

## Dental Ceramics II

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### John F. Kennedy

- Change is the law of life. And those who look only to the past or present are certain to miss the future.

### Aim & objectives

- Types
- Production methods

### Ceramics-Methods of fabrication

- Sintering: by heating a particulate system with a binder to the fusion temperature.
- Casting and ceramming: using the lost wax technique and heat treatment.
- Mechanical preparation (copy milling and CAD/CAM)

## Fusion temprature

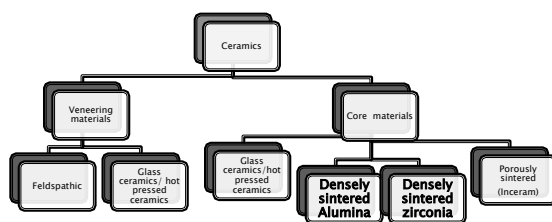
- a. High-fusing: 1288 to 1371 °C (2350 to 2500 °F)
- b. Medium fusing: 1093 to 1260 °C (2000 to 2300 °F)
- c. Low fusing: 871 to 1066 °C (1600 to 1950 °F)

## Ceramics

### Types

- 1 – Predominantly glass materials.
- 2 – Particle filled glasses.
- 3 – Polycrystalline

### ► Types of ceramics

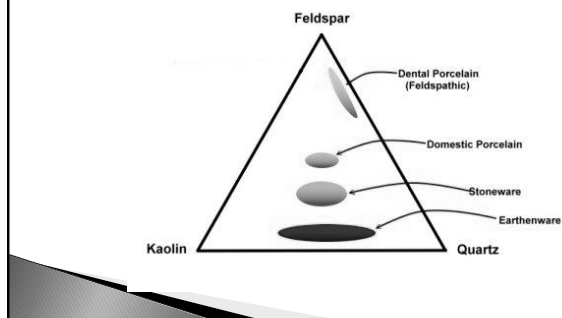


## Ceramics– Predominantly glass

- Feldspathic porcelain; Veneering porcelain

e.g.: Ceramco, VM7, VM13, Vitadur  
The highest aesthetic quality

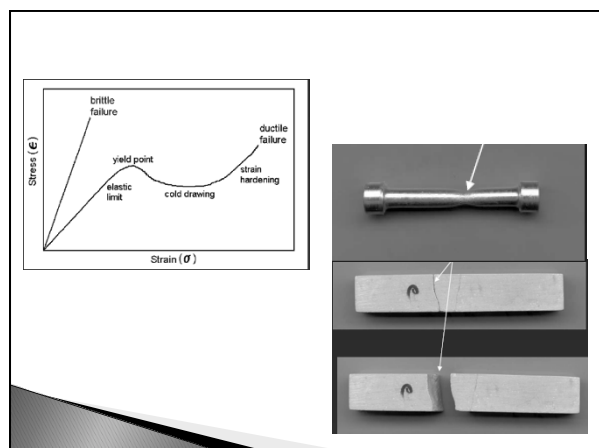
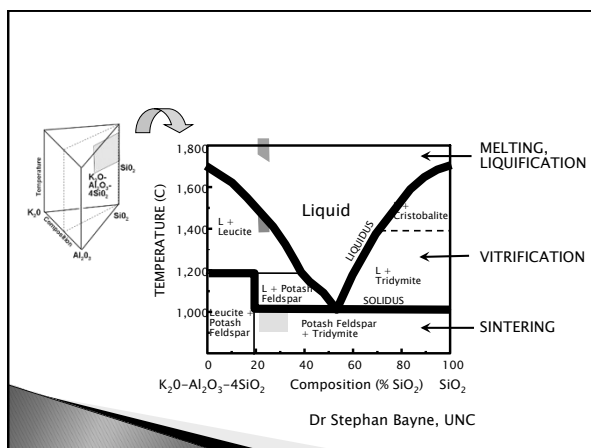
## Feldspathic porcelain



## Feldspathic porcelain

basic composition

- Feldspar (potassium aluminiumsilicate)  
-75-80%
- Silica  
-12-22%
- Kaolin  
-3-5%



### The introduction of leucites ( $\text{KAl}_2\text{Si}_2\text{O}_7$ )

- ▶ They have an index of refraction compatible with that of feldspathic glass
- ▶ Leucite is etched preferentially to the glass when subjected to acid etching.
- ▶ They increase the coefficient of thermal expansion of feldspathic porcelain and to match that of metal for reliable bonding

### Cast-Glass Ceramics

- ▶ 45%v glass and 55%v crystalline tetrasilicic fluormica
- ▶ Ceramming technique
- ▶ Used to be very common,
- ▶ Elaborate technique to produce

### Hot pressed ceramics

- ▶ Leucite based (IPS Empress 1)
- ▶ Lithium disilicate & Lithium orthophosphate (IPS Empress 2)

### Hot pressed ceramics

	IPS Empress 1	IPS Empress 2
type and configuration	Leucite crystals	2 crystal types: elongated lithium di-silicate and short lithium orthophosphate
Degree of crystallisation	35±5% v	70±5% v
Pressing temperature	1160 °C	925 °C
Flexural strength	112±10 MPa	400±40 MPa
Enamel wear	More	Less
Indications	Inlays, onlays, crowns	Inlays, onlays, crowns and bridges (to second premolar)
Clinical durability	Good	Improved



### Incerams

- Alumina
- Alumina spinell
- Zirconia

### Ceramics–Polycrystalline

- Alumina
- Zirconia ( Inceram Zirconia and Yttriumoxide Tetragonal Polycrystals YTZP Zirconia)

### Ceramics–Polycrystalline

- Alumina & Alumina Spinell (Porous and Densely sintered)
- Zirconia ( Inceram Zirconia and Yttriumoxide Tetragonal Polycrystals YTZP Zirconia)

### Zirconia

- Monoclinic at room temperature
- Cubic and tetragonal at increased temperatures
- Tetragonal metastable phase (transformation toughening)

## Zirconia

- Y-TZP
- Ce-TZP

## WHAT IS Y-TZP

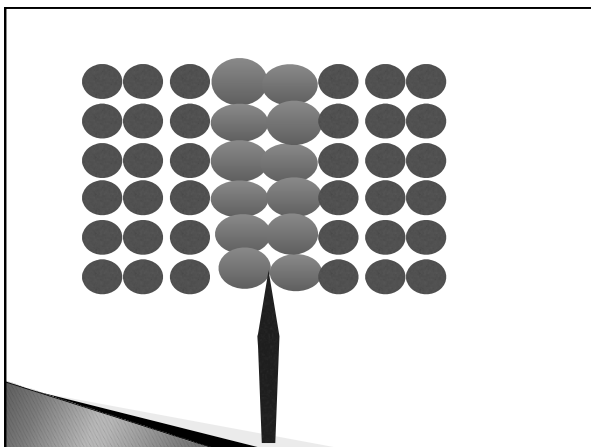
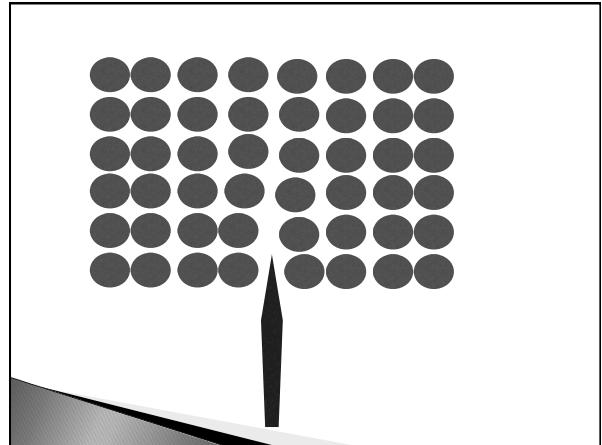
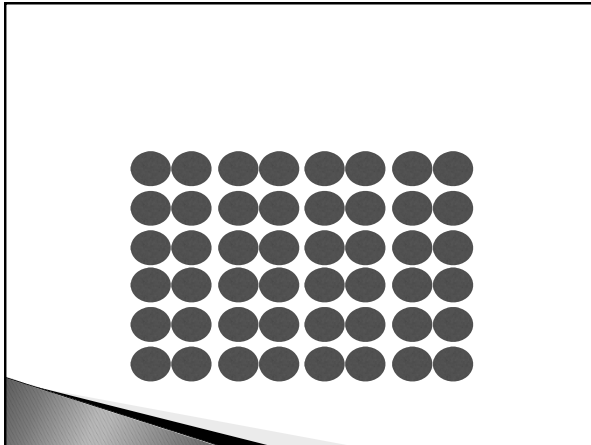
- Yttrium partially stabilised zirconia polycrystals
- 97.5% ZIRCONIUM OXIDE
- 2.5% YITTRIUM OXIDE

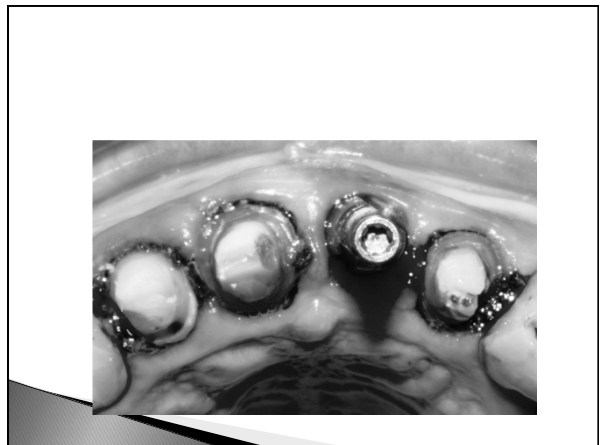
## WHAT MAKES ZIRCONIA TOUGH

- TRANSFORMATION TOUGHENING

## Zirconia Crystals

- Monoclinic
- Cubic
- Tetragonal



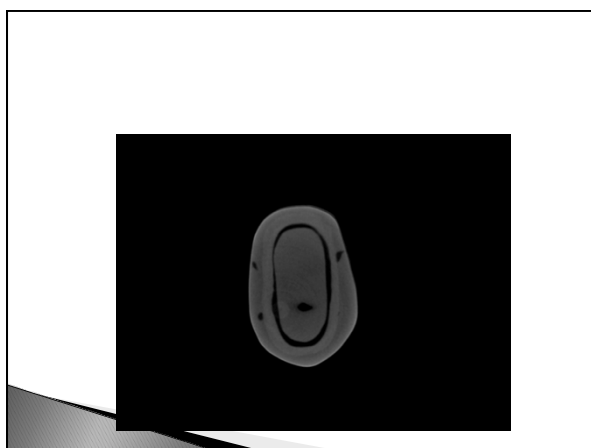




## evidence

Life table analysis revealed cumulative 5-year survival rates of 95.9% for tooth-supported and 97.1% for implant-supported crowns. For implant-supported crowns, the most common reasons for failure were technical (veneering material fractures). For tooth-supported crowns, technical (veneering material fractures, loss of retention) and biologic (endodontic/ periodontic) reasons for failure were equally common

. The clinical success of zirconia-based crowns: a systematic review Int J Prosthodont 2014



## Zirconia-Abutment

