

## Characterization and Modification of the Optical Properties of Zirconia Ceramics for Aesthetic Dental Restorations

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**Abstract :** Yttrium stabilized tetragonal zirconium polycrystalline (Y-TZP) has been used as a dental biomaterial. The strength and toughness of zirconia can be accounted for by its toughening mechanisms, such as crack deflection, zone shielding, contact shielding, and crack bridging. Prevention of crack propagation is of critical importance in high-fatigue situations, such as those encountered in mastication and para-function. However, the poor translucency of Y-TZP means that it may not meet the aesthetic requirements due to its white/grey appearance in polycrystalline form. To improve optical property of the Zirconia, precise evaluation of its refractive index is of significance. Zirconia's optical properties need to be studied more in depth. Number of studies assumed, scattered light is isotropically distributed over all angles from biological media when defining optical parameters. Nevertheless, optical behaviour of real biological material depends on angular scattering of light by anisotropy material. Therefore, the average cosine of the scattering angle (which represent recovery phase function in the scattering angular distribution) usually characterized by anisotropy material. It has been identified that yttrium anti-sites present in the space charge layer have no significant role in the absorption of light in the visible range. Addition of cation dopant to polycrystalline zirconia results in segregate to grain boundaries and grain growth. Intrinsic and extrinsic properties of ZrO<sub>2</sub> and their effect on optical properties need to be investigated. Intrinsic properties such as chemical composition, defect structure (oxygen vacancy), phase configuration (porosity, second phase) and distribution of phase need to be studied to comprehend their effect on refraction index, absorption/reflection and scattering. Extrinsic properties such as surface structure, thickness, underlying tooth structure, cement layer (type, thickness), and light source (natural, curing, artificial) of ZrO<sub>2</sub> need to be studied to understand their effect on colour and translucency of material. This research reviewed effect of stabilization of tetragonal zirconia on optical property of zirconia for dental application.

**Keywords :** optical properties, zirconia dental biomaterial, chemical composition, phase composition

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