Complex rehabilitation of periodontally compromised dentition

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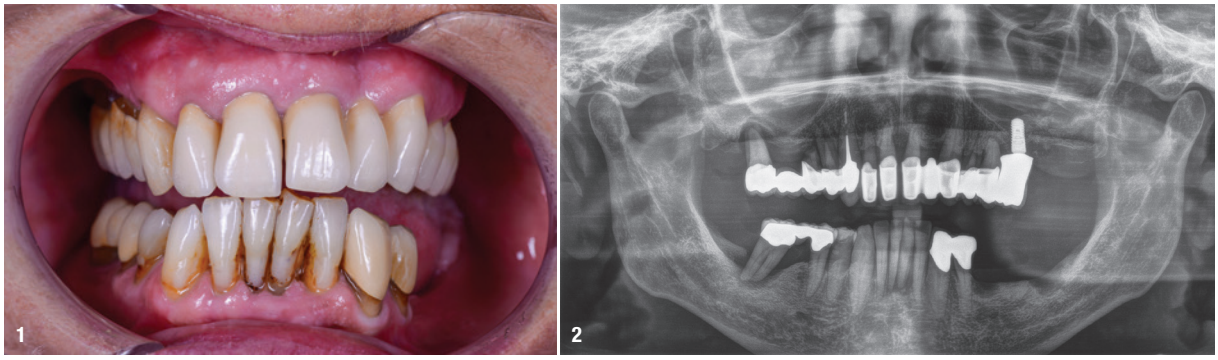


Figs. 1 & 2: Clinical and radiographic representation of the initial situation, showing progressive generalised, chronic periodontitis and significant loss of soft and hard tissue.

During the complete rehabilitation of the severely periodontally compromised dentition of a 69-year-old female patient, the treatment team had to consider various aspects in making treatment decisions for ethical as well as forensic reasons. The patient wanted a functional and aesthetic restoration of the upper and lower jaws that would be stable in the long term and make use of her own teeth that were worth preserving. Thus, the questions arose as to what her potential risk of loss of implants because of her previous periodontal disease would be and whether the intervention could achieve the most permanent improvement possible in her oral health-related quality of life.[1] The patient's age and state of health had to be assessed in terms of how long her manual dexterity for oral hygiene would be maintained.

Initial situation and patient's desires

The patient, a non-smoker, suffered from generalised chronic periodontitis in the upper and lower jaws with loosened (Grades II and III) and painful residual dentition, extensive vertical loss of attachment and considerably limited chewing ability. The molars already showed furcation involvement. However, teeth #13, 23, 33 and 43 were worthy of preservation. There was no craniomandibular dysfunction. The patient wanted a fixed denture with the shortest possible treatment time. As she had lost four implants placed two years previously, she was sceptical about a new implant-supported prosthetic restoration, but did not rule it out. However, she rejected clasp-retained dentures or overdentures in principle. Full-arch implant-supported prostheses was also out of the question because it would require the extraction of teeth worth preserving. In addition, the patient feared the risk of aesthetic restrictions with exclusively implant-supported prostheses, such as long tooth crowns or recognisable transitions from pink ceramic, as well as more difficult cleaning. In a detailed consultation between the treatment team and the patient, the advantages and disadvantages of the respective treatment options—in particular concerning teeth to be extracted and teeth worth preserving—were discussed openly and in a way that the patient could understand. In this manner, the patient's trust could be fostered, and for the purpose of shared decision-making, the decision on combined tooth- and implant-supported hybrid prostheses as the best possible form of therapy for the individual patient profile could be made together.[2] The primarily psychological advantage of the patient of being able to retain the feeling of her own teeth and a certain proprioceptive control over her remaining teeth was also decisive. This can reduce the stress on the implant-supported restoration and thus improve its prognosis (Figs. 1 & 2).[3]

Treatment plan

Tooth extraction solely for the purpose of avoiding hybrid prostheses is contra-indicated.[4,5] However, severely periodontally damaged teeth, especially in the case of planned hybrid prostheses, pose risks that necessitate extraction, appropriate periodontal treatment of the remaining teeth, and targeted hard- and soft-tissue management.[6] Given these considerations, telescopic hybrid restorations are a treatment option with predictable therapeutic success and high patient satisfaction.[7–9] Therefore, after extraction of the teeth in the maxilla and mandible not worth preserving and

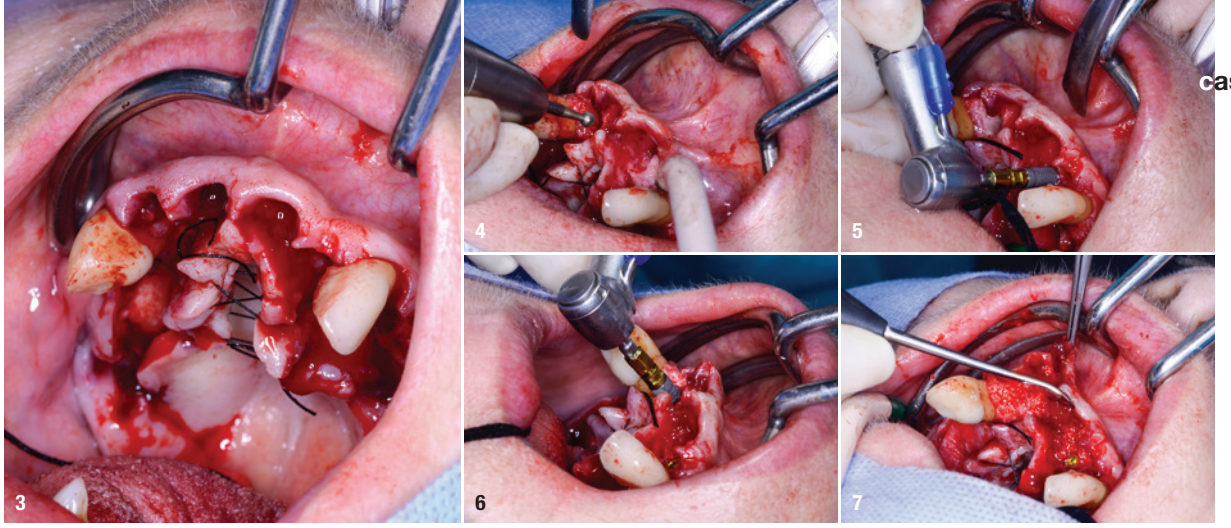


Fig. 3: Situation in the anterior region after extractions in the maxilla. **Fig. 4:** Smoothing of the alveolar ridge with the ball bur. **Figs. 5 & 6:** Placement of the two implants in regions #22 and 12. **Fig. 7:** Augmentation of the ridge defect in region #12 with bone grafting material.

immediate implant placement of four implants in the anterior and posterior regions (regions #15, 12, 22, 25, 36, 34, 44 and 46) was planned.[10–12] CAMLOG SCREW-LINE implants (4.3 × 11.0 mm; CAMLOG) were planned. If the implants are positioned quadrangularly, the telescopic prosthesis remains fully functional even if a tooth or implant is lost. The canines were to be included in the telescopic work as natural abutments. Since this would give the support polygon an even larger surface area, a statically more secure support would be achieved. In addition, secondary splinting of the telescopic prosthesis distributes extra-axial masticatory forces to all abutments and does not overload the natural abutments.[13]

Furthermore, the intra-oral situation required periodontal treatment of the canines and, as a result of vertical bone loss, extensive augmentation, including a simultaneous internal sinus lift and vestibuloplasty to thicken the soft tissue in the mandible. Because of the extensive surgical procedures, the implants were to heal under telescopic interim prostheses. Ready-made teeth were planned for the definitive restoration.

Implantation and bone augmentation

The treatment took place under intubation anaesthesia. First, impressions were taken of the intra-oral situation in the upper and lower jaws for documentation and planning after professional dental cleaning and periodontal therapy. The situation models were articulated in the laboratory, the teeth not worth preserving were erased on the plaster model and two telescopic dentures were fabricated on the canines, the maxillary denture with a palatal plate, as immediate temporary prostheses in an idealised set-up. The assessment of the hard tissue and the planning of the implant positions were carried out using a dental panoramic tomogram and CBCT scan.

Upper jaw

In order to avoid worsening of the existing bony defects, the teeth that were not worth preserving were gently extracted while preserving as much bone as possible and their extraction sockets were carefully trimmed under magnification. After the alveolar ridge had been smoothed with a ball bur, the two anterior implants were first placed in regions #12 and 22 according to the protocol. The bone around both implants was

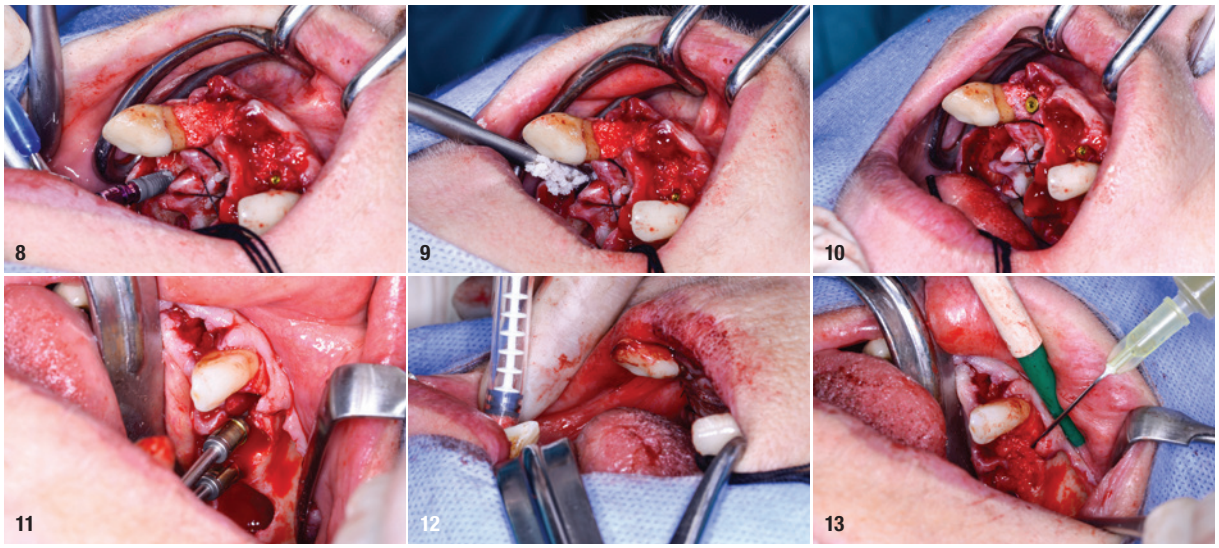


Fig. 8: Insertion in region #25 after internal sinus lift. **Fig. 9:** Placement of bone grafting material for ridge augmentation. **Fig. 10:** Covering of the bone augmentation material with porcine membrane. **Fig. 11:** Situation after extractions and implant placement in regions #44 and 46. **Fig. 12:** Application of porcine MinerOss® XP (CAMLOG) with the applicator. **Fig. 13:** Subsequent biofunctionalisation of the bone grafting material with L-PRF.

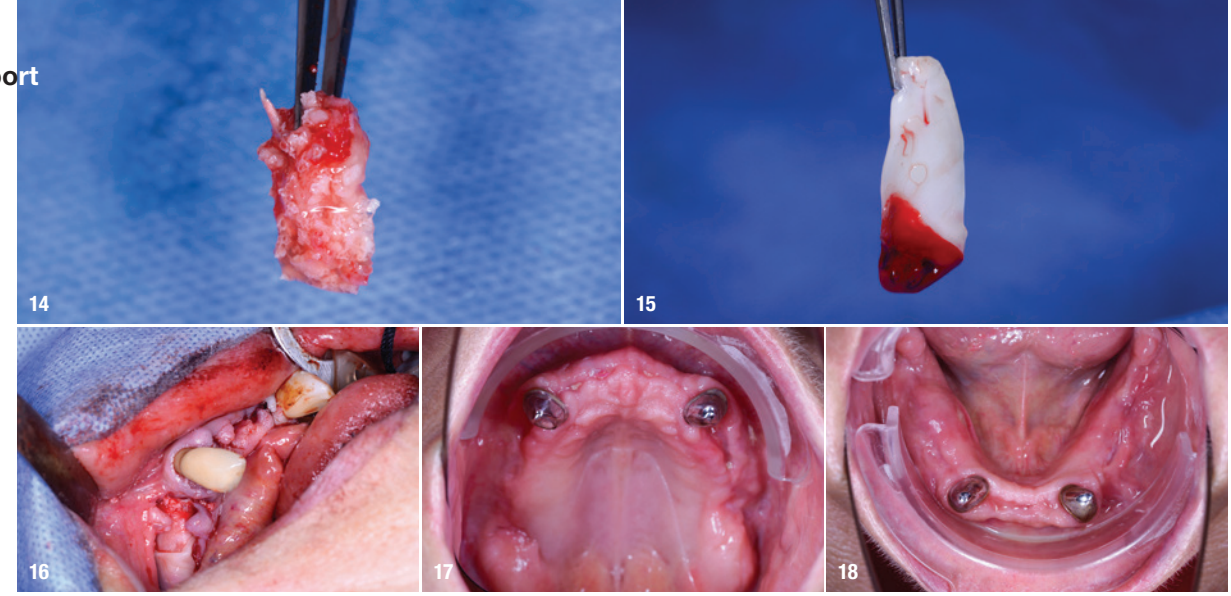


Fig. 14: Autologous bone chips mixed with the bone mineral matrix. **Fig. 15:** "White clot" (A-PRF) obtained from venous patient blood for biofunctionalisation. **Fig. 16:** Fibrin matrix placed over the membrane acting as a "separation layer" distal to region #33. **Figs. 17 & 18:** Irritation-free healed hard- and soft-tissue structures in the maxilla and mandible two months after implant placement.

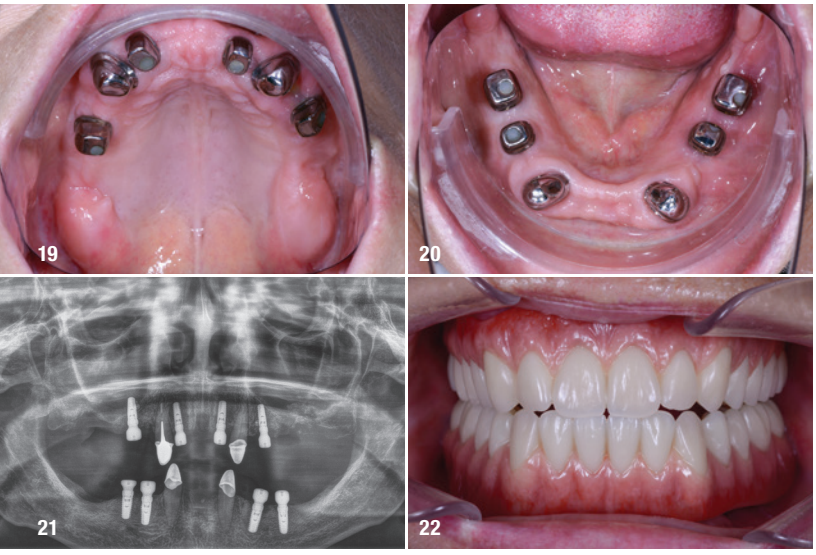
augmented with bone mineral matrix mixed with autogenous bone chips that had accumulated during smoothing. The porcine material (MinerOss XP, CAMLOG) used for this purpose is osteoconductive and accelerates revascularisation because of its porosity, which is structurally similar to that of human bone.[14] The extraction sockets in the anterior region were also stabilised with porcine bone grafting material and autologous bone chips for the purpose of rich preservation (Figs. 3–7).

Owing to the pneumatisation of the maxillary sinus, vertical bone augmentation was required for the implant placement in region #15. This was carried out as an internal sinus lift simultaneously with the implant placement. Drilling and elevation of the Schneiderian membrane were performed with the Crestal Approach Sinus Kit (Osstem Implant). MinerOss XP was then biofunctionalised with leucocyte- and platelet-rich fibrin (L-PRF), the cavity filled and the implant carefully placed. Because of its high porosity and structural similarity to human tissue, the porcine bone grafting material not only accelerates revascularisation, but also limits dimensional changes after extraction and promotes rapid wound healing, which is further promoted by proteins and growth factors contained in the PRF.[14–16]

Bone grafting material mixed with autogenous bone chips was also placed palatally and on the ridge and covered with a resorbable porcine membrane (Mem-Lok Pliable, BioHorizons) to increase the volume of the adjacent hard-tissue structures. Being pliable, it can be easily applied to the tissue.[17] The implant in region #25 was subsequently inserted, MinerOss XP was placed in the implant site and the site was covered with Mem-Lok Pliable. The membranes were then fixed with pins, and the surgical site was sutured in a saliva-tight manner with single button sutures, completing the intervention in the maxilla (Figs. 8–10).

Lower jaw

In the mandible, all four implants were positioned in the posterior region. To fill the defect in the extraction socket posterior to the two implants in the fourth quadrant, MinerOss XP was again applied and biofunctionalised with liquid L-PRF (Figs. 11–13).[18] The extraction socket distal to tooth #33 was augmented with sticky bone. For this purpose, autologous bone chips, obtained with the Safescraper from the retromolar region, were mixed with the bone mineral matrix and liquid L-PRF. The coagulated L-PRF allows the mass to be modelled well and comfortably placed in the defect. The granulate material was again covered with Mem-Lok Pliable for the purpose of a vestibuloplasty. This allows slowly proliferating regenerative cell types such as osteoblasts and periodontal cells to be separated from rapidly proliferating epithelial and connective tissue cells. In order to positively influence wound healing, a fibrin matrix (A-PRF) obtained from the patient's venous blood and thus highly enriched with platelets, leucocytes and growth factors was placed on top.[19] Finally, the surgical site in the mandible was also sutured saliva-tight and tension-free. The maxilla and mandible healed covered under the removable tooth-supported temporary prostheses (Figs. 14–18).



Figs. 19 & 20: Stable soft tissue structures before insertion of the telescopic dentures. **Fig. 21:** Radiographic control image two months after implant placement, also showing the patrices on the abutment teeth. **Fig. 22:** Maxillary and mandibular telescopic prosthesis *in situ*.

Fig. 23: Finalised hybrid prostheses for the mandible and maxilla. **Fig. 24:** Final situation with a happy patient. *(All images: © Marita Heeren, m.c. Zahntechnik, Oldenburg)*

Prosthetic work

Owing to the physiological mobility of natural teeth on the one hand and the rigidly osseointegrated implants on the other, a tension-free (passive) fit and thus an exact fit of the telescopic prostheses was of decisive importance. For the definitive restoration, the titanium abutments were designed as screw-retained primary crowns by the laboratory according to open impressions with individual trays and precision milled by the DEDICAM scan and design service (CAMLOG), as were the four patrices for the natural teeth. The patrices were conventionally cemented on intra-orally. The advantage of screw-retained primary crowns is uncomplicated revision on the implant if necessary. The further steps, such as the fabrication of the galvanic secondary crowns, the tertiary structure and the tension-free intra-oral bonding, were carried out in the conventional way. Until the telescopic dentures had been completed, the patient was fitted with travel dentures that were hollow-ground at the positions of the patrices. After checking the fit, friction and occlusion, the definitive restorations with ready-made teeth and patient-specific finalisation of the red aesthetics were seated.

The patient was carefully instructed in the hygiene of her restoration. Regular periodontal monitoring as part of a systematic recall makes it possible to keep the risk of peri-implant inflammation low or to detect it at an early stage and thus stabilise the restoration in the long term (Figs. 19–23).

Discussion

The patient's desire for a functional and aesthetic restoration including residual teeth worthy of preservation can be fulfilled with a hybrid restoration. Studies show parity in both survival and complication rates for hybrid prostheses and purely implant-supported prostheses.[5,20] There are no fundamental biomechanical concerns regarding the differing mobility of osseointegrated implants and vital teeth.[21] With appropriately built-up hard-tissue structures and the retention of suitable residual teeth, the number of implants can be reduced with an enlarged support polygon. At the same time, biofunctionalisation supports the formation of new hard and soft tissue.[22,16] Based on the experience gained so far, the combination of bone grafting materials and bioactive growth factors from the patient's own blood concentrate represents an optimal combination for the regeneration of the jawbone.[23]

Conclusion

The long-term success of such restorations carried out in parallel in the maxilla and mandible in a periodontally compromised patient requires detailed planning and a structured approach. In the end, however, it was only possible thanks to the close, constructive and trusting cooperation between the surgeon, prosthodontist and dental technician. The patient's desire for aesthetics and stability as well as a high level of chewing comfort and good hygiene could be fully met with the hybrid restoration chosen (Fig. 24).

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Literature

about the authors

Dr Sangeeta Pai is specialised in implant dentistry, minimally invasive sinus lift, bone augmentation procedures, full mouth rehabilitation, aesthetic restorations, functional diagnostics and digital workflow (intra-oral scanning, CAD/CAM procedures). She is an author of specialist dental articles as well as a continuing education speaker for various companies worldwide and a member of various international societies. She has been practising in a group practice in Oldenburg since 2017.

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