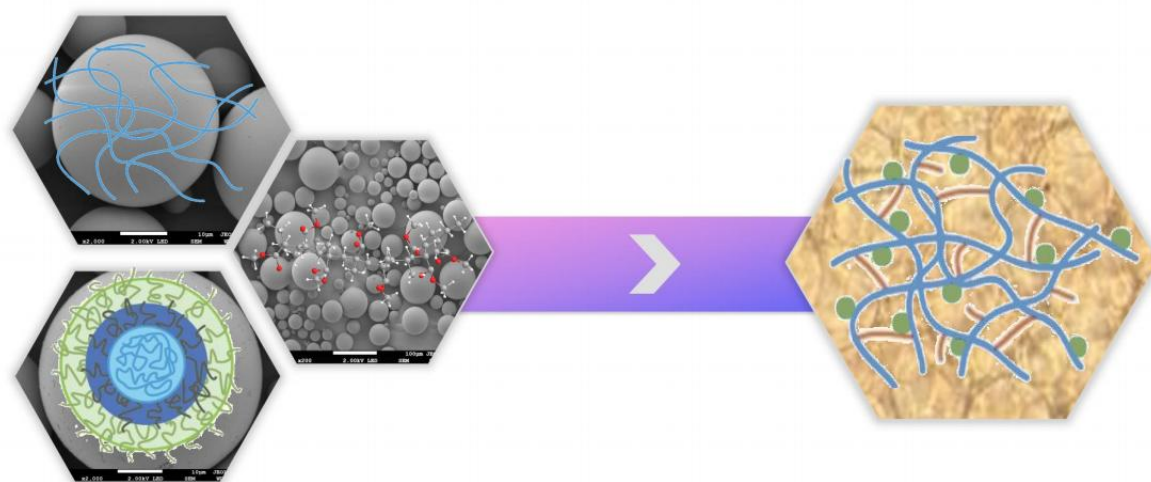
2.Excellent advantages of PMMA BLOCK material

Strong

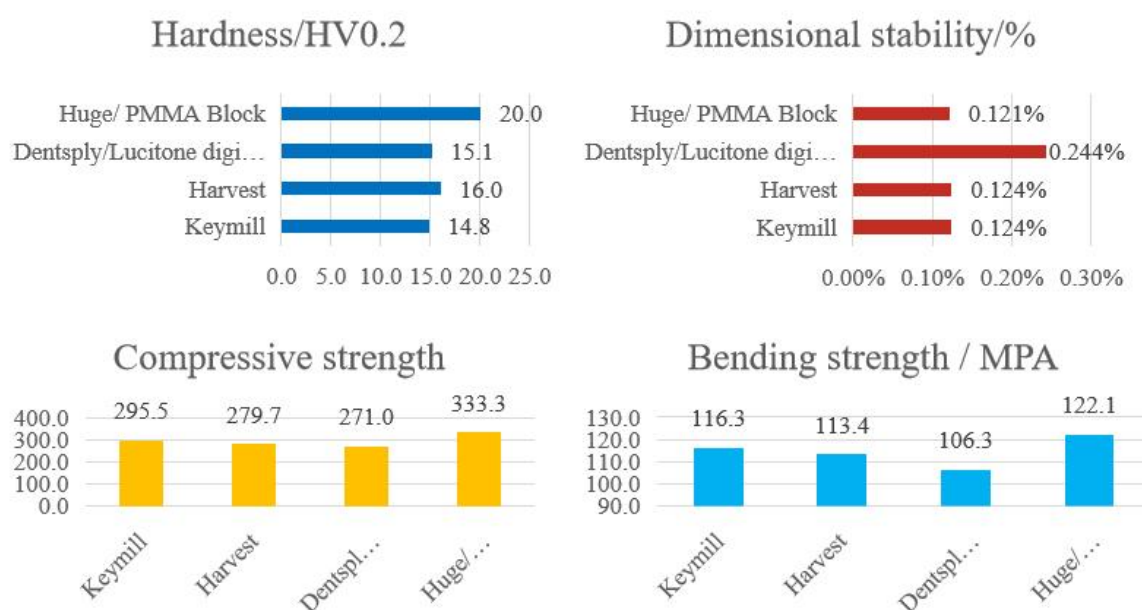
The product name of PMMA Block comes from the fact that its main raw material is (Poly)methylmethacrylate, referred to as PMMA.

PMMA materials are divided into different types according to the production process and performance requirements, including PMMA homopolymer powder and PMMA copolymer powder. The homopolymer powder is made up of the MMA material. The difference between the different brand materials is mainly reflected in the diameter and molecular weight. The larger the molecular weight, the smaller the size of the particle, the density of the product and the higher the intensity. The copolymer powder is made through the mixture of his materials, whose main purpose is to further strengthen the mechanical energy of the material, such as toughness and wear-resistance.

HUGE PMMA Block product uses raw materials from imported first-tier brands. It selects spherical materials with particle size less than 50um (D50) and molecular weight less than 1.2 million, and adds rubber-grafted PMMA copolymers to these materials to increase the impact strength. At the same time, these materials also contain DCL materials to achieve network crosslinking. Such a design can guarantee the HUGE PMMA Block product with high strength, high wear-resistance, low water absorption and low dissolution, and high oral wearing stability, which can improve the clinical service life.



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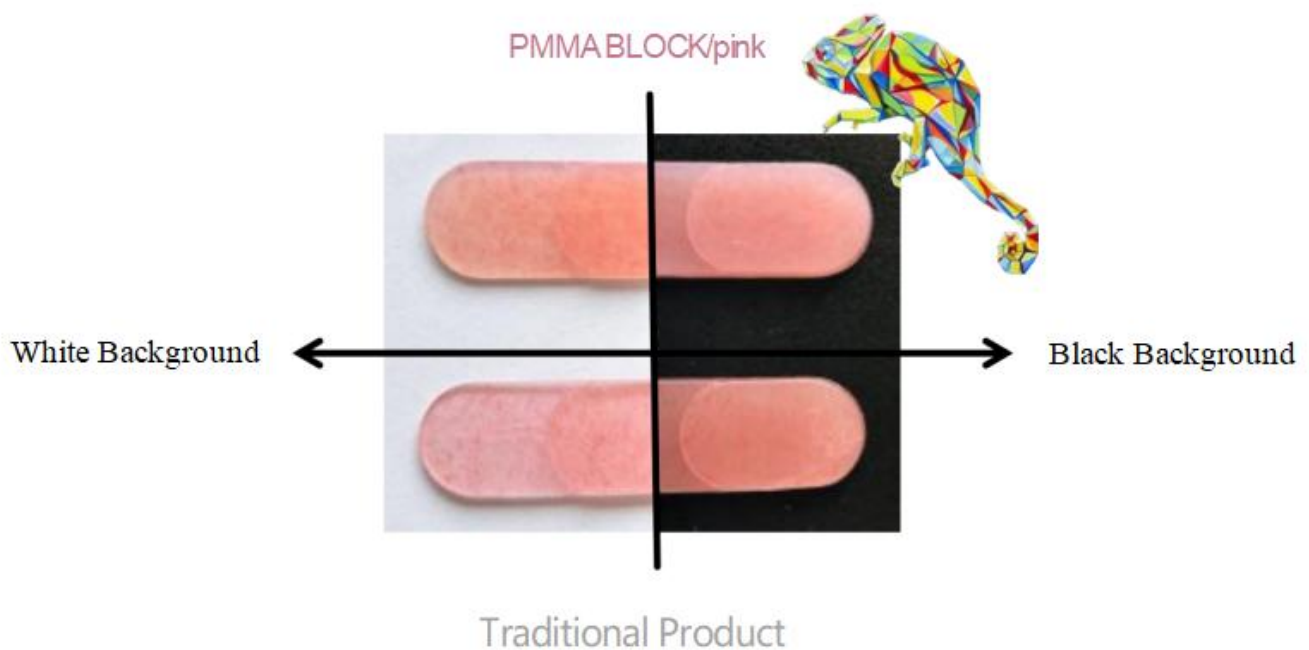


3.PMMA Block's unique aesthetic effect display

Aesthetics

PMMA Block plays a pivotal role in the application of digital full denture, which not only provides performance assurance, but also carries the deep expectation of aesthetic restoration results. Our PINK series is especially suitable for the fine carving of the base part. Its color design is the essence of bionic, striving to achieve the perfect integration with the natural gums. To further enhance the authenticity, we specially added fiber components to the material. In addition, according to the gum color characteristics of different people, we have carefully developed products with different penetration and brightness to meet individual needs.

In particular, the PINK series incorporates a unique nanomaterial. The particle size of this material is much smaller than the visible wavelength range (400nm to 700nm), so when visible light passes through the material, it will have a significant scattering effect. This makes the color seem to be endowed with the clever shape of light, like the sun falling on the clouds after the rain, both gentle and vivid, opalescence is extremely strong. This Tyndall effect is impossible for traditional products to achieve through simple pigment mixing. It makes the PINK series have stronger concealer ability under the same permeability, becoming an ideal choice for people who have higher pursuit of aesthetic restoration effects.



(PMMA BLOCK—The Art of Flowing Colours)

4. Intraoral service life test of PMMA BLOCK

Durability

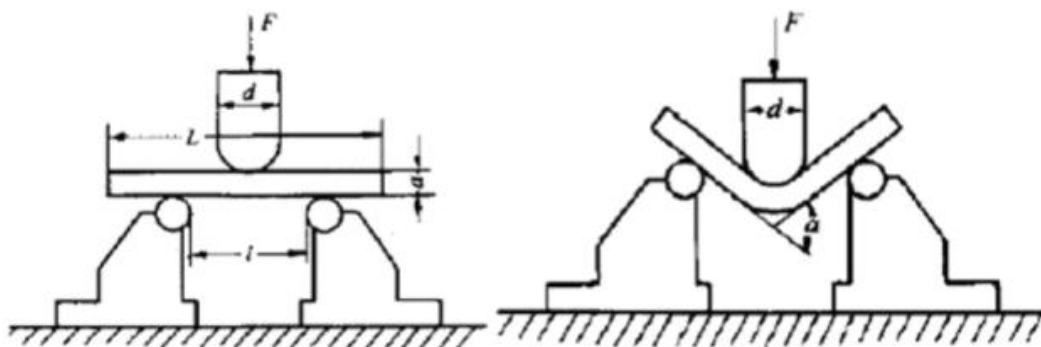
► Flexural Strength Test for Hot and Cold Cycles

1 、 Test Method:

Flexural strength, as a key indicator to assess the ability of a material to remain unbroken after being subjected to a force, is one of the important performance parameters of PMMA BLOCK. In order to accurately determine this parameter, we use the aging treatment of hot and cold cycles, and according to the principle of three-point bending test, to quantitatively evaluate the change of flexural strength of PMMA BLOCK products. The procedure was as follows: firstly, 150 flexural strength test specimens were accurately milled using CAD/CAM equipment, ensuring that each specimen had a length of (25 ± 2) mm, a width of (2 ± 0.1) mm and a height of (2 ± 0.1) mm. These specimens were then subjected to thermal cycling in water at 5°C and 55°C for a total of 10,000 cycles. During the thermal cycling process, the flexural strength of the specimens was tested every 500 cycles to ensure the accuracy and continuity of the data. Through this rigorous experimental process, we are able to comprehensively and objectively evaluate the changes in flexural strength of PMMA BLOCK products under different aging conditions.



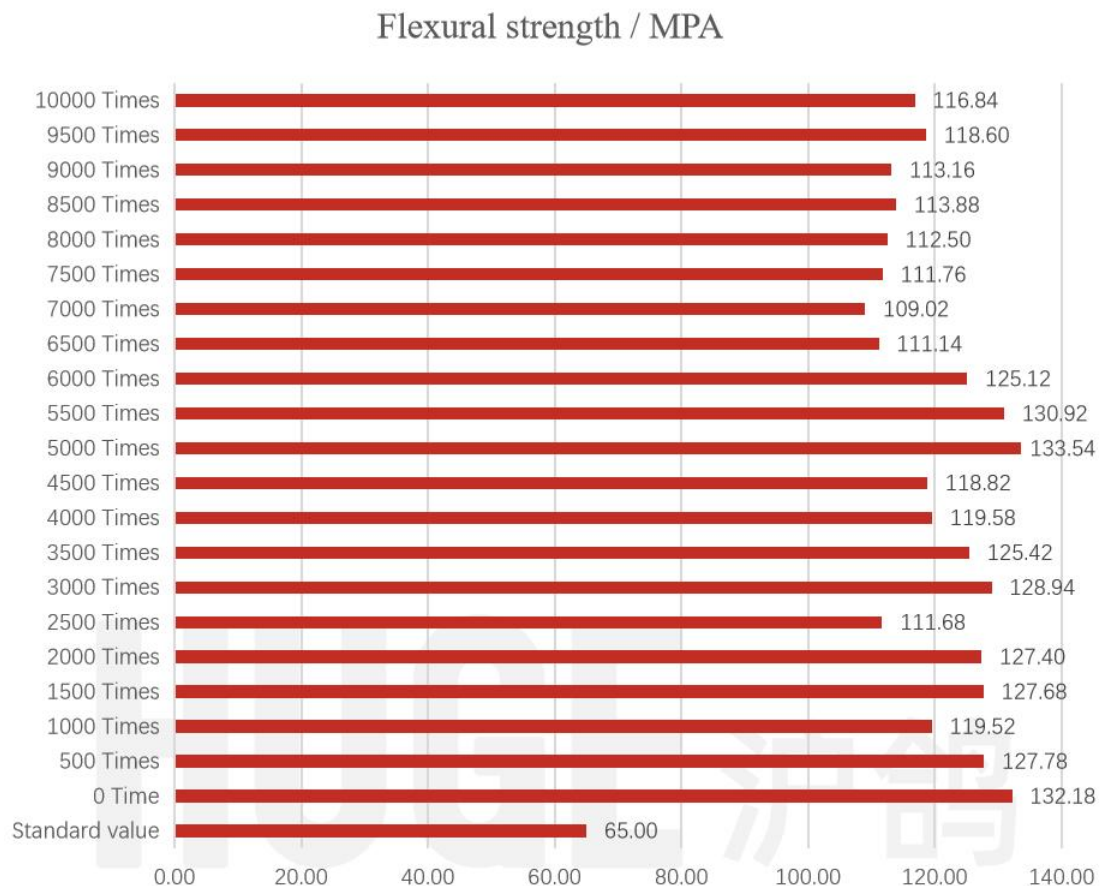
(Schematic diagram of hot and cold cycles)



(Three-point bending schematic)

2. Test results

After a rigorous 10,000 cycles of alternating hot and cold aging test, the strength of PMMA BLOCK shows a slight decline, but its strength value is still stable at over 100Mpa, which is significantly better than the ISO standard value. Therefore, the durability and fracture resistance of the product can be trusted even when it is used for a long period of time and subjected to biting force inside the mouth.



► Mastication simulation and thermal cycling

1. Test method

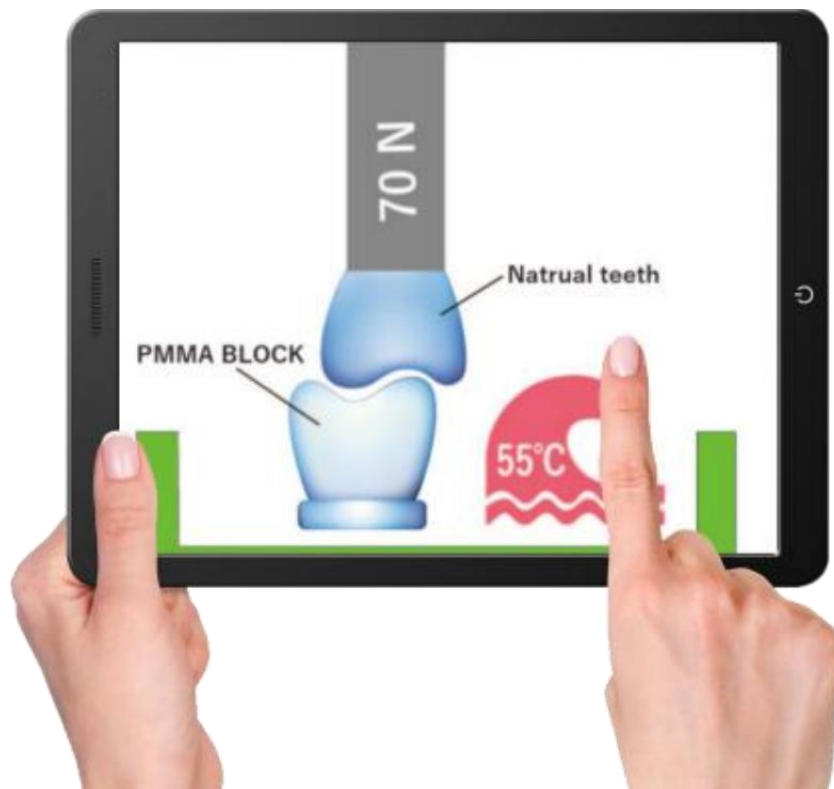
The mastication simulation is designed to evaluate the strength of PMMA BLOCK restorations after a certain period of clinical use.

During this simulation, the restoration is subjected to repeated mechanical impacts that are highly similar to the cyclic loading that occurs in the oral cavity. The test environment also simulates the temperature variations that can occur in the oral cavity. As a result of these simulated conditions, the restoration undergoes a process similar to artificial ageing. Subsequently, the condition of the restoration surface was examined. The test procedure is described below:

Firstly, the installation of the test device is carried out. A natural tooth was firmly cemented to a plunger under 70N of force and then repeatedly pressed against a mandibular denture base made of cemented PMMA BLOCK. This procedure was designed to simulate the natural chewing motion of the teeth in the mouth to ensure that the test conditions corresponded to the actual situation.

Next, the thermal cycling test was performed. The test device was placed in a water bath set to two temperatures, 5 °C and 55 °C, respectively. The test device was alternately cycled in the water bath at these two temperatures around the crown. The process was carried out. This process simulates the temperature changes in the oral cavity due to changes in food temperature during mastication. This simulation helps to more fully evaluate the performance of the restoration under different temperature conditions.

Finally, the frequency of testing was determined. In view of the widespread use of PMMA BLOCK in prosthetics and its long service life, the test simulated 10 years of clinical use, based on the actual service life of synthetic resin teeth in clinical practice. This corresponds to 2.4 million chewing cycles, supplemented by 10,000 thermal cycles. Through this series of tests, the survival rate of the restorations under simulated clinical conditions is evaluated, thus providing a reliable basis for actual clinical application.



2. Test results

Natural teeth and PMMA BLOCK were subjected to up to 2.4 million simulated chewing cycles under occlusal conditions with 70N of gravitational force. After the rigorous testing procedure, the PMMA BLOCK samples showed excellent durability, with no surface damage and no cracks or fractures observed. The 100% survival rate of the samples in this test is a remarkable result that confirms the high reliability and durability of PMMA BLOCK products in clinical application conditions such as implant restorations and full denture restorations.

► Abrasion test

1. Test method

The abrasion test is designed to simulate the abrasion of a product against the opposing teeth in the oral environment. The experiment focused on two scenarios: one with PMMA teeth of the same material and the other with teeth of tooth-like material. In addition, in order to verify the duration of oral use as reflected by the abrasion effect, a synthetic resin tooth product with the same morphology was introduced as a control standard. If PMMA BLOCK performs at a similar level of abrasion as the composite dental product, the clinical service life of PMMA BLOCK will be confirmed to be comparable to that of the composite dental product. Therefore, the test was designed as follows:

Test ①: This experiment aims to evaluate the wear of PMMA BLOCK-carved upper posterior teeth (position 6) under simulated chewing friction between resin and resin materials. The specific steps are as follows: First, polish the 10 carved upper posterior teeth and place them in a grinding jar. Then, add clean water to the jar along with 10 synthetic resin teeth (Sonning upper posterior teeth, position 6) of the same morphology as a control group. Next, add resin as an abrasive to the jar and grind at a speed of 20r/min for 20 days, totaling approximately 550,000 rotations. After grinding, precisely weigh the teeth before and after the test to an accuracy of 0.0001g, with the pre-test weight labeled as m_1 and the post-test weight as m_2 . Subsequently, calculate the weight loss ratio using the formula $(m_1 - m_2) / m_1 * 100\%$ and determine the average value of the test samples. Finally, perform a fitting analysis of the pre- and post-test tooth data to comprehensively evaluate the wear condition of the teeth based on the fitting ratio before and after wear.

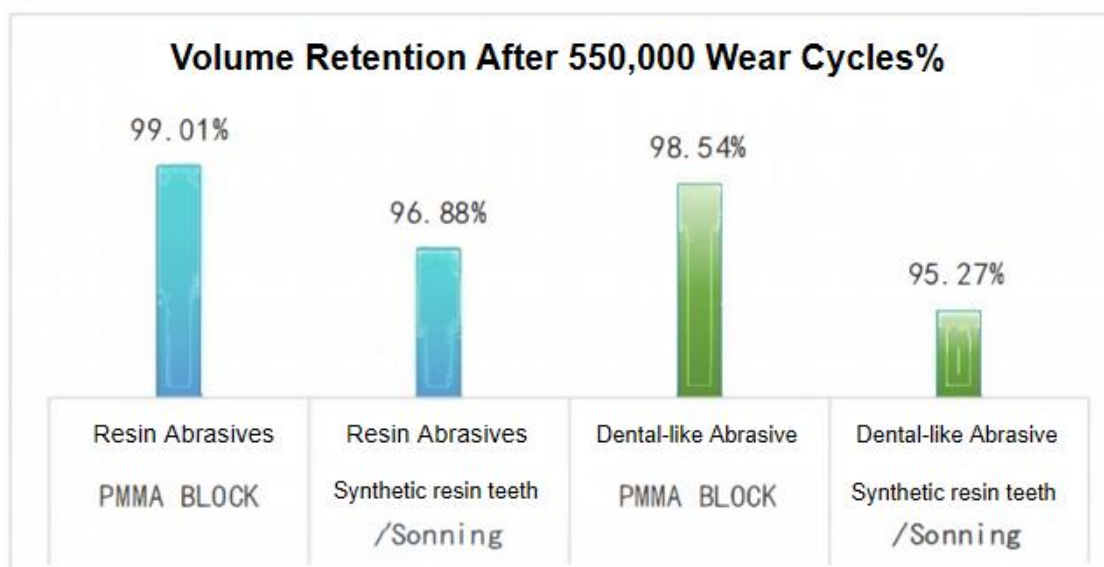
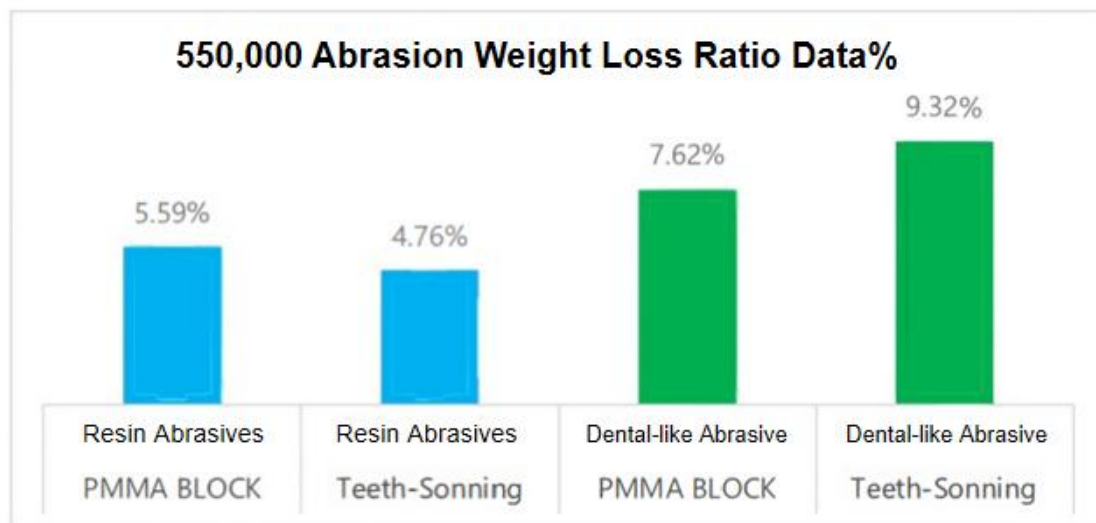
Test ②: This experiment aims to simulate the wear caused by chewing friction between resin and natural tooth materials and assess the wear of PMMA BLOCK-carved upper posterior teeth (position 6). The specific procedure is as follows: First, polish the 10 carved upper posterior teeth and place them in a grinding jar. Then, add clean water to the jar along with 10 synthetic resin teeth (Sonning upper posterior teeth, position 6) of the same morphology as a control sample. Next, use tooth-like abrasive as the grinding medium and grind at a constant speed of 20r/min for 20 days, totaling over 550,000 rotations. After grinding, precisely weigh the teeth before and after the test to an accuracy of 0.0001g, with the pre-test weight labeled as m_1 and the post-test weight as m_2 . Subsequently, calculate the weight loss ratio using the formula $(m_1 - m_2) / m_1 * 100\%$ and determine the average value of all test samples. Finally, through a fitting analysis of the pre- and post-test tooth data, comprehensively evaluate the wear condition of the teeth based on the fitting ratio before and after wear.

2. Test Result

The PMMA BLOCK and the synthetic resin teeth (Sonning) underwent 550,000 cycles of wear testing in two different abrasives: resin-based and tooth-like. The experimental results showed no significant difference between the two materials in key metrics such as weight loss percentage (%) and volume retention percentage (%),

fully demonstrating that the PMMA BLOCK possesses wear resistance comparable to that of synthetic resin teeth.

Synthetic resin teeth have undergone decades of clinical validation, with six-year follow-up studies confirming their excellent functionality. Even after ten years of use, despite noticeable wear, they can still serve patients effectively. However, considering the continuous changes in a patient's bone structure and mucosal tissues, dentists recommend replacing the prosthesis at an appropriate time. Based on this, we have strong reason to believe that PMMA BLOCK, when processed into complete dentures, will exhibit similar durability in the oral cavity.



5. PMMA BLOCK Intraoral Life Test Summary

Experimental results have demonstrated that PMMA BLOCK maintains exceptional strength even after undergoing 10,000 thermal cycles simulating intraoral conditions, effectively resisting the impact of thermal stress. Under a biting force of 70N, the material shows no cracks or fractures, highlighting its superior mechanical properties.

Additionally, when clinicians design treatment plans, they need not worry about wear issues between PMMA BLOCK and opposing teeth. Whether in contact with opposing teeth made of the same material or natural teeth, this material exhibits outstanding wear resistance. After 550,000 cycles of wear testing, its volume retention remains above 98%, fully proving its excellent wear-resistant characteristics.

Therefore, PMMA BLOCK delivers clinical performance comparable to DCL synthetic resin teeth, making it an ideal choice for long-term applications such as removable dentures or implant-supported prostheses. Its reliable performance ensures a service life of up to 10 years, providing strong support for patients' oral health. However, it is important to note that each patient's case is unique. Thus, we recommend regular follow-ups with dentists to assess individual oral conditions and replace dentures as needed, ensuring sustained oral health and comfort.

Attachment: information on selected clinical literature cited

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[2] Iegami C M, Lopes D D M, Nakamae A E M, et al. Different Occlusal Schemes in a Persistent Protruding Complete Denture Wearer[J]. Case Reports in Dentistry, 2016,(2016-3-16), 2016, 2016(1):1-4.

[3] Tong Li. Clinical observation of conical telescopic denture for the treatment of moderate and severe periodontal disease with dental defect[D]. Shandong University, 2009.