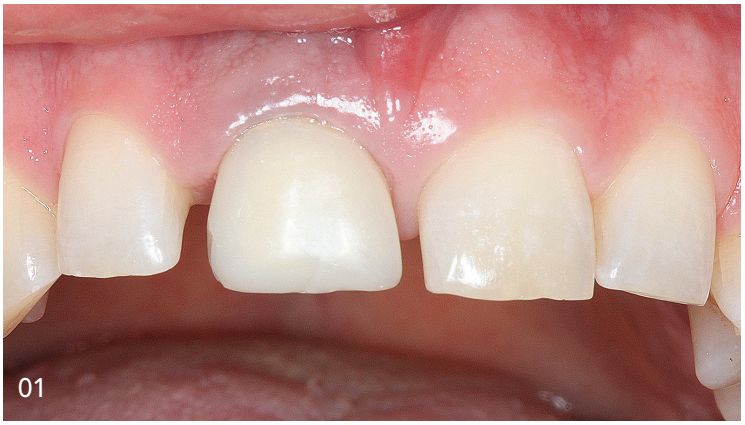
Two-piece ceramic implant:
Customised, fully digital solution for highly aesthetic results in the anterior region

Dr Claudia Michl, M.Sc., Germany

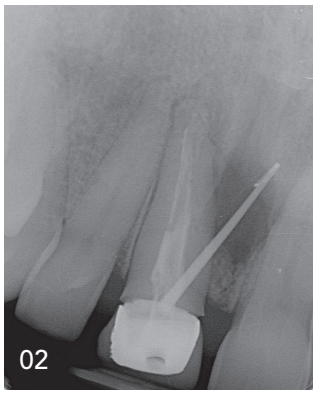


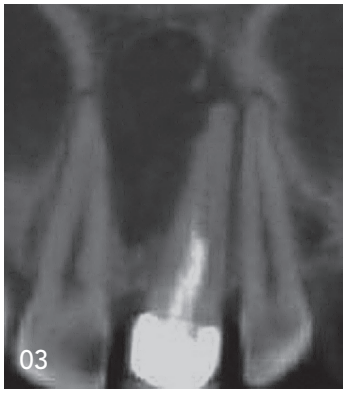
01
Tooth 11 before extraction.

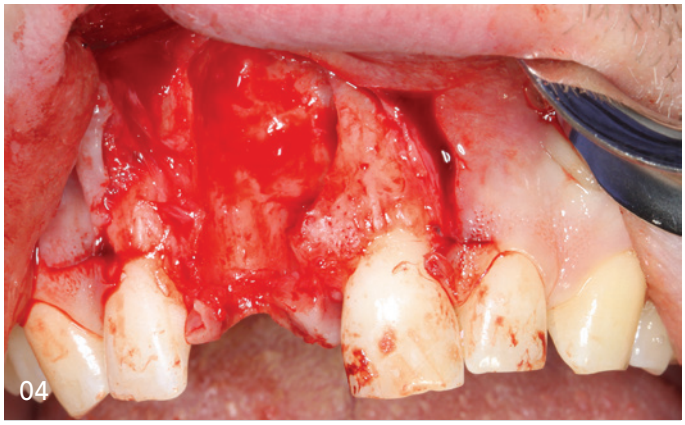
02
X-ray of tooth 11 before extraction.

03
CBCT of pre-op cyst.

04
Tooth extraction and cystectomy.







Introduction

Implants made of high-performance zirconia have now also become an established solution for patients with special aesthetic requirements. Replacing a front tooth with an implant places very high professional demands on the dentist. It is therefore particularly important to carry out precise planning in advance of tooth extraction and implant placement to ensure an attractive result.

However, the use of ceramic implants not only offers aesthetic benefits, but also provides patients with a metal-free restoration. In particular, patients with proven titanium intolerance and an increased individual genetic predisposition to inflammation have a sixfold increased risk of primary or secondary loss of the titanium implant.[4] Furthermore, the risk of peri-implantitis is significantly reduced due to the high biocompatibility of zirconia. Various studies have demonstrated a high implant survival rate of over 94% after nine years,[1] low BOP and stable gingival conditions around the implant even many years later.

Clinical situation and treatment planning

Initial situation
The 38-year-old patient presented to my practice on 3/11/2020. His main complaint was discomfort in tooth 11. He had undergone root canal treatment several years ago and had been experiencing discomfort for the past two years. This manifested as permanent latent bite pain in tooth 11 and sometimes also pressure on the neighbouring tooth 21. In addition, pus and blood sometimes appeared to be discharged from tooth 11.

Clinical examination
Tooth 11 had been restored with a metal-ceramic crown. The gingiva around the crown showed clear signs of inflammation. The BOP index on tooth 11 was positive, there was no plaque. The crown margin on 11 was insufficient. Apical to the tooth there was a prominent fistula, from which secretions and pus were discharged under pressure. Tooth 11 was clearly sensitive

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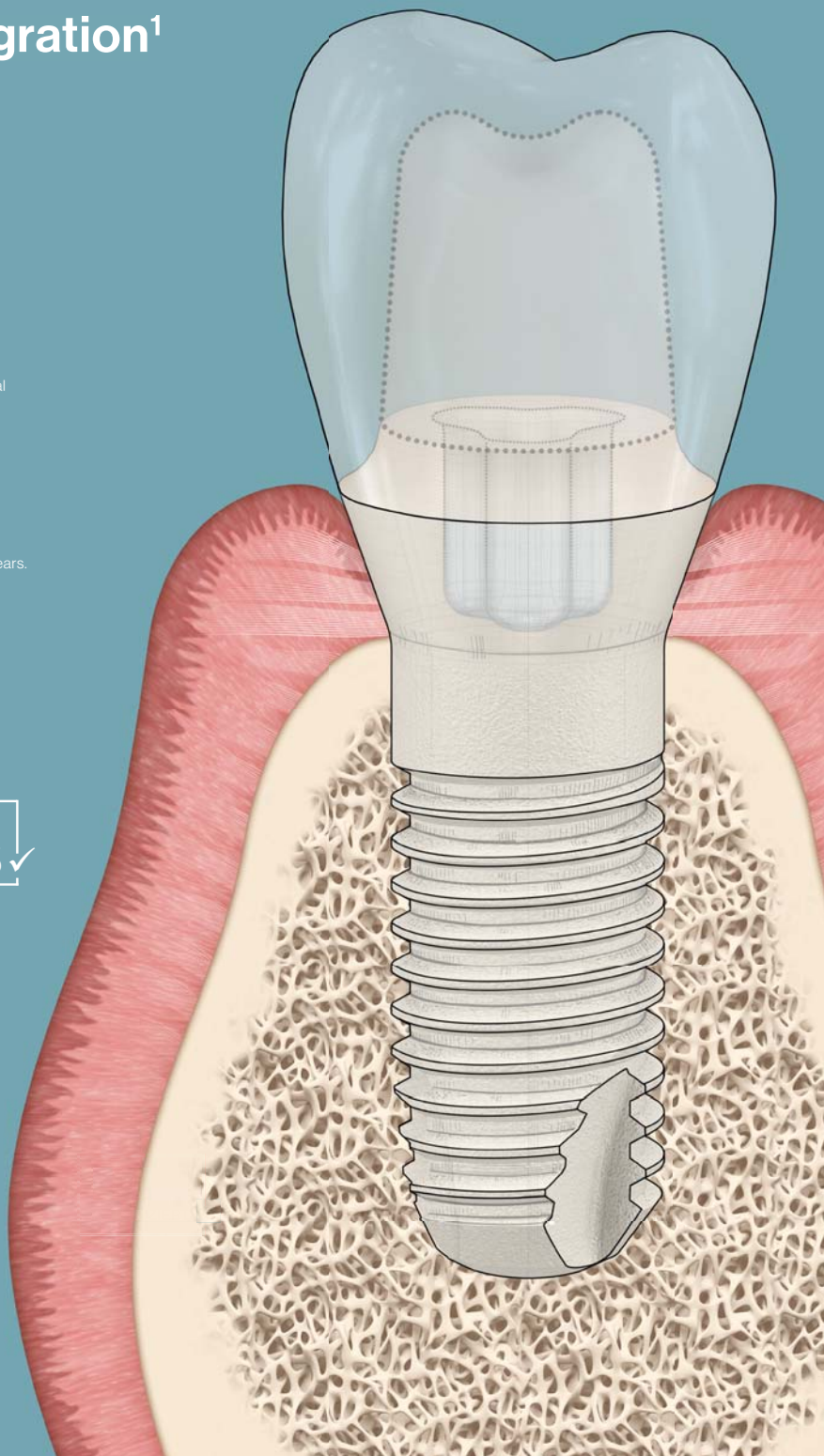
- **No Implant Fractures[2]**
- **No Peri-Implantitis[2, 3]**



1. **Glauser R, Schupbach P.** Early bone formation around immediately placed two-piece tissue-level zirconia implants with a modified surface: an experimental study in the miniature pig mandible. Int J Implant Dent. 2022 Sep 14;8(1):37. doi: 10.1186/s40729-022-00437-z. PMID: 36103094; PMCID: PMC9474793.
2. **Brunello G, Rauch N, Becker K, Hakimi AR, Schwarz F, Becker J.** Two-piece zirconia implants in the posterior mandible and maxilla: a cohort study with a follow-up period of 9 years. Clin Oral Implants Res. 2022 Dec;33(12):1233–44. doi: 10.1111/clr.14005. PMID: 36184914.
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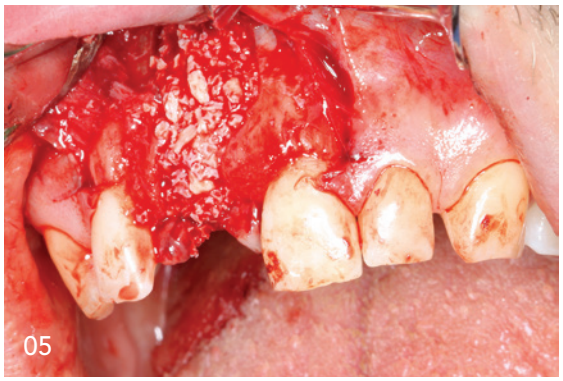
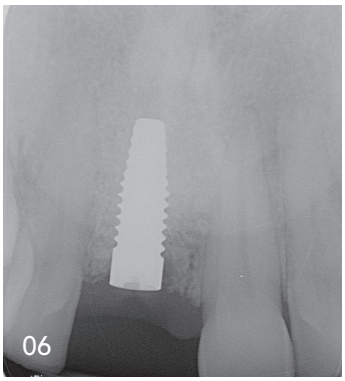


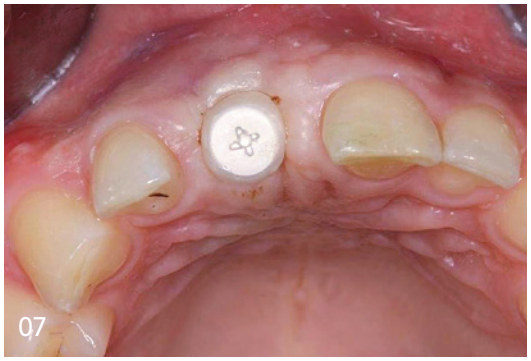


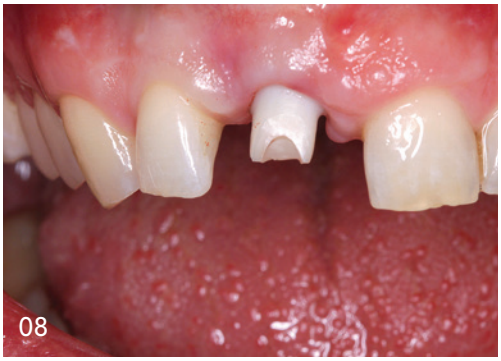
06
Implant *in situ* four months after bone augmentation.

07
Sealing with a 3 mm high gingiva former.

08
Customised abutment.

05
Socket preservation with Bio-Oss.





to percussion. The adjacent teeth were insensitive to percussion and sensitive to cold stimuli. The periodontal screening index was 2 in all sextants and oral hygiene was considered good. The occlusion showed Class 1 interdigitation with many gaps in the maxillary and mandibular anteriors. The vertical dimension was low. The overbite was 4 mm, and the overjet was 1.5 mm. The canines showed clear signs of wear. The Ahlers & Jakstat CMD screening test gave no indication of the presence of arthrogenic or myogenic dysfunction.

Radiological examination
The single-tooth image showed an endodontically treated tooth 11 with a gutta-percha point inserted into the fistula. Bone whitening was visible around the gutta-percha point which, starting apically from tooth 11, clearly occupied the interradicular space between 11 and 21. Based on these radiological findings, a CBCT scan with a FOV of 80 x 90 mm was performed.

The CBCT showed a very extensive interradicular hypodensity in the region 11, 21 starting from tooth 11. The dimension of the interradicular area with low bone density measured from coronal to apical is 19.4 mm and from mesial to distal is 10.9 mm. The buccal bone lamella was extremely thin, and no bone could be detected buccally in the area of root 11. A small hyperdense artefact, which can be interpreted as dispersed, overpressed root filling material, was prominent cranial to the whitening. Diagnosis was inadequacy of crown 11 and radicular cyst originating from tooth 11 with buccal fistula.

Procedure
Based on the findings and in consultation with the patient, the following treatment steps were taken:

1. Removal of tooth 11 with simultaneous cystectomy, reconstruction of the bone defect and fabrication of a temporary restoration (Erkodent aesthetic splint).
2. Placement of a two-piece ceramic implant (Zeramex XT, CeramTec Schweiz) four months after augmentation.
3. Restoration of the implant with a crown.

As the patient had several allergies, a lymphocyte transformation test (LTT) and a basophil degranulation test (BDT) were carried out in advance to rule out type I or VI allergies to the bone replacement material Bio-Oss (Geistlich Biomaterials). Blood samples were taken at our practice and analysed by the IMD laboratory in Berlin. No type I or VI allergy to Bio-Oss was detected. From five days preoperatively to five days postoperatively, the patient was premedicated with amoxicillin-clavulanate 500 mg x 3 daily, prednisolone 60 mg as a single dose one hour prior to surgery. For postoperative pain prophylaxis and anti-inflammatory therapy, a procaine base infusion (4 ml 2% procaine, 100 ml 8.4% sodium bicarbonate and 100 ml physiological saline solution) was administered during surgery and Ibuprofen 600 mg for four days postoperatively, as well as Pantoprazole 20 mg once daily to support the gastric mucosa.

Care was taken to ensure that the tooth removal and cystectomy were as atraumatic as possible and there were no complications. This resulted in a complete buccal fenestration, exposing a three-wall bone defect. This was reconstructed using Bio-Oss bone replacement material, which was biologised with autologous bone in a ratio of 2:1 and PRF (platelet-rich fibrin). In addition, metronidazole powder was added to the augmentation material for antimicrobial prophylaxis. After augmentation, an OSSIX Plus membrane (Regedent) and Plasmamatrix PRF, which

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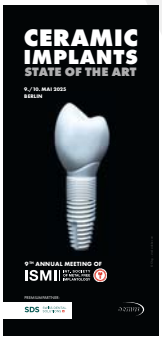

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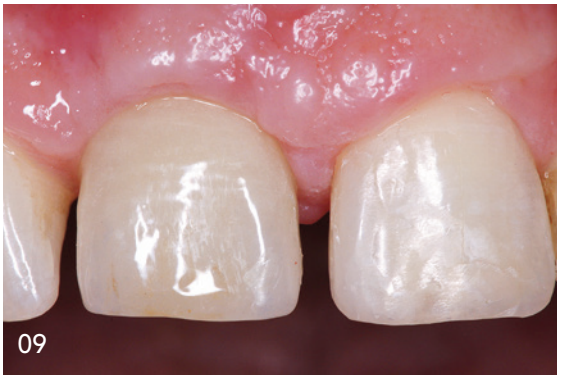
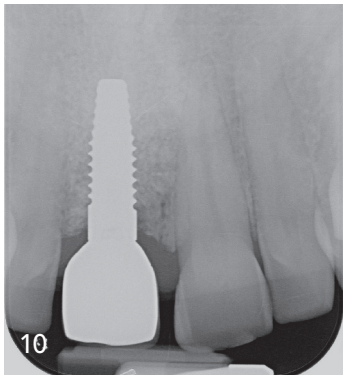
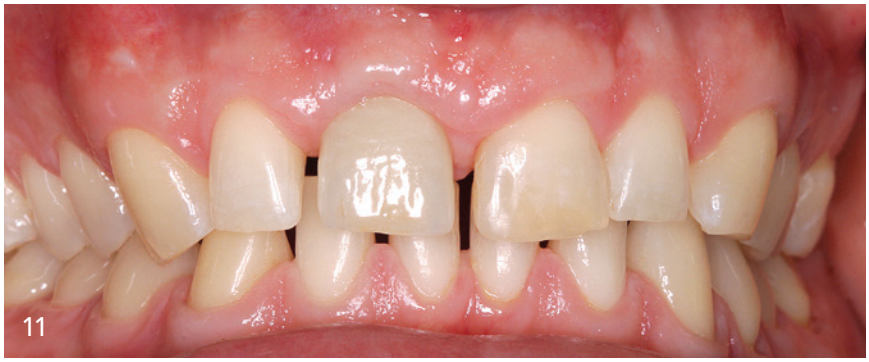


09
Implant crown after insertion.



10
X-ray image after insertion of the crown.

11
Region 11 after a one-year follow-up.



is rich in growth factors, were applied. To ensure tension-free primary wound closure, the periosteum of the buccal flap was stretched using the ST-UP Soft Brushing Kit from Joseph Choukroun.

Histological examination of the removed cyst tissue confirmed the suspected diagnosis of a radicular cyst. After the wound had healed without complications, the sutures were removed 14 days after surgery. The further healing process was uneventful and the CBCT image taken four months after surgery showed a well-consolidated augmentation. Both buccal and crestal bone continuity was almost completely restored. It was therefore possible to proceed with the placement of a two-piece ceramic implant made of alumina-toughened zirconia (ATZ; Zeramex XT, 10 mm RB, CeramTec Schweiz).

Prior to implantation, the patient was premedicated according to the protocol of J. Choukroun. This is as follows: 1,000 mg azithromycin on the eve of surgery, 60 mg prednisolone one hour before surgery, and 600 mg Ibuprofen three times a day and 20 mg Pantoprazole once a day for pain relief and anti-inflammatory therapy up to four days after surgery.

The implant bed was prepared according to the surgical drilling protocol. The pilot hole was drilled in a fully navigated fashion using a digitally designed and 3D-printed drilling template. The drilling template was designed based on a previous intraoral scan (TRIOS 3, 3Shape) and a CBCT image (PaX-i3D Green, VATECH) by the Norbert Delly dental laboratory in Bad Aibling using 3Shape's Implant Studio. The implant bed was drilled to a depth of 11.5 mm to accommodate a 10 mm implant. The implant biologised with PRF was placed at bone level with 30 Ncm. A primary wound closure was performed. Healing was uneventful.

After a healing phase of four months, a slight crestal vertical bone loss of approx. 0.6 mm was observed. This corresponds to the expected bone remodelling effect.[2] During exposure, the implant was sealed with a 3 mm high gingiva former. This was customised with flowable composite prior to placement to optimise the emergence profile. The implant impression was created using a 3D scan (TRIOS 3). For aesthetic reasons and to optimise the emergence profile, a restoration with a custom-made abutment was chosen and fixed to the implant with a VICARBO screw (carbon fibre-reinforced PEEK screw).

The abutment was fabricated from TZP ceramic in shade A3. The all-ceramic crown (made of zirconia ceramic), fabricated by the Norbert Delly dental laboratory, vestibularly veneered with silicone disilicate ceramic using the cut-back technique, was placed semi-permanently with TempBond (Kerr).

Clinical results

The result after insertion of the ceramic crown shows an inflammation-free soft-tissue condition. At the one-year follow-up, there was no inflammation or problems with the implant or the prosthetic restoration.

Discussion

The Zeramex XT implant system is designed for a wide range of indications. The two-piece design offers the usual advantages of titanium implants, such as unencumbered healing, primary wound closure, single-stage augmentation procedures and maximum flexibility in various surgical and prosthetic applications. The bolt-in-tube VICARBO screw connection (carbon fibre-reinforced PEEK screw) also provides a stable, secure abutment–implant

connection that optimally resists biomechanical forces. Low-risk soft-tissue management, customised shaping of the emergence profile and simple re-entry and repair options are also possible.

Strict adherence to biological principles as part of the pre- and postoperative protocol and the patient's individual and current immunological status (allergies, presence of chronic systemic diseases) play an important role in the success of the treatment. Proactive testing using LTT tests, BDT tests or effector cell typing to detect possible material incompatibilities is an important factor in the course of cases to be solved.

In this context, an optimal supply of micronutrients such as vitamins D3, C, B6 and B12, boron, manganese, and melatonin, as well as an "anti-inflammatory diet", including a special form of intermittent fasting, should also be mentioned. Also helpful are locally effective additives, such as the use of platelet-rich fibrin (PRF), which is rich in growth factors. Anti-inflammatory and immunomodulatory measures, such as the administration of specific antibiotics and anti-inflammatory drugs according to a fixed regimen, complete the holistic approach in dental implantology.[1]

All these measures ensure that the oxidative stress in the tissue is kept at a low level, thus providing the best possible support for bone remodelling during wound healing.

Literature

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About the autor

Dr Claudia Michl, M.Sc. is an implantologist and biological dentist specialising in preventive dentistry as well as conservative, prosthetic and surgical rehabilitation, with a practice in Kolbermoor (Germany). She is certified in general implantology (DGZI e.V.) and in environmental dentistry (DEGUZ e.V.). She also holds a Master's degree in dental functional analysis and functional therapy (University of Greifswald). She is a member of the DGZI, DEGUZ and DGAST.

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