Zirconia: *The new technological marvel in dentistry*

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The last decade has witnessed a revolution in milled technology – CAD CAM. This technological marvel has given a boost to a Metal free milled ceramic restorations. Amongst these the most successful have been Zirconia Ceramics.

The term Zirconia is derived from two Persian words: zar meaning gold and gun meaning colour. This material was discovered by German chemist Martin Heinrich Klaproth in 1789. This material does not occur in Free State naturally but is found in as silicate oxides or free oxides. A very interesting phenomenon with this material is its transformation toughening. This material has three forms i.e., cubic phase which is stable above 2370^0C with moderate mechanical advantage, tetragonal phase which exists between 1170^0C - 2370^0C with improved mechanical properties and a monoclinic phase that exists at room temperatures to 1170^0C with reduced mechanical properties.[1] Currently, Zirconia being used in dentistry is Partially Stabilized Zirconia to which – mol% of yttria (or CaO/ MgO) has been added. This allows for small tetragonal grains to exist at room temperatures. Under great stresses, if a crack propagates through this material, there is a phase transformation from tetragonal to monoclinic which is associated with a volumetric expansion of -5% which stops the crack propagation.

The dental fraternity has accepted Zirconia ceramics with a very positive note. From single crown, multiple unit bridges, inlays, onlays, partial veneer crowns, its use have expanded to endodontic posts, implants, implant abutments, orthodontic brackets etc. Various design modifications have also emerged like monolith crowns for posterior areas, Brux Zir crowns for patients with parafunctional activities, high translucency zirconia and super high translucency zirconia for enhanced esthetics.

On the technical forefront, research shows that porcelain veneering can be mislaid at the gingival surface of the connectors to increase their surface area and strength. Estimation according to Fatigue parameters indicate that connector area should be $5.7mm^2$, $12.6mm^2$ and $18.8mm^2$ for fabrication of crown or long span FPD respectively.[2] Looking at the technical complications of this material it can be concluded that these zirconia restorations in the long

run are comparable to metal ceramic restorations and can withstand long term functional forces. One of the most common complications reported are chipping of veneered ceramic, followed by fracture of core and debonding of the restoration.

As compared to glass ceramics, zirconia prosthesis has a reduced translucency. This translucency of zirconia material is determined by impurities and structural defects. To increase this translucency the effects of impurities and structural defects have to be reduced. The translucency of zirconia material is reduced by different refractory index and segregation nature of the alumina which is added into zirconia for aging stability.[3] In few new age Zirconia, the alumina content is reduced to 0.1 wt% and distribution is improved. This has led to emergence of super high translucent zirconia.

It can be summarized that zirconia technology is among the most recent technological advances witnessed in the CAD/CAM industry. Its use has revolutionized the field of dentistry and has unleashed tremendous potential due to its varied applications. Evidence based results are pouring in and the field of Zirconia is constantly improving & improvising itself for more predictable results. Research is going on in this field in the areas of aging, veneering, framework designing, bonding and repair kit.

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