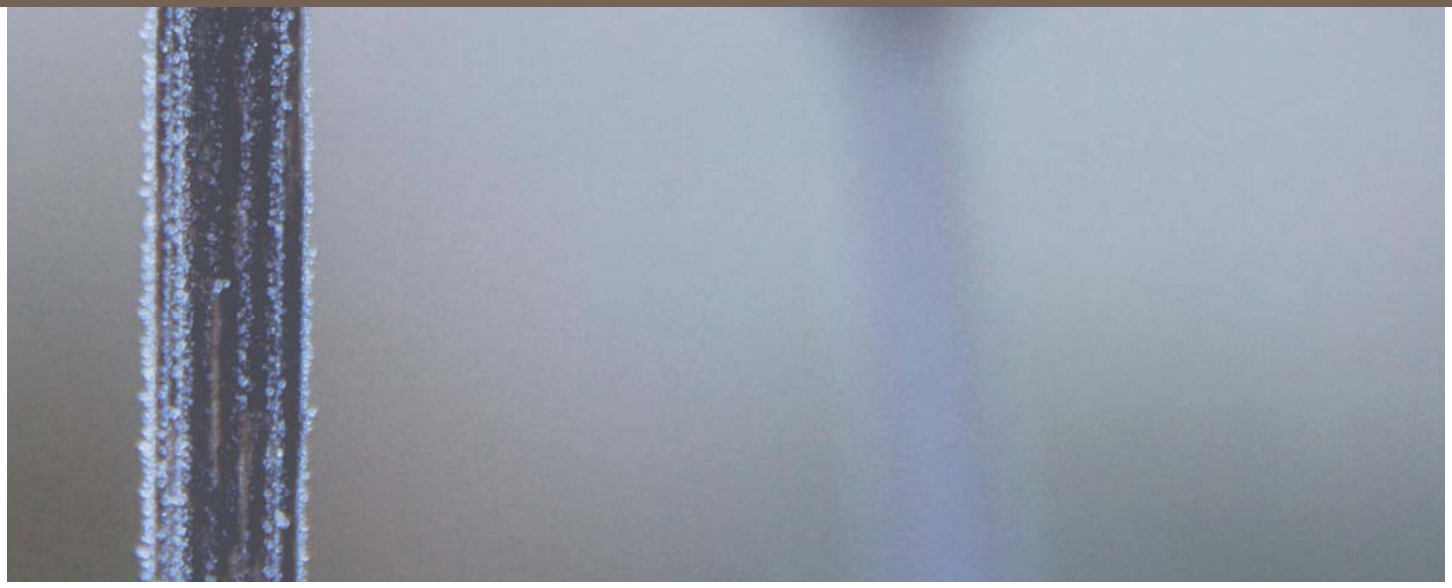
Zirkonzahn®

Human Zirconium Technology

ZIRCONIA – DENTISTS' INFORMATION

FACTS – Practice related questions and answers

ENGLISH



Zr

Facts and possibilities

Facts and possibilities

What is Zirconia?

- Zircon ($ZrSiO_4$) is a mineral belonging to the mineral class of Silicates, discovered in 1789 by M.H. Klaproth.
- Zirconium dioxide (ZrO_2) is a compound of the element zirconium occurring in nature and has already been used for 10-15 years in the prosthetic dentistry. It is partially stabilized by yttrium and enriched with aluminium. This results into positive characteristics such as high bending strength (> 1400 MPa*), hardness (1200 HV*) and a Weibull module of 15,84*.
  (* Values of Zirkonzahn ICE Zirconia Translucent)

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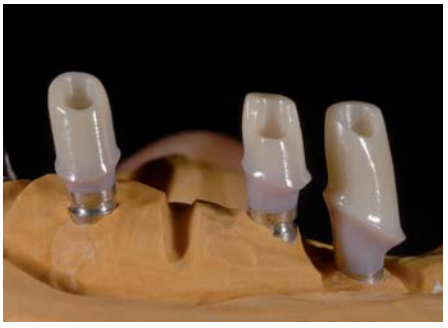
Where is it used?

- In addition to its high resistance Zirconia is fully biocompatible. That is why it is increasingly used in the medical field (auditory, finger and hip prostheses) and in dentistry (pins, crowns and bridges restorations, implants). In industry it has already been used for more than 40 years. The white basic colour of Zirconia, the possibility of colouring in dentin colours and its biotechnological characteristics enable the production of biocompatible, high-quality and esthetical dental and implant reconstructions.



Is full Zirconia possible?

- Experts among the dental technicians are able to realize conventionally precious metal-based dental prosthesis constructions in zircon.
- In this connection Zirkonzahn has developed the high translucent Prettau Zirconia and a colouring technology especially coordinated with it. Thus, aesthetically appealing full Zirconia restorations can be manufactured.

Are removable dental prostheses possible?

- Yes, if certain physical laws of the construction technology for Zirconia are taken into account and the dental technician masters the manufacturing technology.

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Scientific Information

Scientific Information

- The main raw material for the production of Zirconium dioxide is the mineral zircon ($ZrSiO_4$). Zirconia oxide is obtained from it by chemical treatment with additives. The reactant powder obtained is mixed with additives. A distinction is made between sinter additives, which specifically affect the sintering behaviour and the characteristics of finished ceramic, and auxiliary materials, which facilitate shaping. Thereafter Zirconia blanks are manufactured by different procedures.
- While the sinter additives remain in the Zirconium dioxide, the auxiliary materials, which, besides water, are mainly very volatile organic compounds, are removed from the Zirconium dioxide moulding before the sinter process without leaving any traces although the material undergoes a pre-sintering process the material remains workable by means of tungsten carbide burs. The object is milled out from the chalk-soft Zirconia block, approx. 25% larger than the size of the object. It is then end-sintered at 1500°C and thus attains its final consistency. During this process the object shrinks by 20%. Only in the course of the end-sintering process do the structures obtain their actual characteristics. The compression of the Zirconium dioxide powder particles occurs by decreasing the specific surface.

- This is obtained by temperature-dependant diffusion processes with changing portions of surface, grain boundary and volume diffusion. If the solid state diffusion runs too slowly, the sintering process can also be carried out with pressure. This is called hot pressing or hot isostatic pressing (“HIP process”) of Zirconia. The characteristics of Zirconia ceramics depend to a great extent on the chemical composition of the material and the manufacturing process.

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Scientific Information

Scientific Information

- A distinction is made between fully stabilized zirconia (FSZ) and partially stabilized zirconia (PSZ). A partial stabilization can be achieved by using an additive of 3-6% CaO, MgO or Y_2O_3. Depending upon the manufacture conditions the cubic, tetragonal or monoclinic modification can be stabilized. Partially stabilized zirconia shows a high spalling resistance and therefore is also suitable for the use as engineering ceramic at high temperature.
- The cubic modification of zirconia can be stabilized from the absolute zero to the solidus curve by adding an additive of 10-15% CaO and MgO (FSZ) and the ceramic material can thermally and mechanically withstand a temperature of 2600°C. However, due to the lower heat conductivity and higher coefficients of thermal expansion compared with partially stabilized zirconia, the spalling resistance of the fully stabilized zirconia is lower. Zirconia suitable for dental restorations shows the following composition: 95% ZrO_2 + 5% Y_2O_3

ICE ZIRCONIA TRANSLUCENT AND ICE ZIRCONIA PRETTAU

Both kinds of Zirconia can be used for manufacturing crowns and bridges. Due to its high translucent degree ICE Zirconia Prettau is particularly suitable for full Zirconia bridges.

ICE ZIRCONIA

COMPOSITION			Specification
$Zr O_2$ (+HfO_2)	%	:	Main constituent
$Y_2 0_3$	%	:	4.95 ~ 5.26
$Al_2 0_3$	%	:	0.15 ~ 0.35
$Si0_2$	%	:	Max. 0.02
$Fe_2 0_3$	%	:	Max. 0.01
$Na_2 0$	%	:	Max. 0.04
Density (g/cm^3) sintered			6,05
Hardness (HV10)			>1250
Weibull module			> 15,84
Bending strength R.T. (MPa) Transl.			>1400 (MPa)
Bending strength R.T. (MPa) Prettau			>1200 (MPa)

Zr

Practice related questions and answers

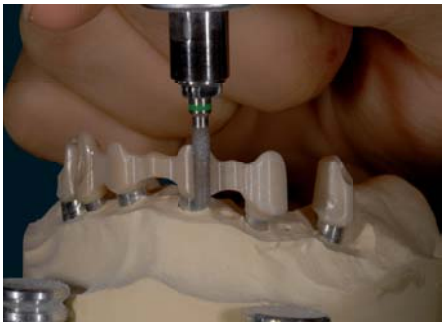
Practice related questions and answers

How does the durability of Zirconia frame structures including veneering compare with porcelain-fused-to-metal crowns?

- When the framework design is correct in terms of dimension and precision there are no disadvantages compared with porcelain-fused-to-metal crown technology.

Must Zirconia be ground with water cooling (e.g. correction when trying on the frame structure)?

- Water cooling is recommended, but not mandatory.



How does the aging process of Zirconia and the involved loss of strength compare with the usual metal ceramics?

- All frame structure materials age, including metals. The bending strength before aging of metal is approx. 500 MPa, of ICE Zirconia approx. 1400 MPa. With a theoretical, but so far not proven loss of strength of 30% still remain 980 MPa in respect to Zirconia.

Why does ICE Zirconia have a continuous contraction?

- This is our secret.

How does the bonding between ceramic and Zirconia develop?

- Mechanical retention. Compressive stress and surface fusion.

How many long-term experiences/studies are there relating to Zirconia work?

- A study by the University of Zurich shows an absolutely positive long-term experience. In this study for the first time, approx. 12 years ago, long-term trials related to zirconia were started.

By what means can Zirconia work be cemented?

- Phosphate cement or glass ionomer cement.

Stability comparison between Zirconia and metal ceramics

- Zirconia is resistant to breaking, however less tough than precious metal.

Which indications and/or contra-indications are there?

- All indications in the fixed and removable range.
- Contra-indications in the case of too small vertical dimension.

Zr

Practice related questions and answers

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Aesthetics comparison zirconia/metal ceramics

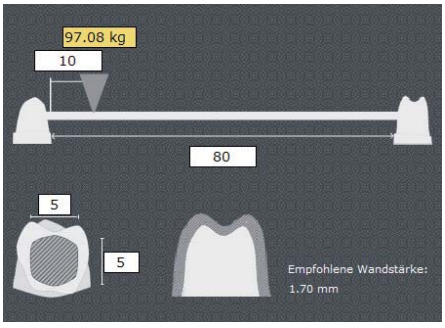
- ICE Zirconia frame structures are translucent and therefore aesthetically superior in comparison with opaque metal frame structures.

Are edge extensions possible after trying-in?

- Edge extensions after trying-in the frame structure are possible by using ceramic shoulders. However it is better to try in the frame-work before milling.

Why can bridges break?

- Bridges can break if fundamental errors are made in the frame structure manufacturing. There is a Zirkonzahn calculation tool for dimensioning bridge structures. This program can be downloaded free of charge under www.zirkonzahn.com.



Zirconia frame structures are always friction-free and always fall from the mouth of the patient when trying-in.

- Friction is technically feasible, but not recommended. It would be better to thinly coat the frame structures with Vaseline before trying-in.

Is Zirconia radioactive?

- Everything is radioactive! The human body has 6000 Bq. One gram Zirconium dioxide has approx. 0.4 Bq. A crown weighs approx. 1 gr., metal ceramic can have up to 2 Bq/gr.

The crown edges on Zirconia objects are too thick.

- This is not a material problem, but a processing error. After milling and before sintering the ICE Zirconia blank, the crown edges must be manually and thinly prepared by the technician.

How do the costs compare with metal ceramics?

- Regarding the material use Zirconia is equivalent or just slightly more expensive than metal ceramic.

Zr

Practice related questions and answers

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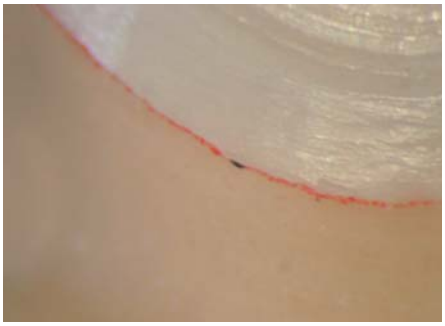
How well does Zirconia fit?

- If the processing is correct, precise fittings in the hundredth range are standard with the Zirkonzahn system. The marginal integrity amounts to 20 µm as with gold work.

What happens when grinding off and/or correction grinding of Zirconia takes place?

- There are no problems, if it is ground off under water cooling and any resulting sharp edges are rounded off.



What is the use of Prettau Zirconia?

- Prettau zirconia is highly translucent and it is used for manufacturing esthetic full Zirconia works in connection with a specially developed colouring technology, in particular within the field of implants, and is also to prevent ceramic chipping.

Is the tangential preparation officially safe enough for Zirconia works?

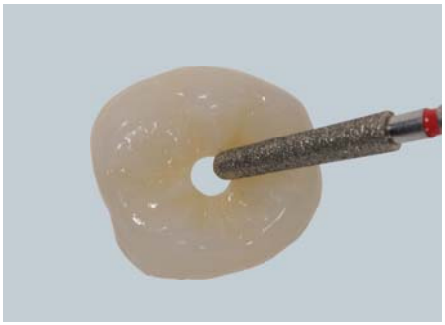
- There are no objections on the part of Zirkonzahn against tangential preparations when the frame design is appropriate.

Is a Zirconia crown stable enough or possibly unusable after trepanation?

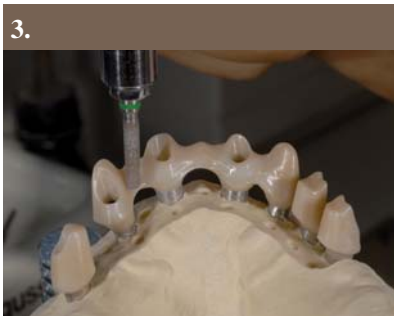
- Using water cooling and with appropriate tools no structural frame damage should occur.

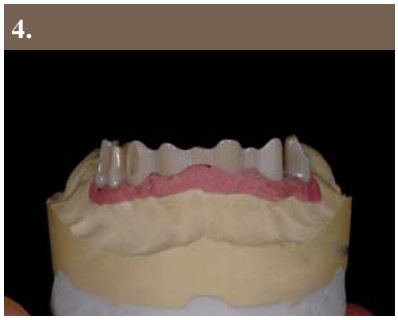
Which drilling tools are recommended for trepanation of Zirconia crowns?

- Zirconia diamond burs are recommended.



1. Starting situation
2. The prosthesis is duplicated in a polyuritan resin materia, (Frame) and from this duplicated prosthesis the bar attachment is eleborated





3. The bar attachment and the bar parts are eleborated using a diamond bur
4. The surface roughness is polished by using fine diamond burs and diamond polishing paste to produce a high gloss restoration

5. The secondary part is manufactured in Frame material and the anterior teeth are prepared to abutments for the later ceramic veneer
6. Sintered bridge

7. The secondary part is aligned
8. Try-in the mouth

9. Ceramic layering of the restoration in the anterior tooth range with ICE Zirconia ceramic
10. Application of gingiva with ICE Zirconia ceramic tissue

11.

12.

11. Secondary part

12. Secondary and primary part

13.

14.

13. Finished work from occlusal

14. Bars screwed in

15.

16.

15. Work is ready for cementing

16. Cemented work by using Temp Bond in the patient‘s mouth

Finished work

ICE Zirconia and ICE Zirconia ceramic

Zilio Aldo, Venice

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