Esthetics in and with All-ceramic Restorations

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Introduction

It is possible that in the near future all-ceramic systems for single crowns and fixed partial dentures (FPDs) may replace standard porcelain fused to metal restorations (PFM). The esthetic and biocompatible advantage of all-ceramic systems has become quiet clear. Several clinical studies demonstrate the success, especially for ceramic frame systems that are generated by CAD/CAM systems.

Objectives

Preparation for All-ceramic Systems

The preparation principles applied in all-ceramic systems are comparable. The margin should be precisely determined either by a modified shoulder and rounded internal angles or a chamfer. The tooth preparation should have a taper of 6° to 10°. All contours ought to be smoothened and rounded. The removal of the tooth structure correlates to the manufacturer's guidelines. All-ceramic systems with zirconia core need similar preparation which is used in porcelain fused to metal restorations (PFM).

Material and Methods

CAD/CAM Systems and Indication

Nowadays dentists and dental technicians can choose from a great variety of all-ceramic systems. The planned restoration determines the proper ceramic system. Ceramic frame systems based on zirconia are suitable for anterior and posterior restorations. As the result of these strong ceramics it is possible to make three or more unit FPDs.
Preparation guidelines for all-ceramic systems

<table>
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Results

Semi sintered zirconia vs. hot isostatic pressed zirconia

The introduction of CAD/CAM systems introduced the possibility of producing dental restorations from materials of extreme hardness and flexural strength. Pre-sintered zirconia is used by manufacturers like DCS ®, Decim AB ® and Digident ®. The milling process is extremely time consuming, due to the subtractive procedure. It is even technically possible to make up to twelve or more unit FPDs.

Chalk-like, semi sintered zirconia is firstly shaped by milling and then condensed by heating. The shrinking rate of the over dimensioned ceramic frame is 20-30%. The duration of the sinter process is about 8 hours. Several studies show that the flexural strength falls back to 500 MPa due to the embrittlement and fatigue of the pre and semi sintered ceramic. Long-term assessments are still needed for evaluation.

Fracture resistance and incidence

The durability depends on the flexural strength of the used materials. Ceramic with low flexural strength of 200 MPa must be adhesively cemented and can only be used for inlays, veneers and partial crowns. For premolar crowns and anterior bridges a minimum flexure rate of 400MPa is required. Extremely high flexural strength of more than 1000 MPa, provided by zirconia, can even be used for posterior crowns and multi unit FPDs.
Flexural Strength of All-Ceramic Systems

IPs Empress ® 1 150 Mpa Inlays, veneers and single crowns
IPs Empress ® 2 400 Mpa single crowns on premolars
In-Ceram ® Alumina 570 Mpa and up to anterior 3 unit FPDs
In-Ceram ® 30% zirconia 70% alumina 700 Mpa
Lava ® >1000 Mpa posterior 3 and 4 unit FPDs
Cercon ® >1000 Mpa
Digident ® ~1200 MPa 12 and more unite FPDs
DCS ® ~1200 MPa

Discussion and Conclusion

- The natural appearance and translucency of the all-ceramic systems makes esthetics in dentistry more achievable.
- Zirconia allows a higher range of indications and multi unit FPDs.
- Ceramics with flexural strength below 200 MPa must be adhesively cemented.
- Accurate preparation methods are necessary.
- FPDs manufactured with CAD/CAM processes made of zirconia could replace the conventionally produced FPDs as long as the production is economical.
- First results of studies at our Institute show great promise for the use of all-ceramic systems based on zirconia frames.

Literature


Abbreviations

DCS ®
Digident ®
Cercon ®
Lava ®
In-Ceram ® 30% zirconia
In-Ceram ® Alumina
IPS Empress ® 2
IPS Empress ® 1
Procera ® all-ceramic restorations.
Balance ® abutment of a crown on teeth 12, 11 and 21.
Ankylos ® implant in regio 12.
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Introduction

It is possible that this age has all-ceramic systems for single crowns, and fixed partial dentures (FPD) have been standard for over 20 years. CAD/CAM systems and fabrication technologies have become more widespread. All-ceramic systems can become part of the clinical routine. The purpose of this poster is to present different restorative systems.

Preparation for All-ceramic Systems

The preparation principles applied in all-ceramic systems are comparable. The mesial and distal walls should be designed as untouched as possible. A chamfer should be prepared on the incisal edge or at the line angle. A bevel should be prepared on the incisal edge or at the line angle.

Fracture resistance and incidence

The hardness of porcelain depends on the type of the all-ceramic material. Esthetics with high fracture strength of 400 MPa could be achieved with specific materials. The preparation should be done with care. Porcelain veneers with different materials are available on the market.

Conclusion

The natural appearance and lifetime of the all-ceramic systems make esthetics an essential and important criteria.