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ZIRCONIA MILLING OR GLASS-PRESSED ALL-CERAMIC?

Alexander Kanotscher

Both techniques are utilized in our laboratory. In indicated cases when a particularly optimal light transport is required, we still consider that glass-/pressed all-ceramic is an advantage. Since glue must be applied anyway, reasonable strength values can be attained here as well. For all other therapeutic indications, such as bridges, dowel crowns, posts and cores, long-term temporary appliance, inner telescopes, posts, anchor and attachment work, crowns, the zirconia technology of „Zirkonzahn“ is our firm favorite. A synergy of both technologies takes place in the zirconia over-pressure technique.

Zirconia milling technology (9 unit bridge)

IPS Empress 2 (6 OK crowns)

IPS Empress Staining Technique (12 crowns)

Whether Staining Technique (IPS Empress Esthetic), IPS Empress 2/IPS Eris for E2 or the revolutionary zirconia milling technology, we decide in each single case depending upon requirement. The difference in price is here an important factor only with respect to the Staining Technique and the Zirconia Complete Technique.

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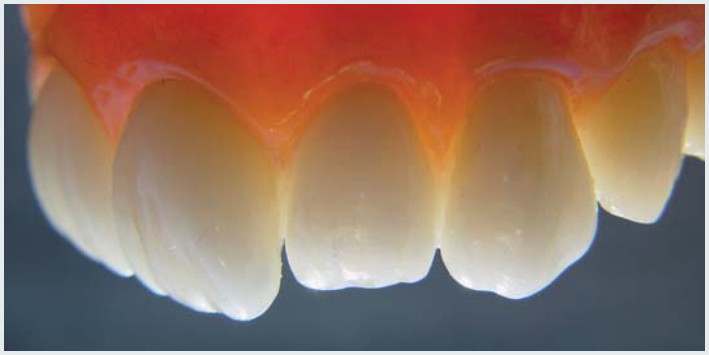

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1 Pressed all-ceramic
2 Glass ceramic Inlays
3 Partial crown Chips
4 IPS Empress Esthetic (6 veneers)
5 Backlit

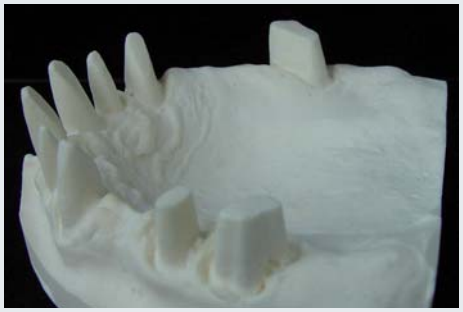
EXPERIENCES WITH THE ZIRKONZAHN MILLING SYSTEM

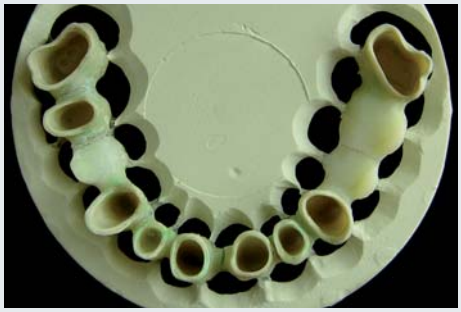
Subsequent to the outsourcing of the production of zirconium oxide frameworks for the time being and after thoroughly investigating all the facts we decided to purchase the Zirconzahn milling system of Enrico Steger.

Steger has been working for dentists and colleagues in its laboratory already since 2001. Within approximately six months after delivery of the first equipment, this system evolved into a market leader. This confirms that not only we and our customers are convinced of the many advantages of this method.

During the presentation of the system including the preparation of two trial works, I was positively surprised in particular by the fitting of the ready caps and a 4-unit bridge framework.

Before deciding a definite purchase, however, I wanted to gather more detailed information and I took up a particularly big challenge: A 12 unit bridge framework of up to 13mm long and partly very thin dies - an extreme situation. I modeled and milled the zirconia structure from the blank in my own laboratory, then once again in Bruneck.





After the sintering process over night, I was extremely curious about the result on the next day. The framework already matched almost perfectly. After minimum corrections, the 12 unit framework has now a tension-free seat and matches perfectly on both the sawed and non-sawed model. Within shortest time this new technology is so well established among our customers that the predominant portion of all crown and bridge works is now manufactured out of zirconium oxide. Furthermore, we mill frameworks for some laboratories as well.

Moreover, the high portion of works with zirconium is certainly due to the fact that with this system we can cope with almost any therapeutic indication for this material.

The fixing of the restorations can be carried out with conventional or modified cement and by means of the adhesive technique. For thin framework designs glass ionomer cement should be used for cementation due to its transparency.

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Indications

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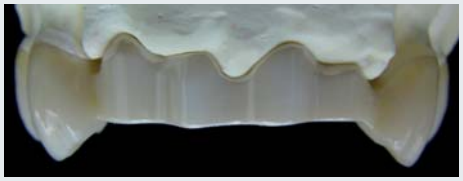

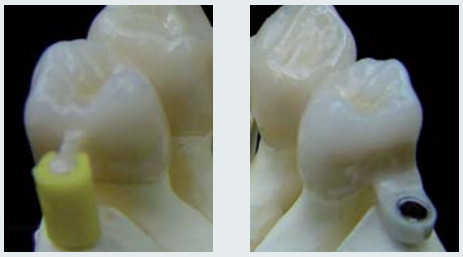

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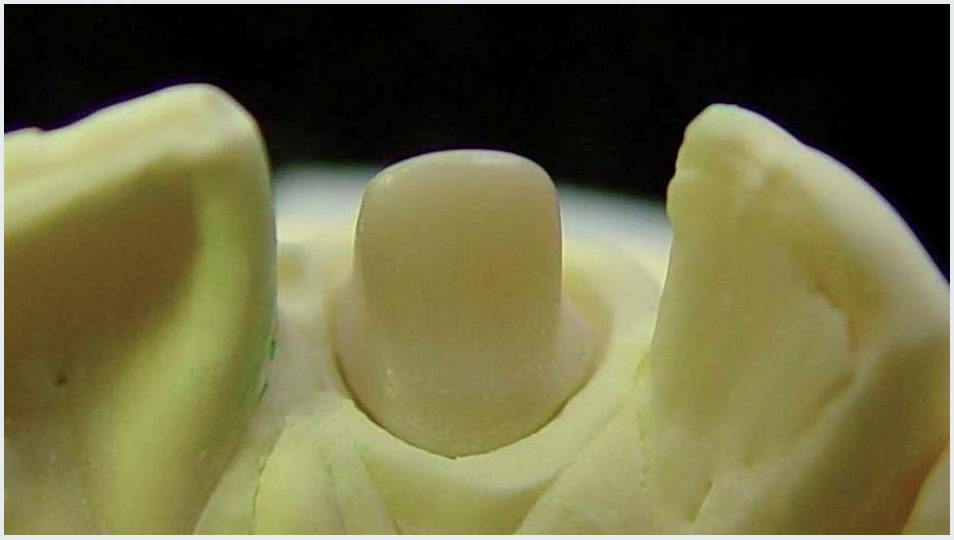
All kinds of preparations can be milled. This applies to circular shoulders as well as deep and light groove preparations.

Various construction types of implant structures, inlay bridges up to 14 unit facing bridges. All divergences can also be examined by touch and milled without blocking out. The edges can also remain non-veneered thanks to the coloring made possible by zirconium dioxide in each of the 16 Vita shades.

We would now introduce an excerpt from different ZrO2 works of our laboratory which will clarify the large extension of the range of application of this technique.



1 Single caps and crowns
2 Core build-up
3 Maryland bridge
4 Inner telescope combined to electroplating
5 Locked crowns with bar, anchor or attachment

Complete zirconium posts and cores are translucent. They are without compare, concerning their stability, with the already known glass ceramic over-pressed ready-made pins made of zirconia. Zirconoxide inner telescopes are visually more attractive - more tooth like - for the patient after removing the dental prosthesis. As is well known, the adhesion to the galvanized secondary parts is very good. We consider as a further advantage the particularly low plaque affinity as well as the excellent biological compatibility.

Clasp crown in existing prosthesis

Apart from the good optics compared to the metal crown the price does not need to be discussed. With regards to clasp crowns which are later worked into existing prostheses, the metal consumption according to experience is rather high, while the zirconium costs can be determined and calculated independently of the size of the crown.

ZrO2 abutments and implant superstructures

With respect to abutments and superstructures made of zirconium the biological compatibility but also the tooth color visual effect on the gingiva play a decisive role.

The individual design occurs also here in the plastic modeling and is converted into zirconium after release only.

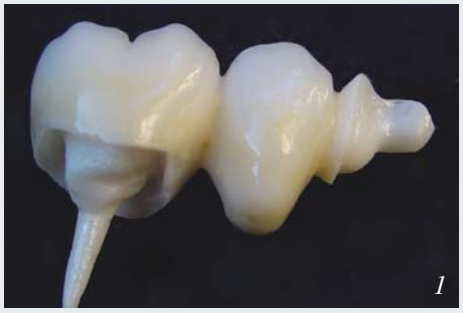
Completely milled teeth - Crown - bridge made of ZrO2

1 Milled blanks
2 Sintered, glaze-baked
3 Complete zirconium crown on implant
4 Full zirconium bridge partly faced

These works are meant to clarify, that there is no restriction in the surface design, the chewing area and the pontics design. In principle, each tooth can be milled in this way as single crown or in a composite bridge as a gingiva friendly long-term temporary appliance as well as a cost-effective full zirconium work. Depending upon the situation in the opposite jaw (natural tooth or plastic tooth) it has to be decided, whether a partial facing must be carried out in order to preserve the opposing tooth.

Zirconium dowel crowns Zirconium dowel crowns

In Austria the production of so-called dowel crowns, endo-crowns or Richmond crowns is quite usual. The root pins are modeled in one piece with the crown and prepared for the facing as a framework cap including the pin. By a special modeling procedure and the conversion into zirconium we succeed in producing even this high performance zirconium-milling technology. Manufacturing a dowel inlay bridge made of zirconium helped us to give proof of the excellent fit concerning this requirement as well.



1 Zirconium dowel crowns
2 Zirconium dowel inlay bridge

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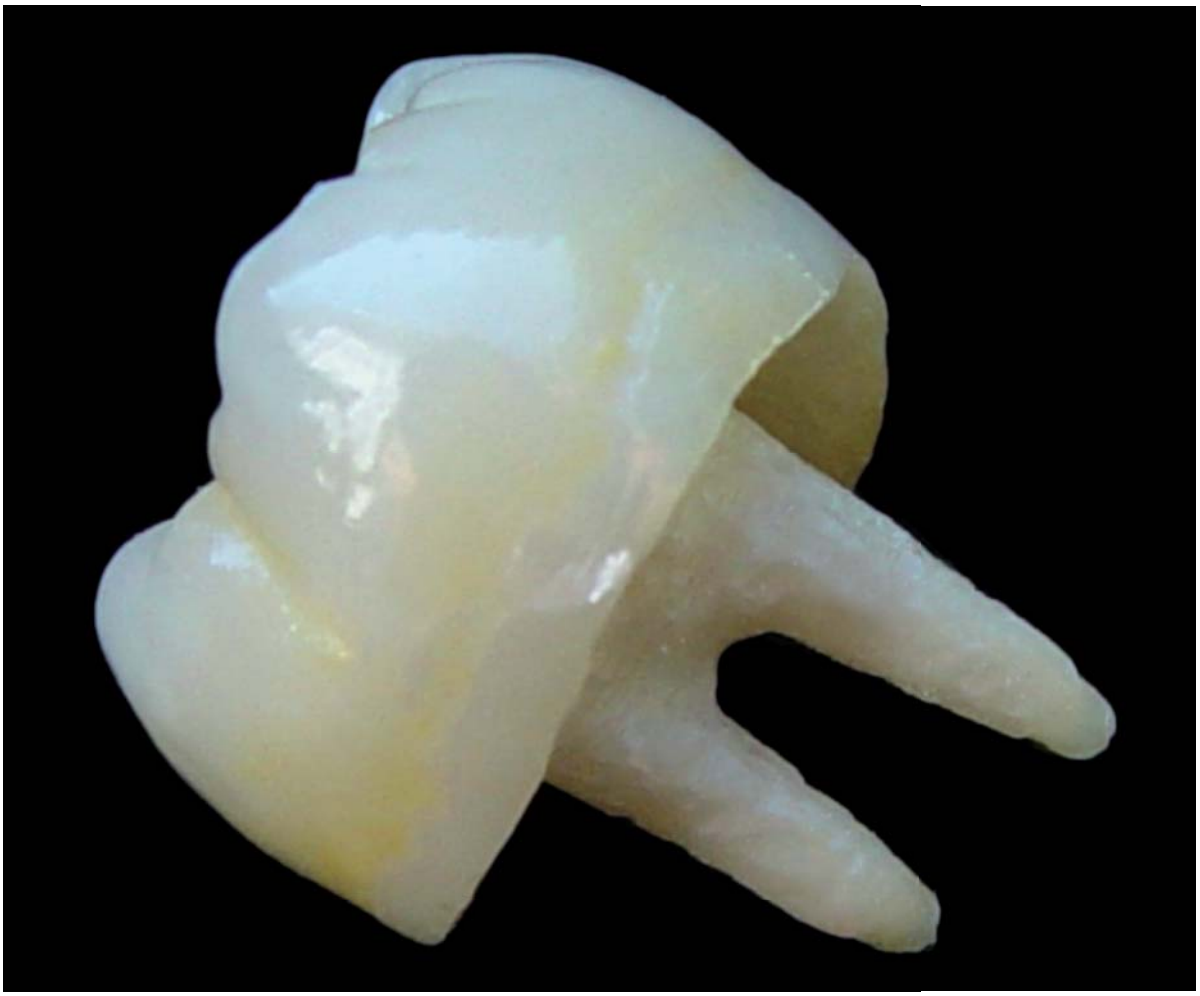
In our laboratory meanwhile a large number of dowel crowns with a various quantity of milled dowels are implanted for the canals. The milling procedure requires the highest concentration on the part of the technicians. The good visual effect with a lower dental expenditure (1 session less) speaks volumes in favour of this technique. The period of time since February 2005, since the first Richmond crowns made of zirconium have already lasted in the mouth, of course give still too little information about the overall „life span". However, we are confident we shall attain good results in the long run, since the remaining stump is circularly extremely well mounted in each case.

„Contrary to the opinion of many colleagues, I enjoy the fact of the manual blank milling technique of the zirconium dental prosthesis. Thus, such works leaving my laboratory are produced not entirely depending on very expensive equipment which basically cannot be used in a variety of applications and constantly is subject to maintenance. Furthermore, this technology enables me to bring in my personal manual ability and I can stand out with an incomparably individual and nevertheless highly precise and sturdy work piece. The inclusion of all condylar paths already for the framework gives me an additional feeling of security during the modeling phase. From the point of view of time expenditure, it can be compared to the Vita Metal-Ceramics (VMK) technology."

Instead of showing further single crowns or up to 5 unit small bridges, which production enables anyway any zirconium-milling system, we present one of our patient cases which prosthesis, of course, was manufactured with the „Zirkonzahn"-System as well.



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PATIENT CASE

11 unit bridge

The framework is made of sturdy and light-hardening plastic on the usual saw model in the articulator. Giving special attention to the condylar paths, this enables an anatomical and exactly matched modeling. Furthermore, the framework is always designed cusp-supported so that the facing ceramic receives an even layer thickness (important counteraction: splitting off of the facing). Since the plastic framework refers absolutely to the later finished framework out of ZrO2, before milling from the zirconium blank, this framework is tried in, a bite control is carried out and the edges are checked.

1 Situation

2 Plastic framework for the matching test with plastic facing at the front for the aesthetics and phonetics test

The plastic framework was provided on request with mobile plastic facets for an aesthetics/phonetics test. These shells are sturdier than wax-ups. The dentist had thus the possibility of correcting the position during the framework test, to shorten the framework with the usual grinding equipment or to change its form.

If at the time of the test the zirconium framework is already produced instead of the plastic framework, a new time and cost-intensive making of the framework can become necessary, in case, for example, of edge inaccuracies or bite divergences. The process of sintered zirconium is difficult and can take place with special abrasive device only. It should anyway not be exposed to any unnecessary stress by polishing.

In practice and in the laboratory, a correction is still possible with this method without a great effort. The dentist can, for example, grind at the plastic framework or apply a light hardening layer. In this case one of the variants is the exactly fixing of the base portions in the area of the pontics. The treating physician will thus carry out a relining in-situ at the plastic framework with light hardening plastic.

For the sampling of the plastic framework, a control bite with cement was made. When required the height of the framework can also be corrected as described above. In this way the cusp-supported framework design is later on prepared out of zirconium for an optimal facing.

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MANUFACTURE OF THE BRIDGE MADE OF ZIRCONIUM OXIDE

Copy milling procedure in 5 axes

Plastic plate with framework modeling

Materials values of ZrO2:

Bending strength: 1200 MPA
(Glass ceramic: 100-200 MPA*)*

Hardness: 1250 Vickers

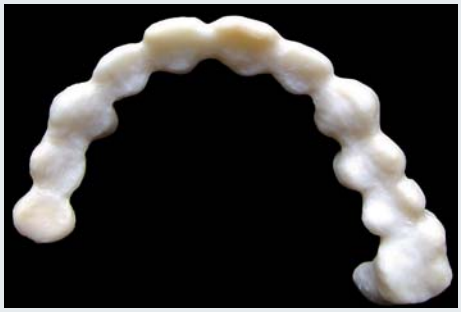
Fracture toughness: 10-12 Weibull

Radioactive: 0,3bq / Tooth

Facing ceramic: 1 bq

Adult humans: 6000 bq

The 11 unit zirconium framework was milled from the blank, dipped and sintered into Vita A3 color liquid. According to university test reports the color particles are present up to a framework depth of 1/10 mm only and do not weaken either the structure or the connectors! The framework matches exactly and tension free.



Facing ceramic

The bridge matches both the sawed model and the 2nd non-sawed model without edge gaps and free of tension

In particular with the facing ceramic, which is baked on zircon frameworks, it is essential to keep the masses constantly humid. Ceramics baked on zirconium dioxide have primarily aesthetic advantages in the cervical area.

Due to the absence of metal, no shadows appear and no blue coloring of the gums compared to the metal ceramic occurs.

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The situation was particularly difficult, since the clearly shifted center line was originally compensated with 2 bridge units 22. It was necessary to find a compromise between a shifting and a substantially too wide tooth 22.
Furthermore the protrusion should be reduced. The asymmetrical course of the lip line was an additional challenge. 16 will be later replaced with an implant. crown.

1 Smoothed model; *2* Initial situation; *3* Initial situation

If in 1980, the year of our laboratory opening, we could manufacture porcelain jacket crowns only, today - thanks to the ZrO2 technology - we are able to solve almost each case using exclusively ceramic. After all, more than 30 years have passed from the full ceramic crown up to the metal-free complete restoration: A long time for me to become perfectly familiar with Zirkonzahn technology, because actually with this type of manufacturing the zirconium dental prosthesis we benefit from the longstanding acquired know-how of the metal supported production of dental prosthesis and implement this know-how with the same custom-tailored and technical precision in zirconium oxide solely.

Report: *Alexander Kanotscher*

Högenauerstr. 3
5280 Braunau/Inn
07722 84064
Germany
84359 Simbach/Inn

office@zahnprofi.at
www.zahnprofi.at