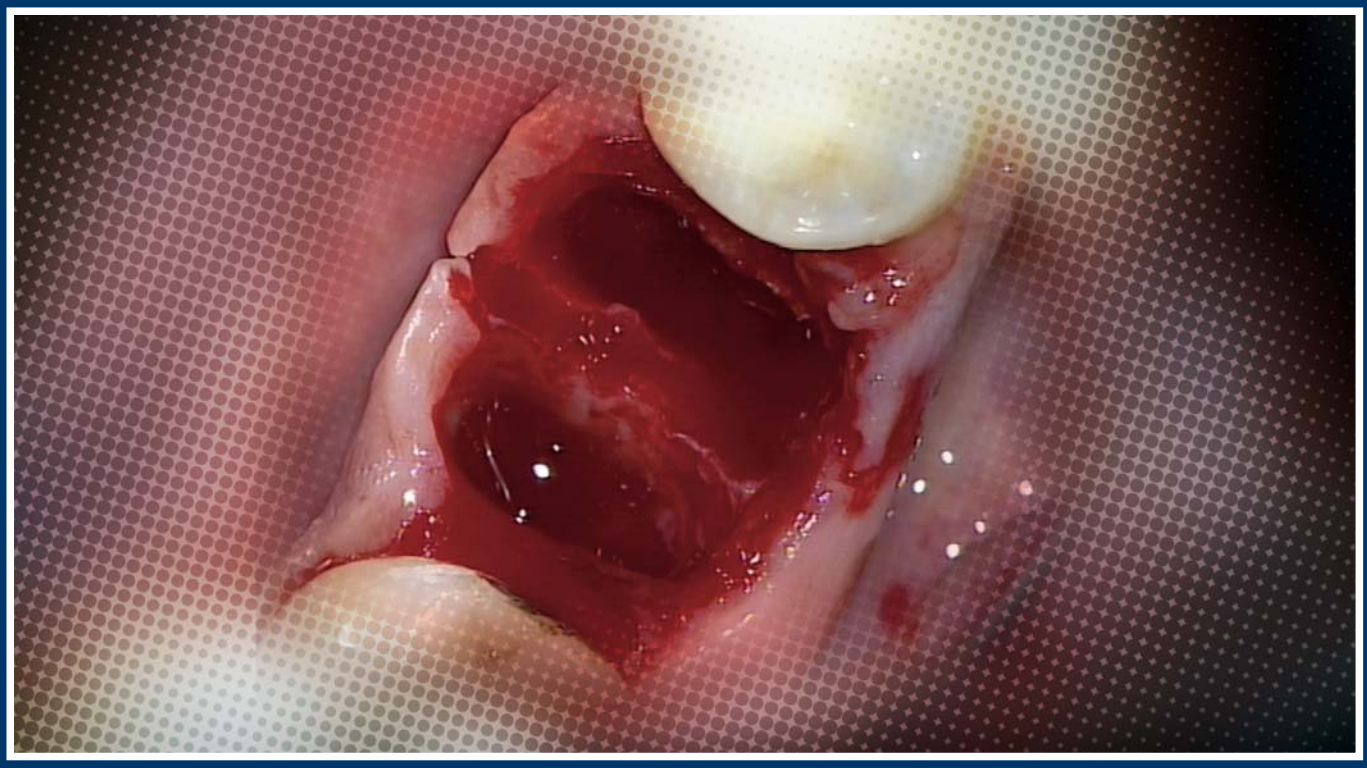
DENTAL MAGAZIN
The forum for specialist opinion formation

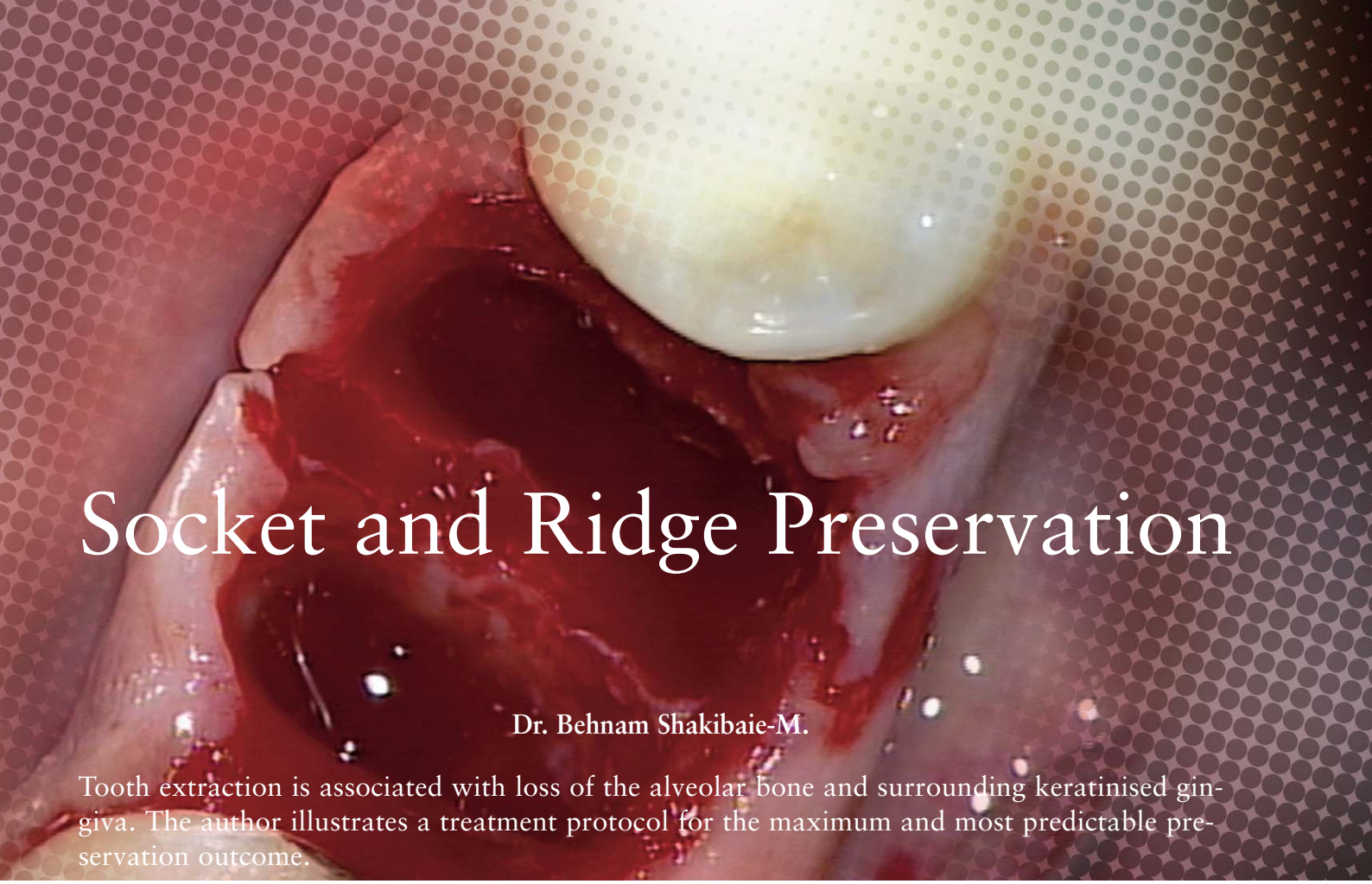
[REPRINT]

DM 2/2009, p. 24–33



Socket and Ridge Preservation

Dr. Behnam Shakibaie-M.



Socket and Ridge Preservation

Dr. Behnam Shakibaie-M.

Tooth extraction is associated with loss of the alveolar bone and surrounding keratinised gingiva. The author illustrates a treatment protocol for the maximum and most predictable preservation outcome.

In recent years, dental science has concentrated increasingly on minimally invasive procedures. In conjunction with this, preventive measures to preserve anatomical tissue structures also occupy an important position.

Especially in implantology, the question still arises prior to and immediately after dental extraction as to how the typical and inevitable resorption of the alveolar ridge can be minimised, thus avoiding later augmentative measures. Summarised roughly, the following options are available depending on the local tissue availability and quality[1,2]:

- 1. Immediate implantation
- 2. No further treatment of the extraction socket
- 3. Socket preservation measures immediately after tooth extraction

Re 1: Immediate implantation is demanding and directly dependent on the implant's primary stability, which cannot always be expected with a fresh tooth socket.

Re 2: If the extraction socket is left to heal spontaneously, three-dimensional tissue atrophy must always be assumed, the extent of which differs individually and does not appear precisely predictable at present.

Re 3: Implementation of socket preservation measures according to the indication for three-dimensional conservation of the future implant bed.

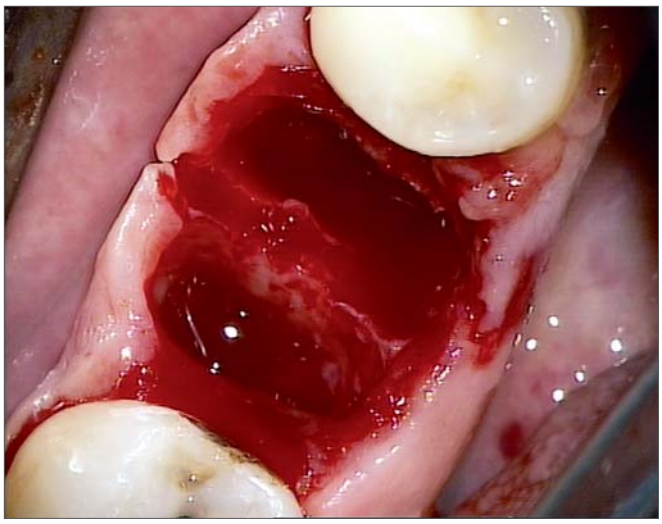
From the various ideas and concepts that have been described in the scientific literature in the last three decades[3-5], it appears that the concepts and techniques of socket and ridge preservation are becoming accepted at present[6,7]. The transition between ridge preservation and ridge augmentation is fluid depending on the defect configuration.

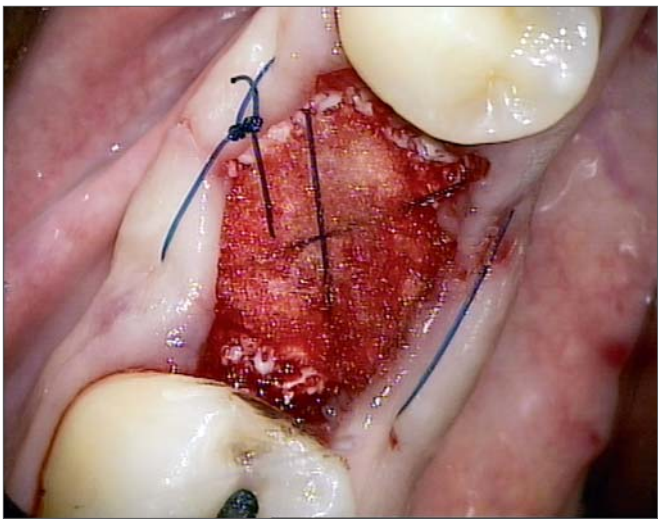
Socket healing after tooth extraction

The socket healing process has now been extensively researched using reproducible animal experimental studies. This process takes place through modulatory mediation of cell activity from development of the intra-alveolar blood clot immediately after tooth extraction up to final full mineralisation of the woven bone over a period of 14 to 18 weeks[8-10]. There are sometimes considerable changes in the shape and volume of the alveolar process, which can vary in extent depending on the case. Clinical measurements show a three-dimensional loss of alveolar ridge volume of approx. 35 per cent in the first three months and 50 per cent in the first six months[5,11]. The negative side effect of this resorption process is the simultaneous reduction and shift of the crestal keratinised gingiva.

Up to now, resorption of the bundle bone after tooth extraction appears inevitable.

In this connection, the term "bundle bone" is used more and more often. Animal histological examinations after tooth extraction show a fundamental loss of height of the circumferential crestal bone layer, which is greatest on the vestibular aspect. Accordingly, this zone was called the periodontium-dependent bundle bone[6,9,10]. Up to now, resorption of the bundle bone after tooth extraction – triggered by any surgical manipulation – appears inevitable. This also explains the unavoidable vertical volume loss, which is observed after tooth removal. However, the extent of the bundle bone resorption appears to differ individually and up to now is not precisely predictable.





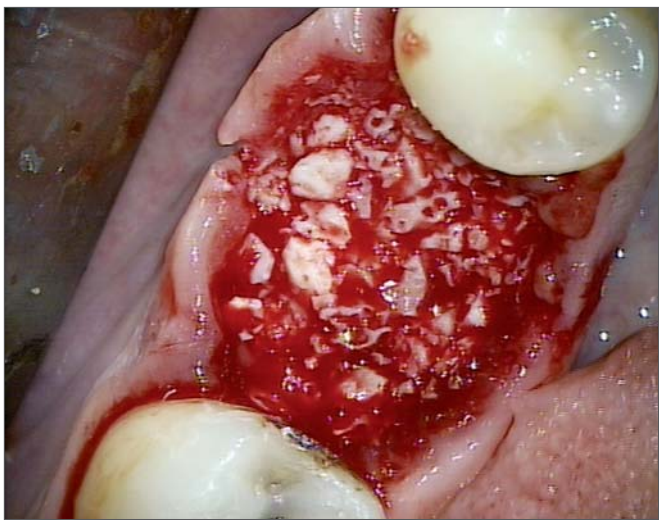


Fig. 1 to 3: Minimally invasive extraction of tooth 46 using the Xtool system, filling of the socket after socket cleaning with Bio-Oss granules size 1 to 2 millimetres.

Fig. 4 to 6: Covering the entrance to the socket by means of Stypro gelatine sponge and fixation by horizontal cross suture (5/0 Seralon), postoperative radiograph.

Fig. 7: Clinical situation 2.5 months after socket preservation of region 46 and 6 months after extraction in region 36 elsewhere without socket preservation measures (taken via mirror).

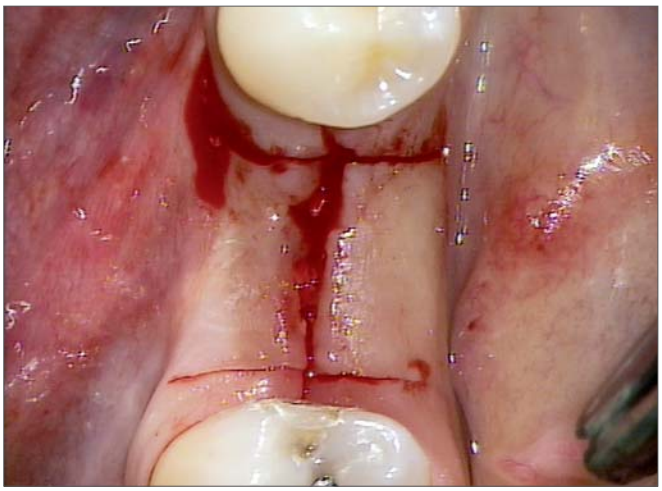
Time and nature of the extraction

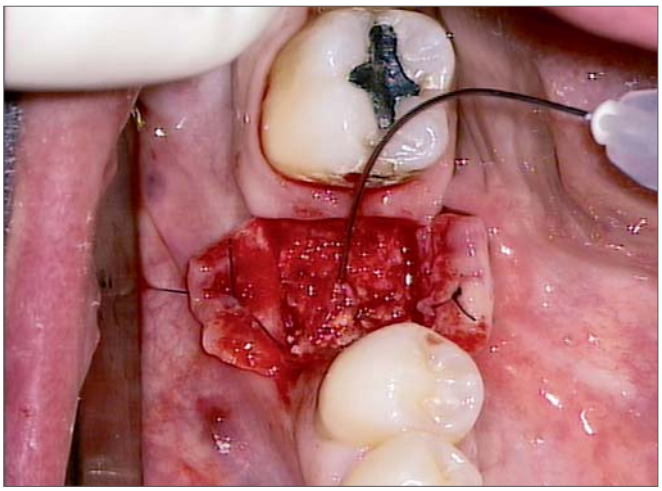
The success of alveolar ridge preservation measures depends on the number, height and intactness of the extraction socket walls. The greater the number of socket walls and the higher and more complete these walls are, the greater is the volume preservation that can be expected. Comparable with periodontal defect regeneration, the aspect of better perfusion plays a crucial role here. Consequently, the time of tooth removal is significant.

Teeth whose sockets are largely resorbed three-dimensionally, for instance due to advanced marginal periodontal disease, can be preserved only partially with the technique of socket or ridge preservation – maximally up to height of the residual socket. In such cases, correctly timed extraction, which may appear premature from the aspect of prognosis, can make sense when later implantation is planned. In this connection, the role of minimally traumatic extraction is also extremely important, in order to spare the bony and mucosal structures of the socket as completely as possible[12,13]. For this purpose, vertical extraction techniques, for instance by means of periotomes, the Benex system and Xtool system etc. have proven effective. This is the only way to prevent injuries of the delicate socket walls largely and reliably[1,7].

The techniques of socket preservation (SP) and ridge preservation (RP)

Scientifically published techniques of SP and RP after Weng et al. and Shakibaie-M. are described below[7,12].





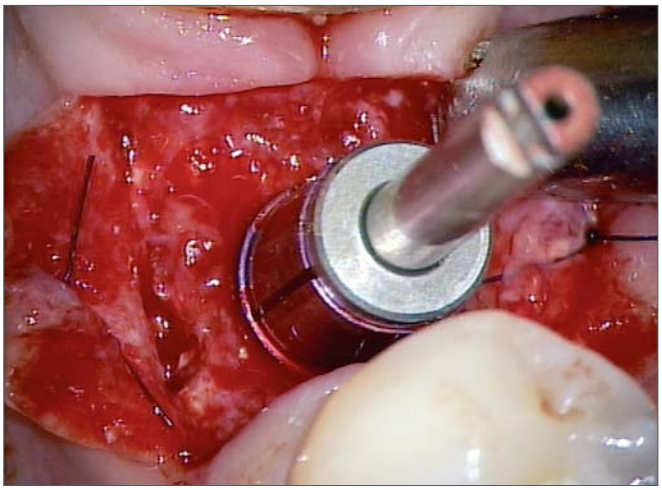
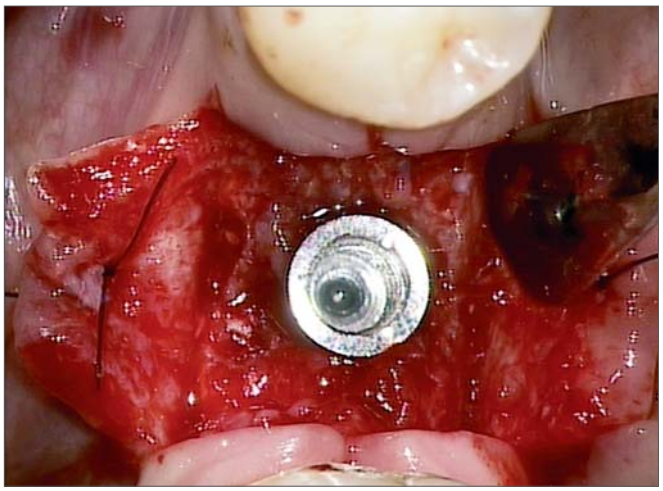
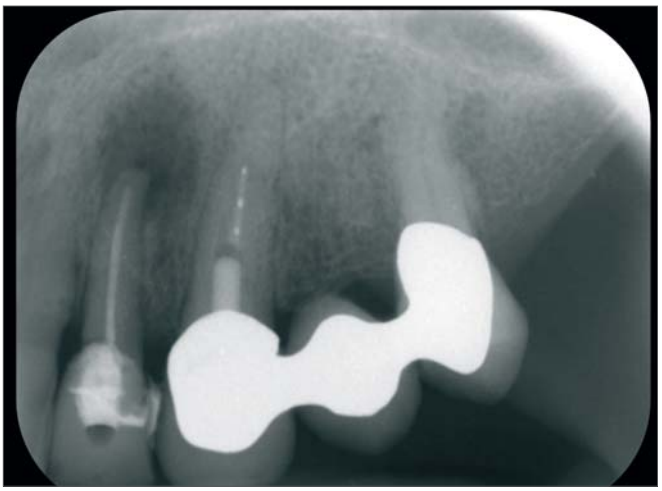
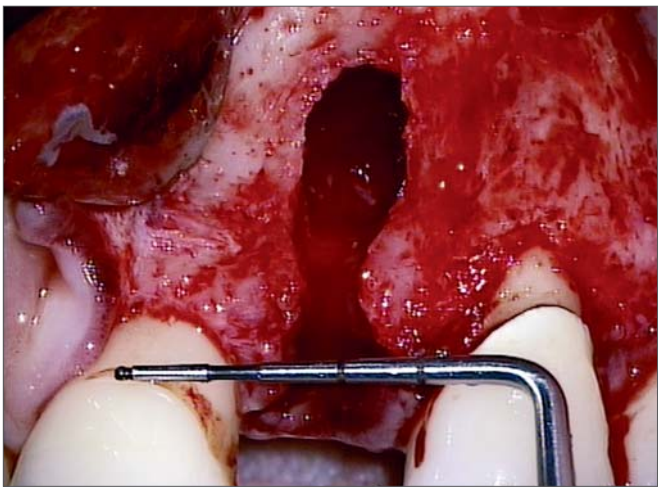


Fig. 8 to 10: Double-door incision in region 46, dissection of a minimal mucosal flap, firmly ossified alveolar ridge in region 46 (injection needle bends on pressure) with partially visible Bio-Oss particles, final preparatory drilling in correct position for prosthesis.







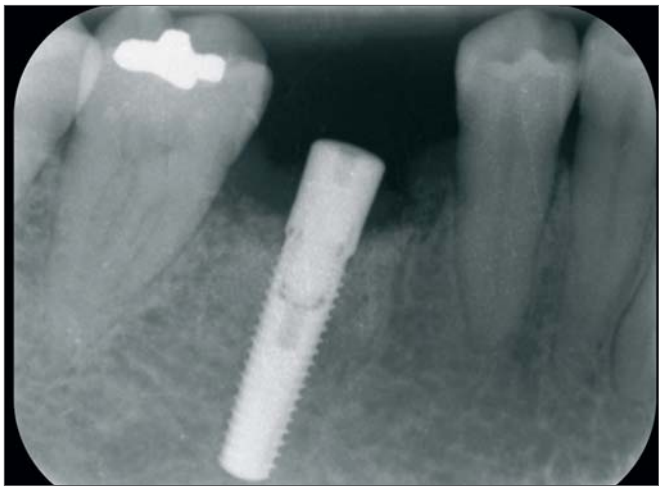


Fig. 11 to 13: Insertion of a Camlog Screw-Line implant (4.3 mm/16 mm) with primary stability, with adequate circumferential bone thickness, fixation of the keratinised gingiva after insertion of the gingiva former, postoperative radiograph.

Fig. 14 to 16: Tooth 22 is not worth preserving in dentition damaged by periodontal disease, three-wall defect configuration after extraction of 22 with cystectomy, defect in region 22 filled with Bio-Oss granules of size 1 to 2 millimetres, simultaneous microscopic apexectomy at tooth 23 with retrograde root filling.

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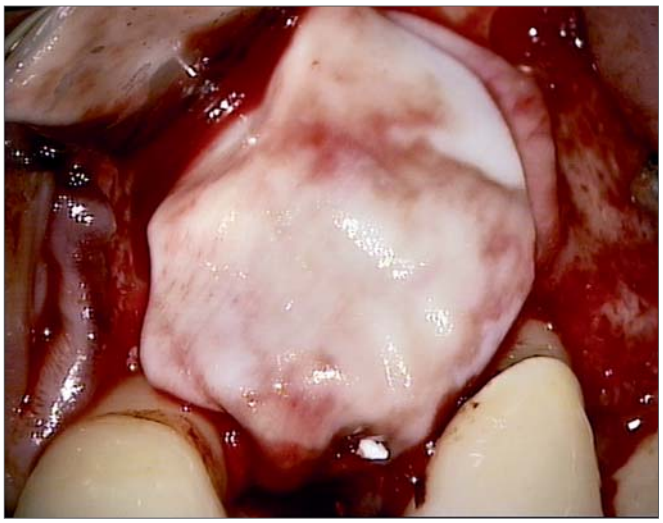

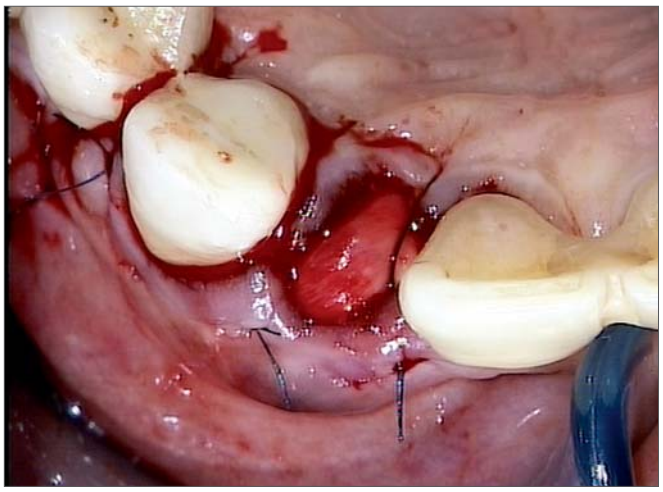

Fig. 17 to 19: Multilayer application of the Bio-Gide membrane. The socket entrance is likewise covered in that the membranes are fixed subperiosteally on the palatal aspect, wound closure without shift of the keratinised gingiva and periosteal slitting using 5/0 Seralon. The membrane remains exposed crestally deliberately, insertion of a provisional pontic restoration.

Fig. 20: Appearance two weeks postoperatively, slow onset of the expected vertical resorption.

If the continuity of the socket has been preserved fully after minimally traumatic tooth extraction, any residual chronic inflammatory soft tissue has been removed and the socket has been cleaned, the technique of SP is employed as follows[14].

The empty tooth socket is filled to the bone margin with a late-absorbing xenogenic matrix (Bio-Oss granules size 1 to 2 millimetres). The entrance to the socket is then covered with a gelatine sponge (Stypro sponge). One or more temporary sutures (5/0 Seralon) finally fix the gelatine sponge over the socket (Fig. 1 to 6).

If missing or perforated socket walls are found on intra-alveolar inspection after tooth extraction, the RP technique is employed as follows. The damaged tooth socket walls are first rendered visible by means of mucoperiosteal or mucosal flap dissection. To minimize the trauma, vertical flap relief should be omitted as far as possible.

If there is one missing socket wall or a perforation, the tooth socket is filled with Bio-Oss granules size 1 to 2 millimetres and the depleted bone wall is covered with several layers of absorbable collagen membrane (Bio-Gide) so that the entrance to the socket is also sealed.

However, if more than one socket wall is absent or there are multiple perforations of the tooth socket, these are first reconstructed with several layers of membrane before the rest of the socket is filled. As in SP, the membranes stretched over the socket remain exposed crestal to the oral cavity. Plastic cover of the socket at this site, apart from the greater trauma, would mean a shift in the crestal direction of the keratinised gingiva, which would interfere with the later implant prosthesis (Fig. 14 to 23).

With both techniques, the sutures are removed as usual after ten days.

Implantation after SP and RP

Implantation in the case of lower teeth takes place after 2.5 to 3.5 months and of upper teeth after three to four months (Fig. 7 to 13).

Shorter waiting times can lead to the bone augmentation material being not yet ossified at the time of implantation and it may become detached during implant bed preparation, especially in the region of the crestal third of the ridge[15,16]. Longer waiting times have not in turn proven worthwhile because of the onset of atrophy.

The healing period in the case of RP is three weeks longer on average than with SP.

At the time of implantation, the covering gingiva should optimally be closed for at least two weeks[17]. Recent clinical studies show a highly significant increase in the preservation of three-dimensional bone volume, the height and thickness of the keratinised gingiva and of local bone density after SP and RP at the time of implantation in the split-mouth model (direct comparison of sides in the same patient)[7].

The employed materials

The coarse-grained Bio-Oss granules can safeguard the intra-alveolar volume better than the fine-grained. In addition, the fine-grained material would be used in greater quantities, which would make the technique more expensive unnecessarily.

The gelatine sponge on the one hand stabilises the Bio-Oss in the socket and on the other hand supports secondary crestal wound healing. The oral exposure of the gelatin sponge in SP and of the Bio-Gide membrane in RP leads to the development of a high-quality keratinised layer of crestal mucosa.

Use of the collagen membrane in several layers in RP leads on the one hand to thickening of the overlying kerati-

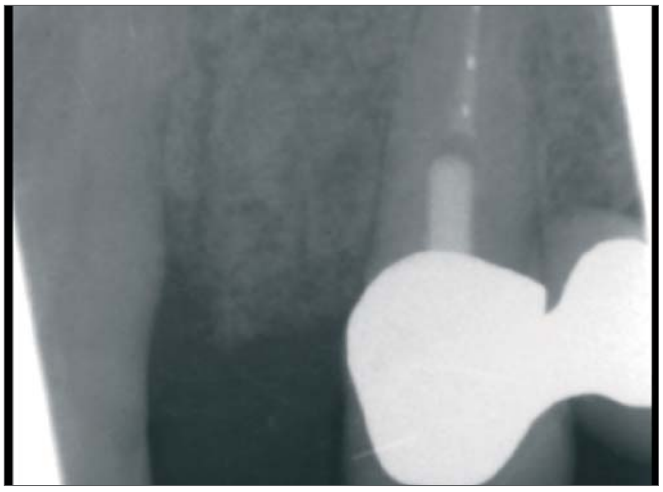

Fig. 21 to 23: Clinical and radiographic situation three months postoperatively shows an excellent implantological horizontal and keratinised alveolar ridge profile in region 22, vertical resorption as expected of 2.5 millimetres mesial and 1 millimetre distal to the defect, which will (partially) improve following implant prosthetic restoration.

nised layer of mucosa and on the other hand to less alveolar bone atrophy.

Because of the relatively uneven surface of the gelatine sponge and the collagen membrane, use of a monofilament smooth suture material such as 5/0 Seralon for the purpose of reducing plaque accumulation has proven reliable for wound approximation.

Time requirement and calculation of costs

Experience has shown that RP is more time-consuming and more demanding surgically than SP because of the multilayer application of the collagen membrane and tension-free suture closure. Under some circumstances, minimally traumatic tooth extraction can take longer than socket reconstruction itself.

On average, a time of approx. 30 minutes can be calculated in the anterior region and approx. 45 minutes in the posterior tooth region. These times can vary depending on the surgeon's technical skill, the difficulty of the tooth extraction and the form of the socket defect.

In our clinic, we calculate an average of 200.00 Euro including material for anterior SP, 300.00 Euro for posterior SP, 350.00 Euro for anterior RP and 400.00 for posterior RP.

Conclusion

The degree of three-dimensional resorption of the alveolar ridge cannot be predicted individually so far. However, it is certain that the alveolar bone and the surrounding keratinised gingiva atrophy, sometimes considerably, not least through loss of the bundle bone after tooth extraction. The extraction socket treatment protocol presented here cannot prevent resorption of the bundle bone but represents an alternative with predictable preservation outcome of these structures.

Overall, the procedures, from the minimally traumatic extraction to socket and ridge preservation, can be classified as surgically easy to perform. The markedly high bone and soft tissue preservation simplify later implantation in the correct position for the prosthesis and often render additional augmentation unnecessary. When avoidance of further surgical procedures with higher costs and the higher prosthetic value of the implant are taken into account, the initial investment and the time required for the techniques presented here appear more than justified.

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NOTE:

All clinical pictures in this article were taken with the Zeiss OPMI Proergo operating microscope.

[Source: Dr. B. Shakibaie-M., Rheda-Wiedenbrueck, Germany]

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[Literatur]

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