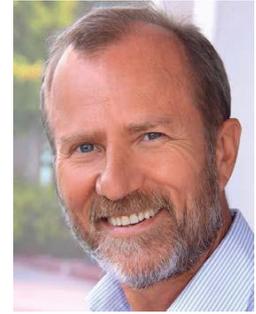




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Ceramic implants: One-piece systems are established on the market. How are two-piece systems developing?

The trend to establishing two-piece systems in the market is advancing. This article reports on the first clinical studies and presents a patient case.

One-piece zirconium dioxide implants

Zirconium dioxide implants enjoy increasing favor, and industry is providing ever-more new systems. The reason for this growth are two characteristics that titanium implants are missing despite the great clinical experience that has been gathered: freedom from metal and the white basic color, the outside that supports aesthetics even in the case of difficult soft tissue situations (1,2,3). Since osseointegration in some ceramic implant systems due to an optimized surface which has become comparable to that of titanium implants (4, 5, 6, 7) and the survival rate of these systems is between 90 and 100 percent [8, 9, 10, 11, 12], which has brought the characteristics of ceramics into ever greater

focus for practitioners. One characteristic limits the use of zirconium dioxide implants: the fact that they are one-piece. Why are two-piece systems of such great interest?

The main risk of a one-piece ceramic implant is the transgingival healing phase. Forces from the oral cavity impact the implant portion which reaches into it, which leads to micro movements of the crestal implant portion, and therefore can endanger healing (13). Therefore, great primary stability and apparatus-supported protection during implant healing are very important to disruption-free osseointegration (14, 15, 16).



swiss made



Fig. 1: Protective apparatus, here as a tooth-colored Flexiplast provisional clamp



Fig. 4: ZV3 from Zircon Vision GmbH, Wolfratshausen

Two-piece zirconium dioxide implants

For a long time, the *Sigma* system from Incermed, which appeared on the market in 2002, was the only two-piece ceramic implant on the market. This has changed in recent years, and in 2014 the first clinical studies on two-piece ceramic implants appeared (see table).



Fig. 2: Vario-C from Ziterion GmbH, Uffenheim



Fig. 3: Zeramex-T from Dentalpoint AG, Zurich/Switzerland



Fig. 5: Two-piece Zirkolith from Z-Systems AG Oensingen/Switzerland

The manufacturers are pursuing different designs with their implants.

The *Vario-Z* implant from Ziterion GmbH supports closed healing. The crestal thread portion is therefore sunk nearly down to the bone level. After healing, the implant is surgically freed, and the abutment is cemented. The transition from the implant to the abutment uses the principle of platform switching in order to get around micro-gap problems at the cement location, which can then cause bone loss. In fact, a study has shown a bone loss 24 months after implant of

Although high primary stability is desired for every implant, this plays only a minor role in closed healing, so experienced operators can frequently build up bone and do implants in one sitting. Patients can also avoid the wearing of separate guardrails with closed implant healing. A further benefit of two-piece compared to one-piece systems is the prosthetic structural freedom of the implant thanks to free choice of abutments after healing.

1.48 mm (SD=1.05mm) under the implant shoulder (17).

A significant challenge of this system to the dentist is the cementing of the abutment. The authors find that a coffer dam must be used, as this treatment step takes place during the surgical release, and is accompanied by bleeding. Since no healing abutments are available at present, one must cement the abutment at a

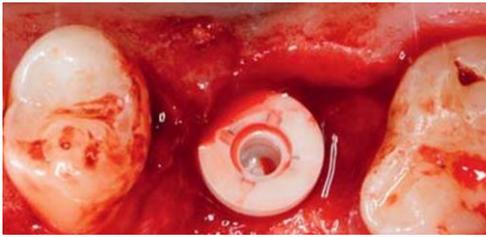


Fig. 6: Inserted implant in region 16 without a healing cap



Fig. 7: 4.5 months later. Successful transgingival healing. The healing cap did not need to be released.



Fig. 8: The inserted implant before placing retraction sutures under anesthesia



Fig. 9: Fitting the Zirkolith abutment (another patient)

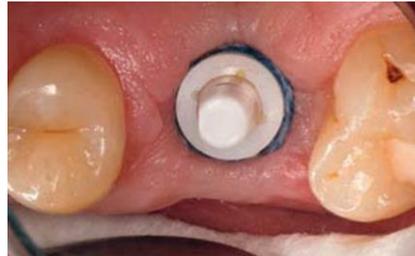


Fig. 10: Cemented abutment before the Impregum impression

later point in time, which is regretful (17). However, a randomized controlled study directly comparing to titanium implants showed no significant difference in osseointegration, bone loss and hygiene. Only one two-piece ceramic implant on 16 was lost after eight months of prosthetic loading. The reason for this was not mentioned.

The *Zeramex-T* two-piece system from Dentalpoint AG pursues another direction. This design uses transgingival, open healing, whereby the implant does not reach significantly over the soft tissue into

the oral cavity, and therefore removes the risk of mechanical load to a great degree.

49 implants were inserted in 32 patients in a prospective study (18). While the healing phase of the crestal implant portion was dependent upon the peri-implant soft tissue strength, either a healing cap or a gingiva former were attached. The abutment could be cemented after three months in all patients. The procedure to cement the abutment and make impressions was not further described in this study. On average, all implants were treated with full ceramic crowns on average after 6.4 months.

Six of the implants were lost in the first year in several patients. The implants were loosened, but showed no signs of inflammation or peri-implantitis syndrome clinically or in X-rays; these could be

unscrewed out of the jaw without anesthesia. A further test run with a previous implant version showed the same fault in four implants in four different subjects. "Aseptic loosening" was named as the cause. One assumes that this was due to a non-infectious bone osteolysis; this has been described in general orthopedics (20). In addition, there was an abutment fracture in two implants which are not contained in the survival rate.

Also, Zircon Vision GmbH followed the principle of open healing with its ZV3 two-piece implant system. As with the *Zeramex T*, the transgingival implant section was contained in the crestal implant section, but did not significantly reach over the peri-implanted gingiva into the oral cavity, and thus limited the risk of incorrect loading. After healing, a formed rod structure made of glass fiber was prepared individually and cemented into the implant. A further special characteristic of the system: in addition to pre-made implants with standard lengths and diameters, it is possible for the manufacturer to individually structure length, width and emergence profiles of the implant shoulder. The desired implant shape can be produced using CAD/CAM on the basis of the starting bone situation.

Authors	Source	Year	Manufacturer	Implant	Total number	Average treatment time (months)	Losses	Survival rate
Paver et al.	[17]	2014	Ziterion GmbH	Vario Z	16	24	1	93.3
Cionca et al.	[18]	2014	Dentalpoint AG	Zeramex-T	49	24	6	87
Brüll et al.	[19]	2014	Zircon Vision GmbH	ZV3	66	18.4	2	97

Table: All of the clinical studies available as of 2014 (except for case reports) on two-piece ceramic implants



Fig. 11: Manufactured



Fig. 12: Cemented crown

Patient case

A healthy 43-year-old patient was to have a single-tooth two-piece implant in region 16. Good oral hygiene as well as a sufficient bony implant bed were present. After forming a mucoperiosteal lap, the implant was inserted using a drilling template made in the laboratory, following the manufacturer's drilling protocol. *Zirkolith* implants are basically only screwed in to the end of the thread in order to ensure sufficient biological width of 2 mm to the implant shoulder. This section forms at the same time the transgingival transition to the implant, and thus supports open healing. A healing cap was plugged into the implant crown at this time. No guardrails needed to be used during the healing period because the cap did not significantly reach over the level of the gingiva. In most cases, the healing cap functions at the same time as a gingiva former, so that after healing is completed, no surplus gingiva need be removed.

After a retraction suture was laid, the cap was removed and the implant structure was cemented with *Panavia SA Cement*. The subsequent impression and further dental procedure was performed similar to prosthetic procedures with natural teeth. It's also recommended with later cementing to lay a suture in order to condition the surface and make it easier to remove the cement remnants. Crowns with zirconium dioxide caps were cemented after cleaning and degreasing all surfaces with glass ionomer cement (*Cefacsem* or *Panavia SA*).

is the *Zeramex T* implant which showed reduced osseointegration in one of the first studies (18); this has yet to be explained. Gingiva management and cementing abutments/structures should receive particular attention for the systems presented here. It appears here that the open-healing two-piece systems are superior to the closed healing systems due to easier handling.

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The bibliography can be requested from leserservice@dzw.de or downloaded as a PDF in ePaper at www.dzw.de

In a retrospective study, 66 two-piece customized ceramic implants were inserted and treated with full ceramic crowns or anchor elements with partial prosthetics (19). After an average of 18.4 months, 97% of the implants remained in situ. Two implants were lost due to poor osseointegration. Unfortunately no clinical experiences were reported in this study, the view into the release, cementing the structure and impressions were not mentioned.

Two additional two-piece ceramic implant systems are available on the market; the authors have not yet gathered any experience with these, or by that time--except for individual case descriptions--no clinical studies had yet been published.

Experience from the practice

A randomized, clinical, controlled study which is on-going from the end of 2013 was carried out in the authors' practice in collaboration with the University of Bratislava with the *Zirkolith* two-piece ceramic implant from Z-Systems. Since some implants are in the recall phase, the first experience can be reported one a patient case.

Summary

There are too few published clinical articles on two-piece ceramic implants, so that one cannot make a general recommendation about them. The hope is that the risk of incorrect loading during healing is reduced with a two-piece system, so that one need not use a guardrail in this phase, appears to be fact. An exception to this