COMPARISION OF ZIRCONIA AND LITHIUM DISILICATE AS A RESTORATIVE MATERIAL

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OBJECTIVE

The aim of this literature review is to compare Zirconia (ZR) and Lithium Disilicate (LDC) and to evaluate these materials based on various criteria like bonding, optical/mechanical properties, clinical performance, biocompatibility, marginal fit, and clinical applications in restorative dentistry.

OVERVIEW

Zirconia and Lithium disilicate have been widely utilized in dental restorations for both partial and full coverage procedures, employing monolithic and layered methods.

3Y-TZP	4Y-TZP	5Y-TZP	Lithium Disilicate
Polycrystalline Ceramic	Polycrystalline Ceramic	Polycrystalline Ceramic	Modified Feldspathic glass
Mainly tetragonal	Tetagonal and cubic	Mainly cubic	Needle like Lithium Disilicate Crystals
ZirCad LT, Lava Plus, BruxZir, Cercon	ZirCAD MT,KATA NA ST/STML	BruxZir Anterior, KATANA UT/UTML, Zpex s mile	IPS E.Max Press IPS E.Max CAD (Ivoclar Vivadent)
Milled Blocks (CAD/CAM)	Milled Blocks (CAD/CAM)	Milled Blocks (CAD/CAM)	Pressed-fit Ingots Milled Blocks (CAD/CAM)

CLINICAL PROPERTIES

Mechanical Properties

- Young's modulus:LDC-95G Pa, ZR:210GPa
- LDC heat extrusion temp: 920 C
- ZR:Cubic:2680-2370 C
- ZR:Tetragonal:2370-1170 C
- ZR:Monolithic:1170-room temp.

Fracture Toughness

- LDC: Pressed ingots:2.8-3.5 MPa, CAD-CAM blocks after firing:2.5MPa,Zr:5-10MPa
- Despite increased yttrium oxide content for translucency, zirconia has greater fracture toughness than mastication (3000N vs 800N in bruxers) due to transformation toughening that also improves compressive strength and self-repair.

Bio-compatibility

- Polished zirconia shows higher levels of biocompatibility due to adhesion and proliferation of epithelial cells and fibroblasts

Polishing & Glazing

- ZR experiences less and LDC experiences same occlusal wear as enamel.
- Wear of the opposing enamel decreased following polishing of both LDC and Zr crowns

Marginal Fit & Adaptation

- CAD-CAM Zr has better marginal fit than heat pressed LDC
- Hot pressed LDC made from conventional impressions(PVS) has better marginal adaptation than LDC produced through CAD-CAM

Optical Properties

- Translucency and Opalescence of LDC are superior to ZR.
- Translucency is affected by sintering temperatures and grain size. Higher sintering temperatures increase material density by closing residual pores at the grain boundary level, thereby reducing refractive index and light scattering.

CLINICAL APPLICATION

INDICATIONS

- **LDC:**
  - Single unit premolars
  - Low stress bearing molars
  - Short span anterior bridges
  - 3-units bridges up to second molars
  - Inlays or onlays
  - Implant abutments
- MZ:
  - High stress bearing molars
  - Teeth that require minimal clearance for a crown
  - Short or long span bridges
  - Any anterior or posterior tooth if esthetics are not a concern for patient
  - The choice of restorative for implant crowns in posterior region
  - **Layered Z:**
  - or esthetic zone
  - both single and splinted units
    - facial has a layer of porcelain but lingual is only zirconia
  - no metal show through or unsightly black lines at the gingival margins

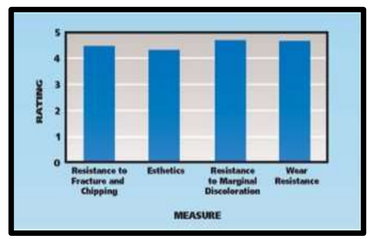
CONTRAINDICATIONS

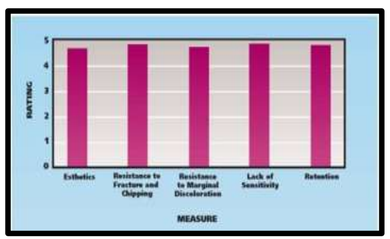
- LDC:
  - Posterior teeth with high load; bruxism
  - When there is insufficient coronal tooth structure or tooth is too thin as cervical
  - Long span bridge
  - Abudment tooth for removable prosthetics
  - Primary teeth
- MZ:
  - Esthetic zone since units may be opaque

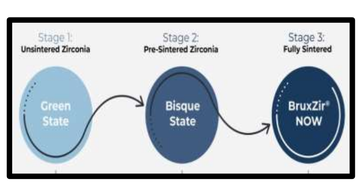
  - **Layered Z:**
  - teeth that need minimum reduction since the layer of ceramic requires additional reduction

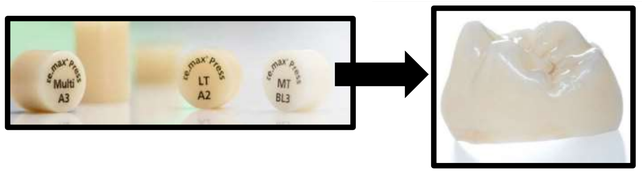
CEMENTATION

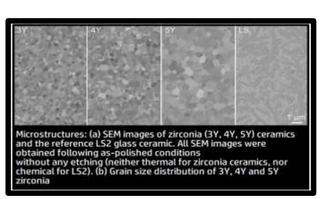
- LDC:
  - Silane and hydrofluoric acid improves the bond strength of LD.
  - Studies show that the micro-shear bond strength between lithium disilicate and composite resin improved from 4.10 MPa to 14.58 MPa when silane was applied.
  - When HF etch was used in addition to silane, the micro-shear bond strength improved from 14.04 MPa to 24.70 MPa.
- MZ:
  - The improvement of the bonding between resin cement and zirconia can be achieved with various techniques such as airborne-particle abrasion with alumina, silica deposition methods, plasma spraying selective infiltration etching, and application of MDP (methacryloyloxydecyl dihydrogen phosphate) primer.

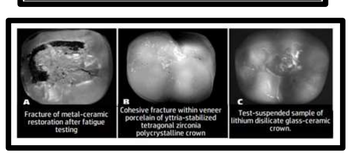


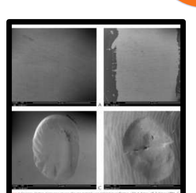


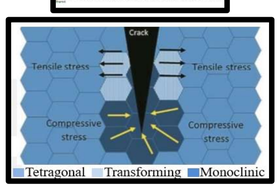












CONCLUSION

After analyzing the available literature, it was concluded that the longevity of the restoration depends on factors just beyond the material properties, such as bonding, adequate tooth reduction, patient compliance, clinician's hand skills and judgment. Over the past few years, the advantageous qualities of ceramics have been increasingly recognized, and with the ongoing advancements in bonding techniques in dentistry, these ceramics have the capability to be considered as practical and durable options for patients.