

Non-compromised aesthetics with multiple single implants in the anterior maxillae

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_Tooth mobility is a clinical finding that indicates several difficulties regarding the treatment possibilities of the patients affected. Regardless of the mobility's cause, periodontal disease, occlusal trauma or a combination, the prosthetic rehabilitation of such patients is challenging. As this case report shows, conventional single-unit prostheses, such as full-ceramic crowns, may solve the aesthetic problems. The aesthetic outcome may be satisfactory at the beginning, but in the medium term the soft tissue will continue to retract. At the same time, the main problem will not have been resolved. Mobility, especially in cases of untreated periodontal disease, will proceed despite the prostheses, which will eventually lose functionality, and a new treatment plan will be needed.

movable temporary denture was not an option for us and therefore we decided to replace each extracted tooth with an implant with immediate loading.

In such cases, surgeons have to deal with tooth loss, epithelial proliferation, bone resorption and loss of the periodontal ligament. In this case, we could clearly see in the pretreatment analysis that major bone resorption had occurred both horizontally and vertically. The bony defects affected more than one wall, but the bone resorption around the root was not infiltrated with soft tissue.

_Clinical and radiographic findings

The clinical examination found severe periodontal defects with a screening index of Grade IV, pocket depths up to 4mm and tooth mobility. The functionality was very limited and the aesthetic situation unsatisfactory. The radiographic findings confirmed that all four maxillary incisors and the left canine needed to be extracted (Figs. 1 & 2). The patient had a low scalloped gingiva with a middle thick gingival biotype, rectangular teeth and a bright smile.

_Treatment plan

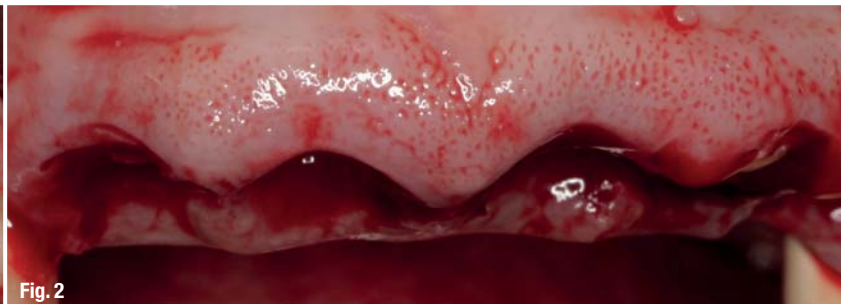
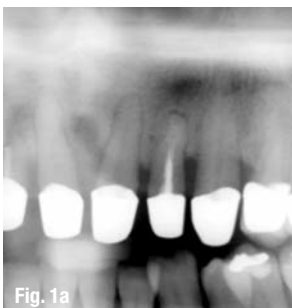
A removable denture was not acceptable, nor was a temporary or definitive denture. Although the ma-

Periodontal treatments have priority over every other treatment. Depending on the attachment loss, tooth mobility can persist, requiring a long-term stability solution. In this case report, the clinical examination found a tooth mobility of Grade II for teeth #12-23 as a result of an attachment loss that persisted even after successful conservative periodontal treatment. As mentioned, fixed prostheses are not an alternative, and fixing the teeth with a bridge would only accelerate further attachment loss, although it would reduce the occlusal load. A removable denture was not an option for the patient. An implant solution was thus deemed the only acceptable treatment. A re-

Fig. 1a Initial situation before extraction.

Fig. 1b Extraction sockets immediately after extraction.

Fig. 2 Soft-tissue quality and anatomy after extraction.



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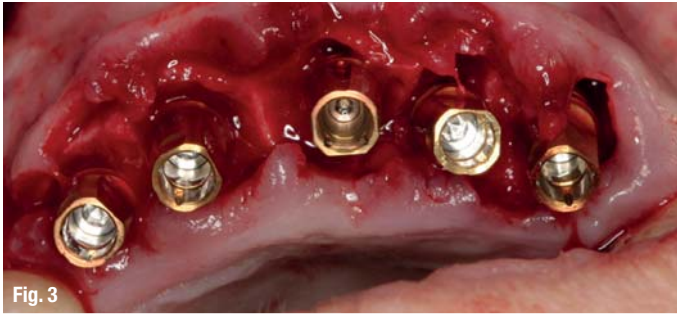


Fig. 3



Fig. 4

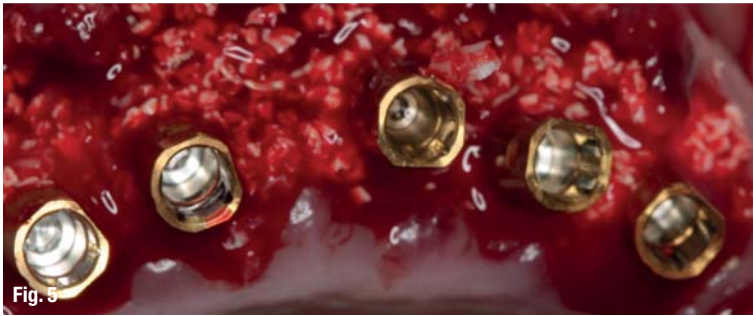


Fig. 5

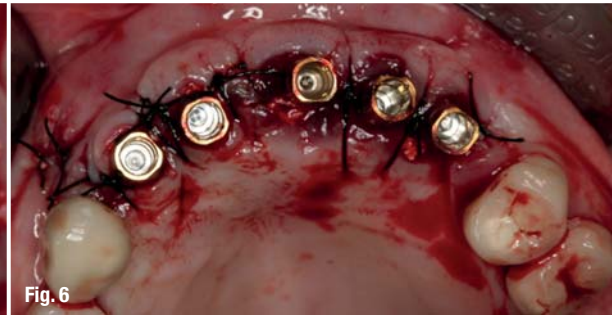


Fig. 6

Fig. 3 Flap raising and implant insertion, showing the bone morphology after extraction.

Fig. 4 Implant positioning, frontal view.

Fig. 5 Guided bone regeneration: filling the gap to the buccal plate and the interproximal space.

Fig. 6 Flap closure, coronal view.

major focus of treatment was on functional rehabilitation, aesthetics should not be underestimated in such cases. Once functionality has been obtained, the patient's attention turns to his or her appearance. The patient was to receive implants for teeth #12–23 in an immediate implantation with simultaneous guided bone regeneration. The implants were to be loaded immediately with a high-filler resin temporary bridge.

Surgery

With a wax-up on the situation model, an optimal form was created to support and manipulate soft tissue during the healing phase. At the same time, the temporary bridge functions as wound coverage if primary closure is not possible (Figs. 3–6).^{1–4}

In the next step, teeth #12–23 were extracted. The flap outline preserved the papillae of the adjacent teeth by an incision at the papilla base. Owing to the interproximal bone defects, papilla raising in this region would have led to severe recession. The vertical bone defects were obvious after raising a full-thickness flap. A releasing incision was made only mesiodistally at tooth #12 and only in attached gin-

giva to prevent scar formation through vertical cuts at the mucosa. The low vestibule made a split-thickness or periosteal pocket flap the less logical choice. Mobilising soft tissue from the lips too, through other flap designs, would have caused functional limitations, suture tension and a second gingival surgery to reposition the coronally transpositioned soft tissue. The wound margins were cut back to remove excess epithelium and the bone defects freed from soft-tissue ingrowth (Figs. 7–10).

The horizontal bone loss was moderate. The implants were placed slightly sub-crestally. Although the gap between the implants and buccal plate was due to the resorption of approximately 1–1.5 mm and the buccal plate thickness of less than 1 mm, we decided on 3.8 mm implants, leaving a 1.5 mm gap from the buccal plate.^{5–10}

The inter-implant space and the buccal plate were augmented with a combination of allograft and xenograft materials. Autologous bone obtained with a bone scraper was placed directly on the implant surface and covered with a mixture of allograft and xenograft materials. A pericardium membrane was used as barrier (Fig. 11).

Fig. 7 Flap closure, frontal view.

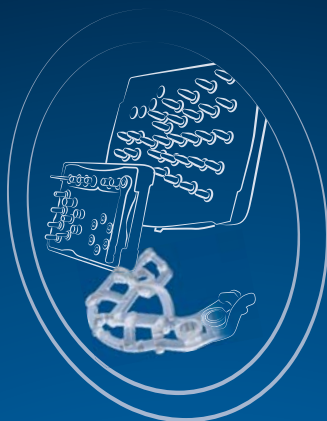
Fig. 8 Provisorium and temporary bridgework.



Fig. 7



Fig. 8



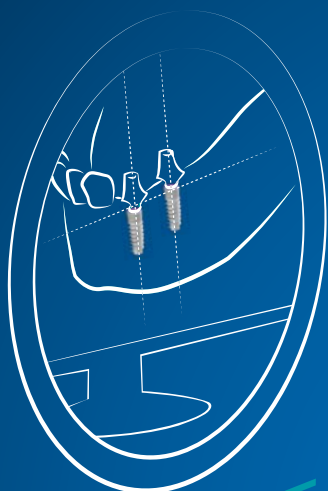
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Fig. 9



Fig. 10



Fig. 11



Fig. 12

Fig. 9 Aesthetics with temporary bridgework.

Fig. 10 Soft-tissue healing three months post-op.

Fig. 11 Soft-tissue quantity and quality before loading.

Fig. 12 Soft-tissue healing, coronal view.

The anatomy of the maxillae and the low vestibule did not allow primary closure. To protect the augmentation and the membrane from proteolytic resorption, we placed two layers of collagen tissue fleece above the membrane. Through the collagen fleece and the protection of the provisional bridge, free granulation of the extraction socket was expected after two weeks (Figs. 11 & 12).

The patient was recalled weekly for prophylaxis and hygiene instructions. Three weeks post-operatively, the sutures were removed. The tissue was not inflamed and the wound healing and closure ideal (Fig. 13).

Re-entry and prostheses

Three months post-operatively, an impression was taken without removing the abutments using special impression screws. The abutments were not removed (except for photographs) until the zirconia abutments had been fabricated. The healed situation showed optimal soft-tissue quality and an adequate quantity of attached gingiva. Above the implant necks, we measured a soft-tissue height of 2–2.5 mm, enough for the

necessary emergence profile. With the help of convex or concave prostheses, soft tissue can be manipulated in the direction desired for aesthetic reasons (Figs. 15 & 16).^{13–16}

The final crowns showed great results. The papillae and pseudo-papillae filled the interproximal space. The interproximal contact had to be deeper and wider than normal in order to compensate for the previous vertical bone loss, especially in regions #11 and 12. Nevertheless, no black triangles could be seen, the patient was satisfied and it was expected that with the proper hygiene the aesthetic outcome would be optimised in the next several months. Therefore, there was no need to use gingival ceramics.

Discussion

In a periodontally compromised situation, it is important to decide whether a curative periodontal treatment offers satisfactory long-term results. As was the case on this occasion, an extraction at the crucial time helps us to preserve what we have, use it to the maximum for implant surgery and risk no further

Fig. 13 Zirconia abutments before loading.

Fig. 14 Fixed single-unit prosthesis.



Fig. 13



Fig. 14

bone loss or recession. Any other procedure would have led to a two-stage surgical approach and probably to a removable prosthesis.

The patient's thick biotype, particularly the low lip line, was very favourable. The quantity of soft tissue was evident. Tension on the flap closure was prevented through the surgical protocol and free granulation of the wound. The bone quantity ensured primary stability of the implant. The immediate implantation provided stability for the augmentation and reduced the amount of material required. The positioning of the implant allowed us to create an optimal emergence profile, making complicated soft-tissue procedures unnecessary.¹⁷⁻¹⁹

Through the positioning of the implants and the free granulation of the extraction wound, we enhanced the soft tissue, a major advantage for the re-entry and prosthesis.²⁰⁻²²

The implants placed have microgrooves of 1 mm in height on the implant neck. This laser-manufactured design imitates biology and promises improved cell adhesion to this surface. Such modern designs, combined with the advantages of platform switching, result in high-tech products. Modern crestal bone maintenance works by means of the protection of the crestal bone. When implants are placed sub-crestally or crestally, a soft-tissue ring is built up on the platform to protect the bone below. When implants are placed supra-crestally, the implant neck designs secure the crestal bone below through soft-tissue fibre attachment to their necks, implants can be placed closer to each other, cases like this can be treated successfully with single implants, and fibre attachment to the surface and between the implants secures the crestal bone, building a natural barrier.^{23,24}

In cases in which primary closure is not possible or mobilisation of adjacent soft tissue through other flap designs is not desired, temporary prostheses are essential. The soft-tissue manipulation begins from the very first moment and is crucial for the aesthetic outcome.²⁵⁻²⁷ Owing to the implants used and the immediate loading, the soft tissue did not have to be manipulated. The implant system allowed us to take the impressions without having to remove the abutments. The continuous removal and insertion of implant components may introduce bacteria under the soft tissue. Every aesthetic try-in could also be performed on the initial abutments. In this protocol, we only removed the temporary abutments once the fixed single-unit crowns had been fabricated.

The clinical situation at the point of implant loading with the crowns showed optimal soft-tissue quality and quantity. No individual abutments were

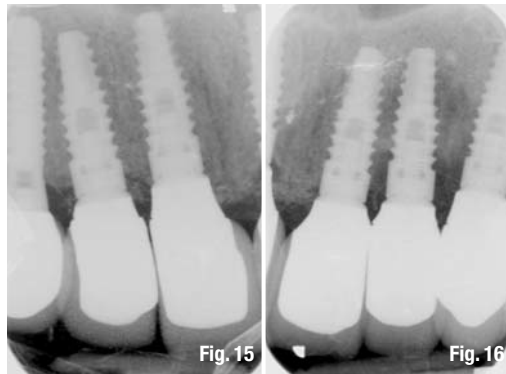


Fig. 15_Radiographic control immediately after loading.

Fig. 16_Radiographic control one year after loading.

needed. The aesthetic achieved was more than satisfactory, especially regarding the soft-tissue outcome.¹³⁻¹⁵

The combination of these biomaterials forms part of our standard augmentation protocol and is well documented. The results of guided bone regeneration are predictable and can be planned, even in case of major defects. The structure of the combined biomaterials is very important. Rocky and edgy particles help to establish internal stabilisation at the augmentation area. Often, external stabilisation with pins or screws is unnecessary. The porosity of the particles is defined by their biology. This is the reason that we do not prefer alloplastic biomaterials and take advantage of the benefits of allografts and xenografts through their combination. These are the requirements of modern biomaterials, including of course osteoinductivity and osteoconductivity.²⁸⁻³⁰

Conclusion

Periodontal disease is frequently a limiting factor in oral implantology, but there are situations in which periodontal disease presents no contra-indication for implantology. Prerequisites for similar procedures are an understanding and knowledge of biology, surgery and prosthetics. There are no algorithms for such procedures, rather the treatment outcome depends on proper diagnosis, analysis and planning for every individual patient and the selection of the right implant system and biomaterials. As the presented case has shown, modern implantology provides all of the tools for successful implant treatment.

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