



**EMERALD**<sup>®</sup>  
dental lab

# **ALL-CERAMIC MATERIALS**

## The Comprehensive Guide

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# THE IMPORTANCE OF A WELL-INFORMED CLINICIAN

## PROVIDING THE BEST FOR YOUR PATIENTS

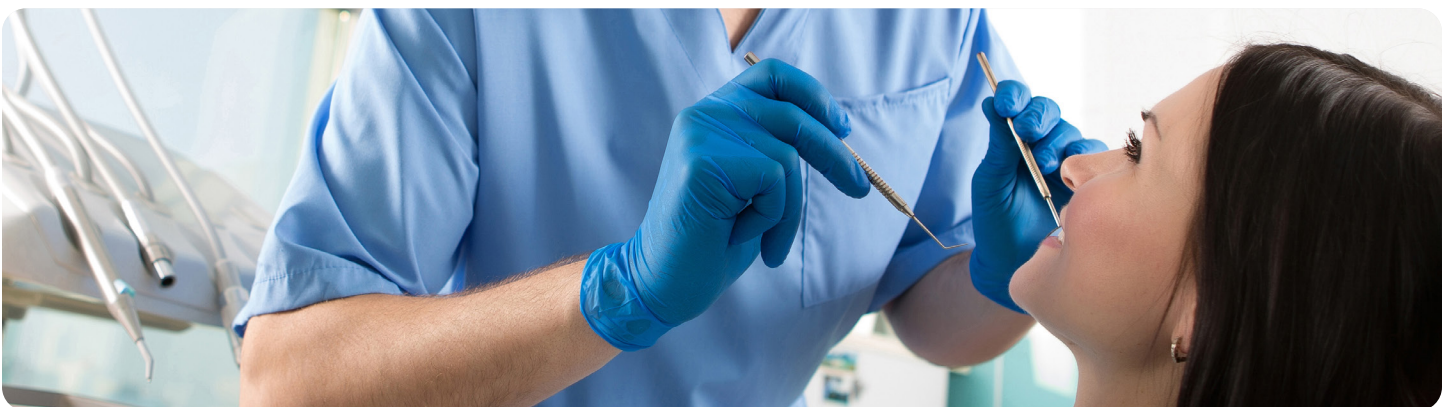
At Emerald Dental Laboratory we believe a successful dental practice is founded on a well-informed doctor. The price of an all-ceramic restoration is directly tied to the quality of its material. While two restorations can be made from the same base material, there are corners that both manufacturers and laboratories can cut. These shortcuts provide a higher profit margin for both parties but will result in a subpar product that does not provide the promised esthetics, strength or durability. It is the responsibility of the lab to ensure they are choosing high-quality all-ceramic materials from manufacturers that prioritize precision and thoroughness in their production process. That responsibility then shifts to the clinician, who needs to ensure they are providing their patients with long-lasting and well-made restorations.

### HAVING CONFIDENCE IN THE RESTORATIONS YOU PRESCRIBE RELIES ON TWO MAIN THINGS:

1. Having a strong relationship with your lab based on trust and communication.
2. Being well-informed about the popular all-ceramic materials currently on the market.

## SUCCESS FOR EVERY CASE

We created this comprehensive all-ceramic guide based on the knowledge that your busy schedule does not provide ample time for you to research and learn everything about materials. This is especially true as the market continues to develop, and materials evolve. This eBook contains vital information about the popular all-ceramic materials you need to make informed decisions and ensure success for every case.



# ZIRCONIA OVERVIEW

## HISTORY OF ZIRCONIA

Zirconia came on the dental scene in the 2000s as an alternative to metal-based restorations. Its evolution has been swift, initially starting out as either a base for an esthetic porcelain overlay or monolithic posterior crowns. Now more companies are coming out with highly esthetic monolithic anterior zirconia restorations that provide extreme strength and esthetics while eliminating the less durable porcelain aspect.



## MINING ZIRCONIA

The metal zirconium is a naturally occurring element, which is predominately mined in Australia and South Africa. Zirconia is created through the combination of purified zirconium with oxygen. The dental industry utilizes extremely strong zirconia by incorporating a small amount of Yttrium, creating the compound  $ZrO_2Y_2O_3$ .



### DID YOU KNOW?

High-quality zirconia helps prevent the propagation of cracks.

# ZIRCONIA OVERVIEW CONTINUED

## DISC MANUFACTURING

Manufacturing a zirconia disc first requires the zirconia to be ground into a powder. Disc manufacturers either purchase or create the powder, which requires a thorough purification process due to the amount of impurities the material contains when initially mined. High-quality and more expensive zirconia powders typically go through 2-3 purification washes, whereas subpar zirconia often only receives a single wash.

Quality zirconia is pressed twice to form the discs. Firstly, it is pressed in an industrial press that is specifically designed to create zirconia discs. Secondly, it is pressed in an isostatic press, which ensures consistent particle disc density. After pressing, discs are placed into a sintering furnace for pre-sintering, which can take 3-5 days and can reach temperatures of 1832° F.

The manufacturing process of zirconia requires high precision to ensure quality restorative materials. This is one of the primary areas where manufacturers can skimp on steps to provide low-quality zirconia at a cheaper price point. Cheap zirconia often means that it was not properly purified, did not go through two presses, or was not sintered for the required length of time or at the correct temperature.



## THE IMPORTANCE OF HIGH-QUALITY ZIRCONIA

Choosing high-quality zirconia ensures the durability of the final restoration due to the molecular changes that occur throughout the manufacturing of the discs. The specific makeup of zirconia allows the molecular structure to change when necessary, for example in the case of cracking it alters from the tetragonal phase to the monoclinic phase. This switch allows the volume to increase by 4% sealing off the break and preventing it from spreading throughout the rest of the zirconia.

High-quality zirconia also allows for improved esthetics to the point of anterior full-contour restorations. It also provides advanced options including high translucency and multilayered shading, which ensures smooth and lifelike color gradation throughout the restoration.

# AVAILABLE ZIRCONIA PRODUCTS

The Emerald team is dedicated to choosing the highest quality zirconia material for all our restorations. The materials we use are carefully selected to ensure the best match for every indication. We take pride in our zirconia products as they have proven to be a more esthetically pleasing and durable alternative to metal-based restorations. The natural translucency of the material ensures there is no discoloration or black line running along the gingiva, which are common esthetic challenges that accompany PFM products.

## PORCELAIN-FUSED-TO-ZIRCONIA

Crafted by layering porcelain over a zirconia substructure, these restorations provide the strength of PFM crowns with the warmth and coloration of lifelike dentition.

**STRENGTH:** 1,450 MPa (Zirconia Substructure) 130 MPa (Layered Porcelain)

**INDICATION:** Anterior and posterior crowns, crowns over implants, and bridges of up to 14 units.

**BENEFITS:** Hypoallergenic. Biocompatible. Highly translucent.



## FULL-CONTOUR ZIRCONIA

Offering the highest flexural strength of any all-ceramic, full-contour zirconia combines durability and esthetics for a monolithic restoration.

**STRENGTH:** 1,450 MPa

**INDICATION:** Can be used in almost any situation, including singles, bridges with any combination of abutments and pontics, inlay bridges, and screw-retained implants.

**BENEFITS:** Gentle on opposing dentition. Chip and crack resistant. Suitable when occlusal space is limited.



# LITHIUM DISILICATE OVERVIEW

Lithium Disilicate is the most well-known and widely used glass ceramic in the dental industry. It is primarily composed of quartz, lithium dioxide, phosphor oxide, alumina, and potassium oxide. The popularity of this material is due to its advanced esthetics and strength when compared to traditional metal-based restorations. It can be conventionally cemented or adhesively bonded. Low thermal expansion occurs when lithium disilicate is processed, which provides it with high thermal shock resistance. This material is available in both pressable and machinable options.



## PRESSABLE LITHIUM DISILICATE

Pressable lithium disilicate is produced through a continuous manufacturing process, which is heavily based on glass technology. This process involves melting, cooling, simultaneous nucleation of 2 different crystals, and the growth of crystals. This process is consistently optimized to prevent defects forming in the material. The ideal color is achieved for this pressable material with polyvalent ions, which ensure even distribution of shade.

## MILLED LITHIUM DISILICATE

The same manufacturing process is used for milled lithium disilicate, but it is not carried out to the end and instead is stopped once intermediate crystallization is reached. This is done to create lithium metasilicate crystals in the material. These crystals are what allows lithium disilicate its processing properties, machineability, and edge stability. Due to the different state of the material, the milled lithium disilicate gains a blue color from the polyvalent ions. After the restoration is milled and enters the firing process, the material becomes lithium disilicate. After this, the color changes from blue to the chosen tooth color.

# AVAILABLE LITHIUM DISILICATE PRODUCTS

## IPS E.MAX®

Emerald offers both pressed and milled IPS e.max®. This restoration is available as a full-contour monolithic or cut-back and layered with porcelain for highly advanced esthetics.



**STRENGTH:** 400 MPa

**INDICATION:** Crowns, 3-unit bridges, veneers, thin veneers, occlusal veneers, inlays, and onlays.

**BENEFITS:** Four levels of translucency. Additional impulse ingots for maximum flexibility.



# ADDITIONAL ALL-CERAMICS OVERVIEW

While zirconia and lithium disilicate are the two most popular all-ceramic materials, there are various others currently on the market. Whether our laboratory carries restorations made from them or not, we believe it is still important for every clinician to understand the full scope of the all-ceramic materials market. These additional all-ceramics exemplify how material science continues to expand and develop.



## ZIRCONIUM SILICATE MICRO CERAMIC

Zirconium silicate micro ceramic provides extreme translucency and mimics the esthetics of natural dentition. These restorations are made by bonding the zirconium silicate micro ceramic to a substructure, which can be fabricated out of non-precious or high noble alloys. Its incredibly small structure provides a high compressive and tensile strength, as well as excellent elasticity.

## LITHIUM SILICATE

This glass-ceramic provides more durability than traditional ceramics while providing a high degree of esthetics. Their monolithic composition makes them chip resistant. Unlike zirconia, lithium silicate can act as a porcelain replacement and be fused to metal. This innovative PFM option provides four times the strength of traditional feldspathic porcelain.

## ZIRCONIA REINFORCED LITHIUM SILICATE

ZLS is carefully formulated to have a unique microstructure, which ensures esthetics and strength. Unlike traditional lithium silicate, this material is combined with 10% zirconium oxide to increase strength. ZLS has a microstructure that is far smaller than its alternatives. This microstructure allows for high flexural strength and improved light-optical and mechanical properties.