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☐ slides ☐ handout ☐ sheet

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24
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Slip casting technique

Condensation of aqueous porcelain .slip (low viscosity slurry ,mixture of powder and liquid ,applied on porous refractory die ,can tolerate high temperature, after 4 hour

Core is weak ,because its partially sintered ,its mainly composed of alumina based ,its porous and its made from die stone .

Die stone will absorb water))

Core is porous so we will make infusion with glass (lanthanum glass) this make like capillary action , then we will fire it again (this will eliminate the void and porosity)

Core look like metal core but the difference that core here made from ceramic .

Here the core(90% made of alumina) is opaque so we have to put fieldspathic porcelain ,this technique called in ceram (vita) .

Infusion make the core less porous more strong and tough ,all of these properties more than fieldspathic .

Inceram can be a alumina ,spinel, zirconia.

CAD/CAM technique :

supplied as ingot

machine has disk come in different size ,large for bridge ,small for crown and core .

in the past they used to put zirconia as core then fieldspathic porcelain ,but nowadays we can make monorestoration or layered restoration by this machine.

CAD/CAM has no error ,better strength .

The machine scan preparation or cast so it will make digital impression for 3d scanning .

Framework might be conventional or visual)

Visual we do preparation and scan

CONVENTIONAL (DIE we put above it material like silicon or resin then we make

\ frame work

(القطعة البلاستيك) block of ceramic) و بتجيب قطعة ثانيه framework بتجيب قطعة بلاستيك بتحفر جواتها بتحط) اسمعوا). ceramic زي المفتاح لما بدك تنسخه و هو المكان اللي رح تطلع عليه النسخه framework اللي جواها الريكورد عشان تفهموا المثال)

CAD/CAM HAS 2 type

Indirect (partially sintered) advantage :easier ,less time ,soft material ,less wear, less micro crack

Disadvantage shrinkage so we have to make scanned die oversized 20%

Direct (fully sintered) :take more time ,its might harm the machine

But its eliminate shrinkage problem and have good marginal fit .

Both technique used depend on block and design and the company

Ceramic composed of glassy phase and crystalline phase

More glass more esthetic less strength .

More crystal more strength less esthetic .

Percent of crystalline from 35_100%

Zirconia has no glassy phase

Most common use of this material is as a veneering porcelain in metal ceramic restorations , again we are talking about Feldspathic Porcelain and it is classified under the category of low to moderate leucite reinforced glass ceramic
according to manufacturing technique it comes as a powder-liquid and this technique could be used with most of ceramics types except the Zirconia which is mainly manufactured by milling

High Leucite containing Ceramics (Leucite based Ceramics)

This subcategory has more than 50% leucite, it contain lesser amount of Glass
for example : **IPS Empress 1**
can be manufactured by Heat treatment more than one cycle of Heat treatment will lead to higher amount of crystals containing Ceramics, and as known higher amount of crystals will improve physical and mechanical properties and this improvement is dependent on the interaction between the crystals and the glass matrix ,and the size of the crystals
can be manufactured by powder-liquid technique ,machining technique or pressing technique but not slip-casting as previously mentioned slip-casting is only for alumina

Lithium Disilicate based Ceramics (E max)

Composition: the same composition of Feldspathic porcelain added to it Lithium Oxide((Li_2O)
this is first introduced by Ivoclar under the name **IPS Empress 2**
manufactured by pressing, machining or powder-liquid
what is new about this subcategory is the higher amount of Lithium Disilicate crystals that reaches about 70 % and the remaining is glass and because of that you will see differences in the literature classification about this category of ceramics, some books put it under Glassy based ceramics and some books put it under Polycrystalline Ceramics
the Flexural strength is very improved in this type of ceramics about 3 times of the flexural strength of IPS Empress 1, and even with the higher amount of crystals, E max is considered

very translucent due to relatively low Refractory Index of the Lithium Disilicate crystals that is why it is very common to be used with Veneers and anterior crowns
*** in the old days when we seek more translucent restorations we go for Feldspathic and when we seek more opaque or stronger restorations we go for Zirconia but nowadays the esthetic property of all-ceramic restorations is not a problem and even they developed types of Zircon that is translucent by manipulating the Refractory Index but still the best type of Ceramics by esthetic means is the Feldspathic Porcelain and the E max will give us a good result
By E max we can manufacture "Monolithic restoration" which means all the restoration is made by one type of material
or we can manufacture a core (coping in case of a crown and framework in case of a bridge) and veneer it by Feldspathic Porcelain or Flouroapetite ceramic
because the high flexural strength of the E max we can manufacture even a bridge

Polycrystalline phase Ceramics

Or could be named inter-penetrating phase ceramic it has very high percentage of crystals and a minimal amount of glass, this category contain the In-Ceram, Alumina and Zirconia crystalline sintered matrix permitted to have the junction between the crystals themselves not like the previous categories where the junctions are between the crystals and the glass particles
the pores between the crystals are infused by glass like the In-Ceram type.

The physical and mechanical properties are improved in this type of ceramics because the highest amount of crystals and because of geometrical structures of the crystals that resist the crack pathway which causes deflection of the crack and absorption of its energy , examples:

In-Ceram

Introduced by VITA , mainly manufactured by Slip-casting , according to the crystals type we have Spinel In-Ceram ($MgAlO_4$) alumina In-Ceram and Zirconia In-Ceram and off course by these types we can make a bridge.

Polycrystalline solid phase Ceramics

This type is solid monophasic crystals formed by high temperature sintering to create a dense air-free ,glass-free polycrystalline structure this category contain pure Alumina and pure Zirconia , examples: Procera , Lava-Zirconia

Alumina

Al_2O_3 crystals form more than 90% of a crystalline phase and the rest is glass. Alumina has a high modulus of elasticity and relatively high fracture toughness but at a sharp point of the stress strain curve it will have a dramatic bulk fracture
the introduction of Zirconia led to reduction of the use of Alumina

Zirconia

Zirconia used in dentistry is not pure cubic zirconia but rather it is partially stabilized by some stabilizing oxides such as magnesium oxide (MgO), yttrium oxide (Y2O3), calcium oxide (CaO), and cerium oxide (Ce2O3) , the most common to be used is the yttrium (3% -5% in wt) and the best stability is earned from cerium
Zirconia in term of flexural strength is 2 times higher than Alumina and has the highest fracture toughness so it is the most preferred ceramic to be used in multi-unit restorations

the pure Zirconia has a problem of low temperature degradation which leads to cracks in between the zirconia crystals
Zirconia has 3 types of crystal phases : **Monoclinic, Tetragonal and Cubic** ,At temperatures Greater than 2367 °C, zirconia has a cubic structure. Between 1167 °C and 2367 °C, zirconia is tetragonal, and below 1167 °C, the structure is monoclinic. At monoclinic phase which represent the room and the oral cavity temperature, the zirconia is in the weakest form so we aim to stabilize it in Tetragonal or Cubic phase
that is why the concept of **partially stabilization** by the stabilization oxides is introduced and by that we gain a cubic phase zirconia at low temperatures The structural stabilization of zirconia by yttria results in a significant proportion of metastable tetragonal phase. This metastable tetragonal phase strengthens and toughens the structure by a localized transformation to the monoclinic phase when tensile stresses develop at crack tips. The resulting volume expansion adjacent to the crack tips produces a high local compressive stress around the crack tips, which increases the localized fracture toughness and inhibits the potential for crack propagation. This phenomenon of **transformation toughening** increases the flexural and tensile fracture resistance of stabilized zirconia prostheses 44:10

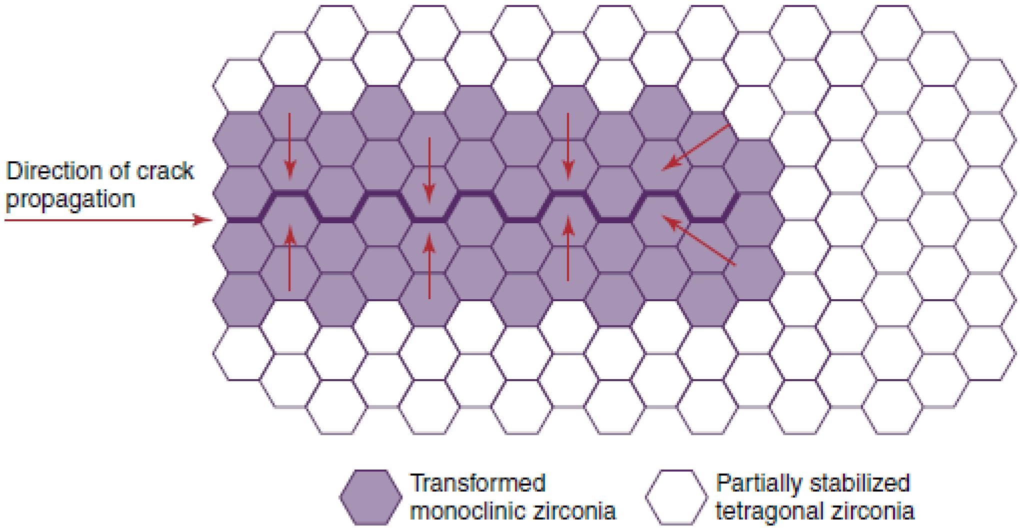

FIGURE 11.2 **Schematic of transformation toughening mechanism in partially stabilized zirconia.**