Lava™ Plus High Translucency Zirconia is the next generation of Lava™ Frame Zirconia that has proven its reliability in more than 10 years of clinical history. The Lava™ Plus System is designed to enable unprecedented Lava™ Zirconia esthetics with uncompromised strength.

Esthetics is determined by the viewing light, the observer and finally the optical properties of the restoration: Restorations reflect, scatter or absorb part of the viewing light while the remainder is transmitted. Theses optical properties depend on the surface texture, the chemical composition and the microstructure of the materials used. Simplified one can say that the potential of a restoration material to mimic tooth structure is determined by its color and translucency.

Lava™ Plus is a complete zirconia restoration system offering a high translucency combined with a unique shading solution for full color control. This sheet focuses on the science behind the improved translucency of the Lava™ Plus material.

What is behind the excellent translucency of Lava™ Plus restorations?

Translucency is the physical property of allowing light to pass through a material. The translucency of zirconia materials is mainly determined by

- Presence of impurities and structural defects
- Alumina content and distribution

Impurities lead to light absorption and structural defects like pores to scattering. Both factors reduce the translucency. The high quality processing of Lava™ Zirconia minimizes these effects (Fig. 1 a). This is very much in contrast to what was found for some low quality materials (Fig. 1 b).

Alumina is a dopand with many useful effects including increased aging stability of zirconia. However, Alumina has a different refractive index and can segregate in the zirconia material (Fig. 1 c) which decreases translucency by scattering. Some zirconias do not contain Alumina to enhance translucency. To fully maintain the aging stability a different approach was chosen for Lava™ Plus Zirconia: The Alumina content is reduced to 0.1 wt%. At the same time the Alumina distribution was improved to fully maintain the aging stability on Lava™ Zirconia level. 1,2

Fig. 1: SEM images (3M ESPE internal data)
A common method to compare material translucency is to determine the Contrast Ratio CR: The white light remission from a specimen placed over a standardized black (Yb) and white (Yw) background is determined. CR is calculated as \( CR = \frac{Yb}{Yw} \). CR is \( \leq 1 \), a CR value of 1 represents a completely opaque specimen. The lower CR the higher is the translucency of a specimen; translucency can be expressed by 1-CR.

Zirconia is mostly used in the shaded state. Color is generated by absorbing part of the white light spectrum. Therefore shading is always accompanied with a loss in translucency. Lava™ Plus is a complete system including dyeing liquids tailored to the microstructure of Lava™ Plus Zirconia. The patented 3M ESPE ion dyeing technology allows higher translucency in dyeing liquids tailored to the microstructure of Lava™ Plus Zirconia with a loss in translucency.

Lava™ Plus Zirconia translucency improvement was achieved keeping Alumina inside to ensure aging stability (Fig. 2).

The high strength of zirconia allows thinner walled, tooth structure preserving restorations. The minimum occlusal wall thickness is 0.5 mm for Lava™ Zirconia posterior crowns as compared to 1.5 mm for lithium disilicate. The wall thickness also has a big influence on the translucency – thin structures are more translucent. Comparing minimum allowed occlusal thicknesses reveals that A3 shaded Lava™ Plus Zirconia can reach a translucency level in the range of IPS e.max CAD LT A3 (Fig. 5).

Lava™ Plus Zirconia translucency improvement was investigated at Tokyo Medical & Dental University: “… Lava™ Plus High Translucency Zirconia showed improved translucency without compromising its mechanical properties.” In the same study glass ceramics were found more translucent, however at a fraction of the flexural strength of zirconia (Fig. 4).

### Fig. 2: Translucency (1-CR) of unshaded zirconia samples (1 mm thickness, Color i7, 3M ESPE internal data, partially published).

### Fig. 3: Translucency (1-CR) of zirconia samples shaded A3 with the manufacturers shading liquid except “*” shaded with Zirkonzahn Prettau Color Liquid A3 (1 mm thickness, Color i7, 3M ESPE internal data, partially published).

### Fig. 4: Biaxial flexural strength of zirconia and glass ceramic materials. Bars with same letter indicate no significant difference (P < 0.05).

### Fig. 5: Translucency (1-CR) of IPS e.max CAD LT A3 and Lava™ Plus shaded A3 for a thickness of 1 mm and for the respective minimum occlusal wall thickness for posterior crowns (Color i7, 3M ESPE internal data).

Lava™ Plus Zirconia is smartly engineered for excellent translucency. The esthetical improvement comes with the quality you can expect from a Lava™ Zirconia restoration: Precision of fit, high strength and aging stability. This is backed up by a 15 years limited warranty on Lava™ Plus Highly Translucent Zirconia frameworks and monolithic restorations.

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