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RESEARCH ARTICLE

ANTERIOR CERAMIC CROWN : WHAT CERAMIC FOR WHICH SITUATION?

Ahd Zaghba and Hicham Soualhi

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Abstract

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Introduction:-

A large number of all-ceramic materials represent today, an alternative to metal-ceramic. However, it must be noted that despite these advances, the exact reproduction of natural teeth remains a challenge for both the practitioner and the laboratory technician. Reproducing the optical properties of natural teeth is not always easy.

The "right" choice of ceramic reconstruction material for an anterior single crown is the basis of successful reconstruction (Figure 1a, 1b).

Nowadays, there is no universal material or system that can be used in all clinical situations. The choice has become difficult because of the large number of existing processes. It is resulting of experience more often, rather than rigorous rational reflexion.

The choice of ceramics must be made following the rigorous analysis of several clinical parameters [1]. Thus it seems important to know the materials to respect their indications and to limit the therapeutic failures.

It is only by virtue of this knowledge that it is possible to ensure the clinical success of ceramic restorations on anterior teeth.

The materials used can be summed up in three categories: glass-matrix ceramics, alumina particle filled glass-ceramics, and polycrystalline ceramics. They are implemented either by hot-pressing, by slip casting or by machining (CFAO). This latter method, however, allows the fabrication of prosthetic elements from all types of ceramics.

Optical properties are crucial to know at the moment of choosing the infrastructure. It will be necessary to choose a ceramic with an adapted translucency matching the supporting tooth, and with luminosity, hue and saturation that coordinate the best with the adjacent teeth (Table 1)

The classification of dental ceramics from the most translucent to the most opaque according to clinically appropriate infrastructure thicknesses, is as follows: [2, 3]

1. IPS Empress® (0,5 mm)
2. In-Ceram Spinelle® (0,5 mm)
3. IPS Emax® (0,5 mm)

Corresponding Author:- Ahd Zaghba

4. IPS Empress® (0,8 mm)
5. Procera AllCeram® (0,5 mm)
6. IPS Emax® (0,8 mm)
7. In-Ceram Alumina® (0,5 mm)
8. In-Ceram Zirconia® (1 mm).

Such a classification suggests that the thickness of a material affects significantly its translucency. Increasing the thickness of the ceramic reduces the brightness and increases the red and yellowish appearance thereof. [4,5,6]

For anterior single-tooth reconstructions, the choice of the material depends mainly on several aesthetic factors: → the translucency and brightness of the remaining teeth to be imitated, the space available in the mouth, → the discoloration amount of the underlying core to be covered.

Evaluation of adjacent teeth:

Translucency/ opacity:

Adjacent teeth are the reference teeth, so their degree of translucency or opacity should be determined.

If the teeth have high translucency (good light transmission), the choice of the reconstruction material should preferably be the glass-matrix ceramics which give a translucent appearance [7,8] (figure 2)

On the opposite, if the adjacent teeth are luminous opaque (no transmission of light), zirconia is recommended here for the infrastructure because of its uniform hue and its tendency to prevent the transmission of light [9].

Brightness of the remaining teeth:

If the material is chosen according to the brightness of the reference teeth, the result is most predictable when the luminous teeth are made with zirconia or In-ceram crowns and the less luminous teeth with glass-ceramic crowns (Figure 3)

Degree of coloration of the dental abutment:

The abutments to be prepared may be with no discoloration with a homogeneous appearance, or presenting a light to medium staining or even strongly discolored with or without metallic posts [10]. The translucency or opacity of the infrastructure can be used as an asset to the clinical situation.

Dent non discolored or esthetic abutment The translucent systems (glass -ceramics and In-Ceram Spinelle®), due to their great capacity to lead the light will give the restoration a natural aspect. [11] (Figure 2)

Discolored tooth or metallic post and core:

With a dental abutment presenting a dyschromia, the use of translucent systems will lead to an aesthetic failure. The Procera AllCeram® is the ideal material, with the right opacity to hide the discoloration, and enough translucency to ensure a natural and lively appearance of the restoration.

The Y-TZP zirconia frameworks are more translucent than those in In-Ceram Zirconia®, yet able of masking the abutments with dyschromias.

For an all-ceramic crown on a discolored anterior tooth, the choice will therefore be an opaque (In-Ceram Alumina®) or semi-opaque (IPS e.Max Press HO®, Procera AllCeram® or zirconia Y-TZP) framework. [12,13] The finish line should be subgingival to mask the dyschromia. [11] (Figure 4)

Reduction thicknesses:

In a philosophy of minimally invasive dentistry, the ideal system will be one that will offer the best optical qualities, excellent mechanical reliability and minimal thickness reduction to preserve the tooth as much as possible.

It is necessary to produce a preparation that allows optimal material thicknesses. These are conditioned by the choice of system and the minimum recommendations given by the manufacturer. For example in the case of a zirconia framework, the required thicknesses are less important than for a glass-matrix ceramic infrastructure

because the zirconia is more resistant. The minimum cervical thickness required is 0.8 to 1.5 mm for glass ceramics enriched with leucite or lithium disilicate, and 0.5 mm for aluminous ceramics and zirconia. [14,15]

Retention of the preparation:

The resistance prevents the rotation of the crown and the loosening of the latter in an axis other than the insertion axis. It depends on the geometry of the abutment and the precision of the crown adaptation, but also on the method of cementation [15,16].

If the shape of the abutment lacks retention, restoration must be resin-bonded. The first choice will be a lithium disilicate reinforced ceramic that is suitable for bonding [15]

In the opposite case, the decision of the assembly method will be made among others according to the level of the finish line. (Figure 5)

Preparation margins:

For ceramics enriched with lithium disilicate, aluminous ceramics and zirconia a tooth preparation with a chamfer, or rounded-shoulder finish line is recommended. Flat leaves, bevel preparations and chamfers are contraindicated. [14, 16]

Finally, the situation of the finish line is supra or juxta-gingival whenever it is possible, at one condition of using a translucent bonding material, cement, hybrid material or resin-bond. All ceramic systems can be indicated.

When necessary, the limit will be subgingival, leaving a safety marge for the biological space. In this case, a resin-modified glass ionomer cement (CVI-MAR) or a conventional cement should be used. [16] Thus, glass-ceramics are not indicated. (Figure 4)

Resistance requirement:

In patients with a parafunction, it is more advisable to perform metal-ceramic restorations. However, some patients insist on having a metal-free restoration. The infrastructure material must have a high mechanical strength: the choice is thus for aluminous ceramics (InCeram Alumina®, Procera AllCeram®) or zirconia Y-TZP [12].

Conclusion:-

A large number of all-ceramic materials today represent an alternative to metal-ceramic. There is no universal material or system that can be used in all clinical situations. The choice of ceramics must be made following the rigorous analysis of several clinical parameters



Figure 1a:- Failed choice of ceramic system, the crown on the upper right incisive (11) is too translucent with an incorrect hue.



Figure 1b:- Failed choice of ceramic system, the crowns on the incisors are too opaque.

Table 1:- Translucency of Different systems.

Different ceramic systems translucency			
Translucent	Semi-translucent	Semi-opaque	Opaque
Feldspathic Empress E-max HT, LO In-ceram Spinell	Procera Alumina E-max MO Zirconia (> 0,4mm)	In-ceram Alumina Zirconia (>0,6mm)	In-Ceram Zirconia E-max HO Porcelain-fused-to-metal crown



Figure 2a:- Tooth preparation on the 11, non discolored abutment, juxta-gingival finish line, translucent adjacent teeth.



Figure 2b:- The choice will be reinforced glass-ceramic (E-max).



Figure 3:- Tooth preparation on the 21, non discolored abutment, luminous adjacent teeth, the choice will be oriented to filled-glass ceramics (In-ceram Spinell).



Figure 4:- Tooth preparation on the 21, discolored abutment, subgingival finish line, the choice will be polycrystalline ceramic (zirconia).



Figure 5:- Tooth preparation on the 11, lack of retention , indication of glass-ceramics with bonding abilities (E max).

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