ZIRCONIA
Based Dental Prostheses
State of the art and research outcomes

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Yttrium Zirconia and dental prostheses
Toughness

Stress-induced crystalline transformation

Lughi et al. Dent Mater. 2010

Zirconia

Low Temperature Degradation


Biocompatibility


Technical complications

Veneer fracture (Chipping)

PFM’s veneer fracture significantly lower
UNDERSTANDING CHIPPING

TENSILE STRESS = RESIDUAL STRESS + EXTERNAL STRESS

Residual Stress
Locked-in stresses generated during the cooling process

- Compressive
- Tensile
Residual Stress

Metal framework

Zirconia framework

Crystalline Transformation

SEM observation+ XRD, Raman


VOLUME INCREASE AT THE INTERFACE:
- CTE mismatch STRESS ?
- DIFFUSION process ?

Deflection measurements
In favor of diffusion processes


Confocal Raman microscopic and EDS analysis

Ramos CM et al. J Prosthet Dent 2014

2 micron-deep silicon-zirconium interdiffusion zone
SEM and FB nanotomography

Observation of structural changes

- Designed and Thick framework (min 1mm)
- Thin veneer (max 1/1.5 mm)

Residual Stress

Importance of Veneer-Framework thickness ratio


Influenced of framework material

- Alumina
- YTZP
- ZTA

Classic cooling
Sintered without liner
External Stress
Clinical risk factors: Retrospective study at the University of Liege
- Parafunctional habits
- Absence of occlusal splint
- Restorations on implants
- Ceramic restoration as antagonist
- Multi-unit restorations
- Hard-milling manufacturing

Koenig V, Vanheusden A, Mainjot A, submitted

5-mths follow up

External Stress
External Stress

Alternatives to the classical veneering process

Pressed Veneering Ceramic
Milled Veneering Ceramic

FUTURE PERSPECTIVES?
Data Acquisition
Manufacturing
Data processing

CAD/CAM processes: Limitations
Accuracy
Economical and environmental aspects
Zirconia

Monolithic Zirconia Crowns

Kim et al, J Dent, 2012
Preis et al, Dental Mater 2011
Yung et al, J Adv Prosthodont, 2010
Suputtamongkol et al, Dent Mater 2008

Feldspathic Glass Ceramic

Less abrasive than other ceramic materials

TDP
Lithium Disilicate
Feldspathic Glass Ceramic

MATERIAL and ANTAGONISTIC WEAR

Conclusion
Merci

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