issn 1868-3207 Sondernummer • Vol. 4 • Issue 1/2020

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Georg Isbaner

Editorial Manager

Ceramic implantology in times of a pandemic

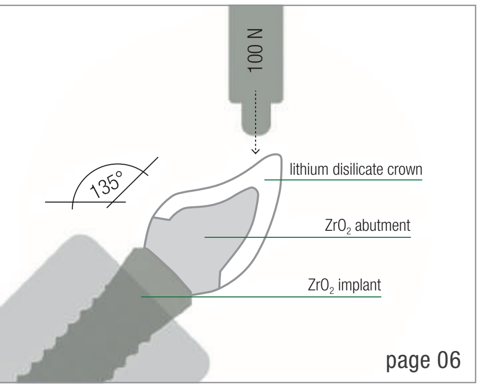
Ceramic implantology has never been this multifaceted. The users are able to choose from a great repertoire of one- and two-piece implant systems by acknowledged vendors and manufacturers. Especially the two-piece implant systems promise great prosthetic variety and flexibility, otherwise only known from titanium systems. Multi-unit implant-supported works are now feasible for specific indications. Of course, all of that requires a high degree of education and training for the users to understand and master the advantages and limitations inherent in the system of the respective ceramic implant concept.

This leads me onto the main issue of this preface: the global pandemic caused by COVID-19. Under normal circumstances, numerous colleagues, experts and industry partners of ceramic implantology would have met at larger conventions in the upcoming days and weeks. They would have learned from each other, talked to each other, laughed and made plans for the future to ultimately better their abilities for the benefit of their patients. The new cooperations between expert associations would have been fleshed out. Unfortunately, all of that is currently not easily possible in the light of global restrictions on travel and larger gatherings. We fall back on phone calls, video chats, online tutorials and extensively reading journals. In many countries, dental offices have grinded to a halt, with sometimes grievous economic consequences for owners, employees and patients. On top of that, scarcely any other profession is at a higher risk of being infected with the coronavirus as dental specialists and their assistants. Everyone is aware that the pandemic will change all areas of human coexistence. A, if not the prominent position is reserved for medicine and dentistry. The ramifications alone for patient management regarding hygiene measures and reducing the patients' and employees' risks of contagion will be a watershed.

It will be all the more important that dental specialists can offer their patients therapy options that are gentle and support the immune system. Our current knowledge about ceramic implants suggests that the material-specific properties exhibit good tolerability. So far, no adverse immune responses to zirconium dioxide are known.

On that note, I wish you an enlightening read and that you, your families and your fellow employees will weather this crisis well.

Sincerely yours, Georg Isbaner



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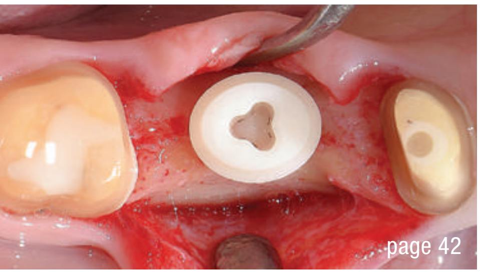
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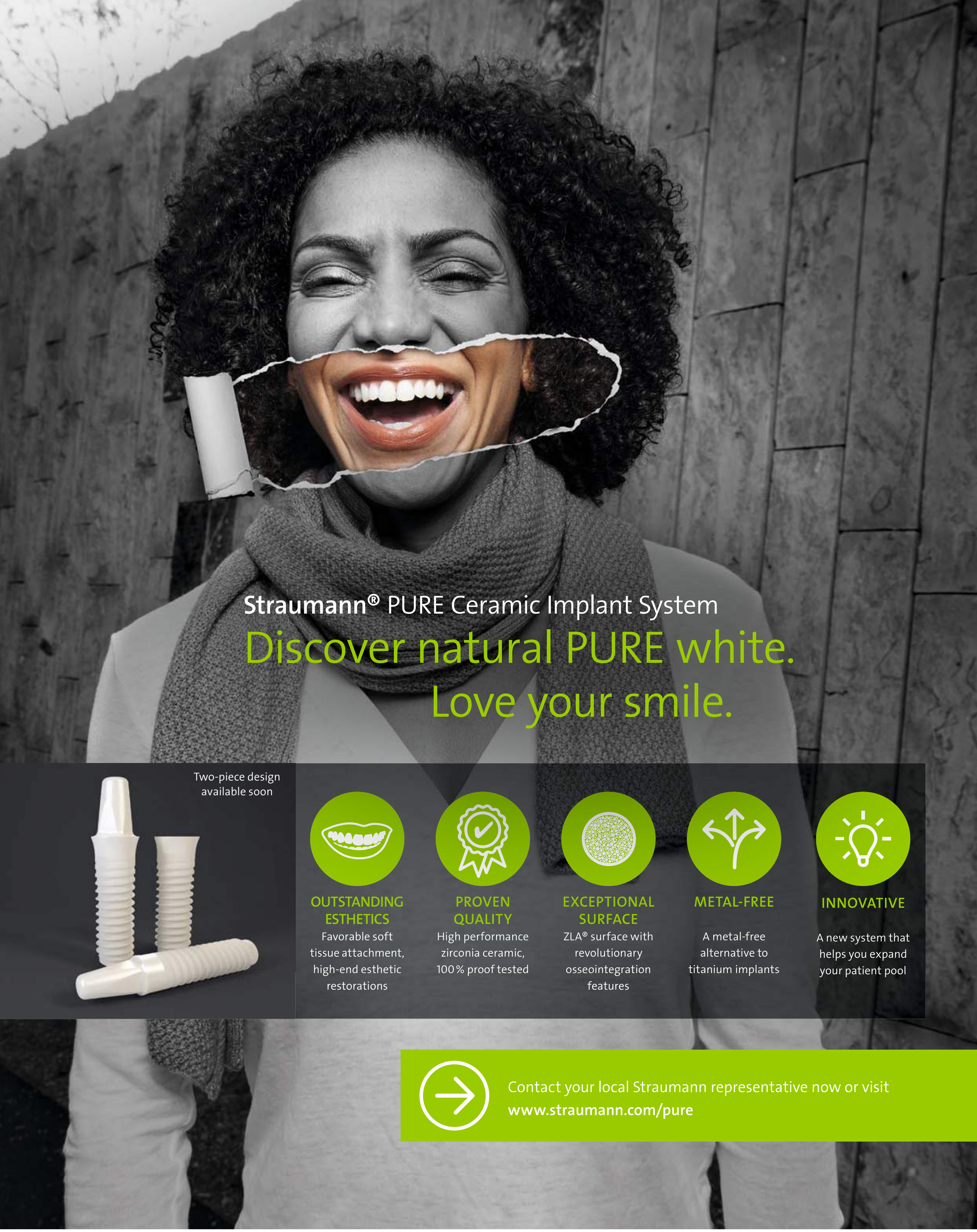

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Prosthetic complications after artificial ageing

A study with two-piece zirconia implants

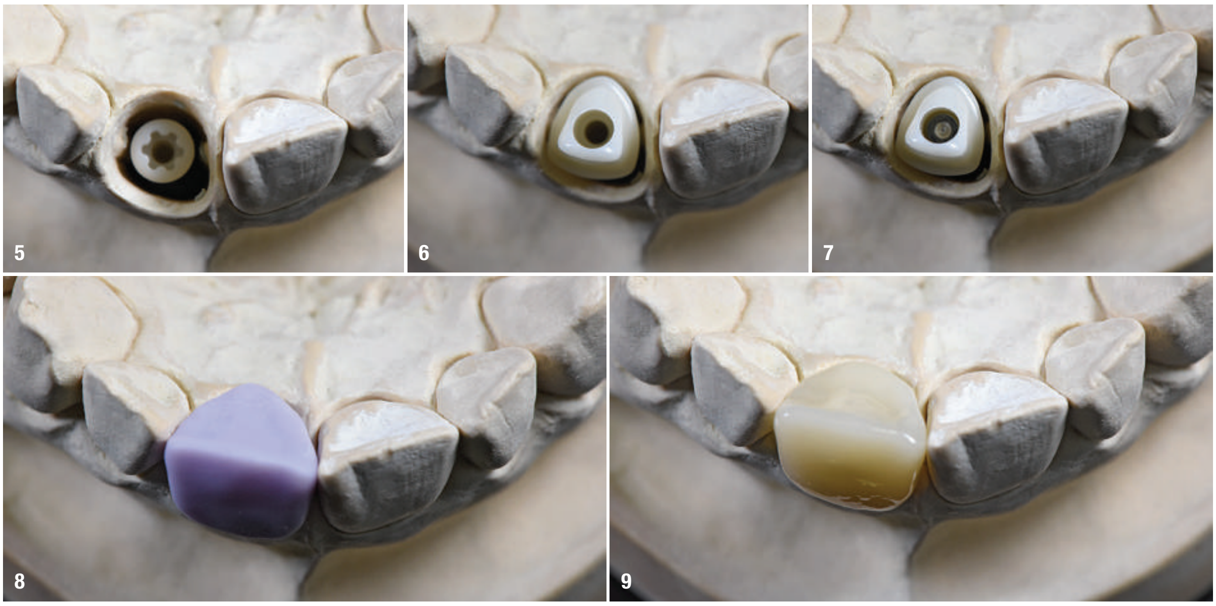
Dr Manuel Reinisch (lead author), Dr Martin Koller, Dr Elisabeth Steyer, Prof. Karl Glockner, Prof. Norbert Jakse & Prof. Michael Payer (co-authors), Austria

Currently, the majority of ceramic implants used are one-piece implant systems, which, however, have some limitations and disadvantages.[1,2] One-piece implants cannot always be inserted in the optimal orientation and require angulation correction to enable prosthetic restoration. In addition, one-piece implants are subjected to soft tissue and chewing forces immediately after insertion. These reasons motivated the development and manufacture of two-piece ceramic implants.

Several two-piece ceramic implants are already available on the market, but only limited clinical evidence is available for these systems. Currently, a large proportion of two-piece ceramic implants have a bonded implant–abutment connection. While bonded zirconia abutments have promising clinical results,[3,4] there is uncertainty about the long-term stability of the adhesive bond between the implant and abutment and the biological effects of adhesive residues in the area of the gingival sulcus.

Concerning two-piece screw-retained ceramic implants, *in vitro* studies showed higher fracture rates compared to two-piece titanium implants or one-piece zirconia implants.[5] The weak location for increased fracture susceptibility is the area directly around the abutment screw. Further studies are needed to indicate the ideal connection design for two-piece screw-retained zirconia implants.

Manufacturing of the crown: Fig. 1: Zirconia implant inserted instead of missing tooth #21 in an exemplary upper jaw tooth model. **Fig. 2:** Zirconia implant region #21 fitted with an individualised zirconia abutment. **Fig. 3:** Lithium disilicate crown after milling. **Fig. 4:** Lithium disilicate crown after sintering.



Manufacturing of the crown: Fig. 5: Zirconia implant inserted instead of missing tooth #21 in an exemplary upper jaw tooth model. **Fig. 6:** Zirconia implant region #21 fitted with an individualised zirconia abutment. **Fig. 7:** Abutment screw tightened at 25 Ncm. **Fig. 8:** Lithium disilicate crown after milling. **Fig. 9:** Lithium disilicate crown after sintering.

Additionally, the exact influence of different cementation and crown materials on the loading capacity of two-piece screw-retained zirconia implants is still uncertain.[1,6] Further preclinical evidence for the prosthetic restoration of two-piece screw-retained zirconia implants is required to provide practical recommendations for clinical use. The aim of this *in vitro* study was to investigate the survival rate and the relationship between prosthetic complications and the type of crown fixation after dynamic loading of CAD/CAM-fabricated anterior monolithic lithium disilicate crowns mounted on two-piece screw-retained zirconia implants.

Materials and methods

Twenty two-piece screw-retained zirconia implants (4 mm in diameter and 12 mm in length; CERALOG Hexalobe®, CAMLOG) were each fitted with an individualised zirconia abutment (Figs. 1 & 2, Figs. 5–7) and embedded in acrylic resin (Fig. 10). The abutment aspect was optically scanned, and a standardised upper left incisor-shaped ceramic crown was designed (Figs. 11 & 12). Twenty lithium disilicate crowns were milled, sintered and mounted on the implants (Figs. 3 & 4, Figs. 8 & 9) either with an adhesive resin composite cement (Multilink Automix®, Ivoclar Vivadent; Group A, n = 10) or with a resin modified glass ionomer cement (FujiCEM 2®, GC; Group B, n = 10). All samples underwent thermomechanical loading at an angle of 135° (Fig. 13) to simulate an aging of five years (TCML; TC: 5 °C and 55 °C, 3,000 cycles, 2 min/cycle; ML: 100 N, 1,2 x 106 cycles). The evaluation of prosthetic complications was compared with the Mann-Whitney-U-Test. The significance level was set to $\alpha = 0.05$.

Results

The 5-year survival rate of both groups (n = 20) after artificial ageing was 95 % (Fig. 13). One abutment of Group

Fig. 10: Specimens embedded in blocks of epoxy resin at angle of 45°. **Figs. 11 & 12:** Designing of a standardised upper left incisor-shaped crown using CAD-software.

B fractured after 1,123,200 cycles. All specimens in both groups had grinding facets. In group A grinding facets had an overall mean appearance of 639,360 ± 200,106 cycles with no significant difference ($p > 0.05$) to group B with 483,840 ± 208,800 cycles (Fig. 14). None of the samples showed cracks, fractures or decementations of the crown.

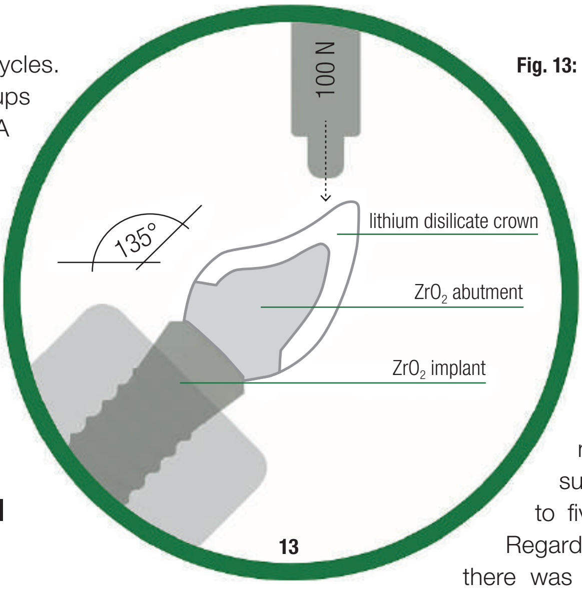


Fig. 13: Dynamic loading setup.

Conclusions and clinical implications

Of course, long-term, clinical, randomised trials are one of the best ways to generate reliable data. But it is necessary to implement preclinical study designs that simulate clinical conditions before clinical trials are conducted. Thermomechanical loading of implants, abutments and crowns offers a suitable method for this. Within the limitations of this preclinical trial it can be concluded that CAD/CAM-fabricated anterior monolithic lithium disilicate crowns mounted on two-piece screw-retained zirconia implants should provide sufficient resistance at least up to five years of intra-oral forces. Regarding prosthetic complications, there was no statistical difference between using an adhesive resin composite compared to a resin-modified glass ionomer cement for crown cementation.

It can be assumed that different manufacturing methods or design properties of two-piece screw-retained ceramic implants lead to variable fracture behaviour under load. A generalisation for two-piece screw-retained ceramic implants does not yet seem to be possible. Further studies are needed.

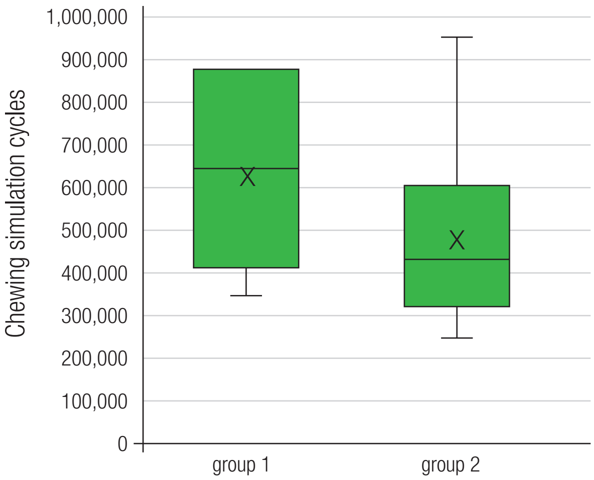


Fig. 14: Incidence of grinding facets during dynamic loading in the chewing simulator.

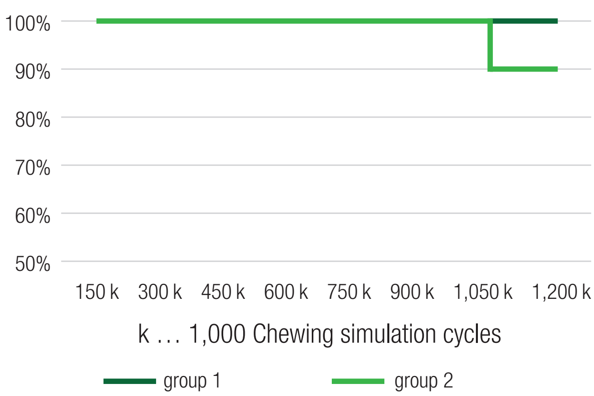


Fig. 15: Survival rates for the different cementation methods.

Literature

about the author

Dr Manuel Reinisch studied medicine and is now a student in the last year of dentistry at the Medical University of Graz. He is a member of the European Society for Ceramic Implantology (ESCI). In addition, he is doing a master's degree in medical ethics and the master's programme in implantology and periodontology at the Medical University of Vienna.

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