



the ring technique

Part 3: Donor regions and indications for bone rings
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In the first part of this series of articles on the bone ring technique the clinical procedure was described in detail (iDENTity 1/2010), while in the second part we looked at soft tissue management (iDENTity 2/2010). This third part discusses possible donor regions for bone rings and describes the various indications by way of examples. Autogenous bone is considered the gold standard for all grafting procedures on the bone. The intraoral harvesting of donor bone is less stressful for the patient than extraoral harvesting. The ring technique has the benefit of combining bone harvesting, grafting, and implant placement in only one intervention. Because of the beneficial design the authors use Ankylos implants exclusively in the ring technique.

Safety first – this of course applies also in the harvesting of bone rings. In the selection of the donor region for bone ring harvesting the risks must be foreseeable. Injury to the dental roots, nerves or vessels must be ruled out. This presupposes appropriate experience. It is advisable therefore to perform the ring technique solo only after appropriate courses and workshops have been completed. Important components for a successful application of bone transplantation include a very

similar histological bone structure in donor and recipient regions, shape congruity between transplant and recipient site tissue, and a simplified harvesting technique with few complications for the patient. These criteria are met in the concept behind the ring technique. The intraoral donor regions have a bone structure that is adequate for the potential recipient regions. With the use of diameter-matched trephine drills the harvested bone rings fit precisely in the prepared bone site in the recipient region. This procedure means less stress for the patient since intraoral bone harvesting, grafting, and implant placement occur concurrently and usually under local anesthesia. The presence of vital bone regeneration cells is crucial for bone healing and because of this the transplantation should proceed as swiftly as possible. Interim storage of the transplant *ex situ* in native blood (Fig. 12) protects it from desiccation and maintains cell vitality. Which donor region to select depends primarily on the amount of replacement bone required and on anatomical conditions, as well as the patient's pathology. The chin or the symphysis, the palate, and the retromolar mandibular region are suitable as donor regions for corticocancellous bone rings. In theory, provided there is an adequate bone supply, bone rings may also be obtained from other regions, for example

laterally from under bridge units or from the os zygomaticum. A three-dimensional radiographic image should always be obtained before the intervention to calculate the bone volume exactly – and also for legal protection.

THE CHIN REGION

Because of its easy accessibility, the chin region is a preferred donor region. Adequate cancellous bone can usually be harvested from between the labial and lingual corticalis. The size of the transplant volume is determined by the vertical height of the mandible. Regardless of the individual anatomical situation, three to five bone rings can be obtained. There is little reason for worry about negative effects on the physiognomy in this procedure as long as a distance of at least three millimeters from the lower margin of the bony chin is maintained. A similar safe distance from the root tip of the mandibular incisors and canines should also be maintained. This will help prevent disruption of blood perfusion and innervation of these teeth. A similar safe distance from the mental foramen should also be maintained. An appropriate incision direction (see Part 1) will expose the mentalis nerve at its emergence site (Fig. 1). Fenestration of the labial corticalis must be strictly avoided in this region. The entire donor region must be exposed through an appropriate incision direction (Fig. 2).

THE PALATE

The anterior portion of the palate offers very good bone quality because of the presence of cortical bone with a high cancellous portion. Bone ring harvesting should be limited to the anterior region of the hard palate between teeth 14 and 24 and to edentulous jaw segments (Figs. 3-5). This will prevent perforation of the maxillary sinus. Injury to teeth must be prevented. Furthermore, care must be taken to avoid the incisive foramen while grafting in the anterior region (Fig. 6). The risk of palatal bleeding exists but this is usually managed easily. Bone harvesting can be somewhat difficult in the presence of an unfavorable anatomical situation such as a sharp palate roof. If the recipient region is the maxillary anterior region, harvesting of the ring from this donor region can be slightly stressful for the patient since one site only is operated on.

THE RETROMOLAR REGION IN THE MANDIBLE

The bone in the retromolar region of the mandible contains an extensive cortical portion compared with the other donor regions. But this benefit is offset by harvesting problems. No more than one bone ring can be obtained from this region at one time (Figs. 7-9). Furthermore, harvesting through a cramped oral opening or the presence of a high alveolar nerve can make it difficult.

1_ *Bilateral dissected mentalis nerve (human cadaver preparation)*

2_ *Recommended incision direction: horizontal for one to two millimeters the mucogingival border from canine to canine.*

3_ *Exposure of the palatal donor region*

4_ *Marking of the harvesting site with a trephine drill*

5_ *Preparation of the implant site before the final drilling*

6_ *Exposure of an artery on the palate (human cadaver preparation)*

7_ *Dissected lingualis nerve (human cadaver preparation)*

8_ *Prepared retromolar bone ring before harvesting*



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In order not to injure this nerve, a safety distance of one – and even better, two – millimeters should be maintained. The lingualis nerve must be protected with an instrument during all drilling procedures. Likewise, make sure to allow adequate dimensions for the lingual lamella in order to preserve its structural integrity and avoid the risk of intra- or postoperative fractures.

INDICATIONS FOR THE BONE RING TECHNIQUE

The great benefit of the ring technique is that vertical grafting and implant placement can be performed concurrently. Grafting with bone rings is an option in the following situations: with external sinus lift, severe atrophy in the mandible or after the removal of retained canines.

SINUS LIFT

Usually an implant can no longer be inserted and have primary stability if the thickness of the sinus floor is less than three millimeters. In such cases the conventional method is to use the

two-stage technique. First the maxillary sinus is lifted so that the implants can be placed three to six months later. Using the bone ring technique makes it possible in a single session to significantly shorten the time to the final restoration and loading by the patient.

In the case presented here (Fig. 10) two bone rings were harvested from the chin region, one of which could not be widened cortically. Until the lateral access to the maxillary sinus is prepared (Fig. 11), the bone rings are steeped in native blood (Fig. 12). The bone rings were introduced laterally into the maxillary sinus. They stabilize the implants by buttressing them. The cortical portion of the rings was aligned cranially since this makes adaptation of the cancellous portion of the ring to the concave-shaped sinus floor much easier (Fig. 13). The still existing cavity is filled with bone regeneration material; Frios Algipore is a good choice. By screwing in a membrane screw, the bone ring is stabilized within the sinus and the implant is anchored in a primary stable position (Fig. 14). This procedure enables good results with long-term effects (Fig. 15).

9_ Retromolar region bone ring

10_ Extensive bone build-up at tooth 25 with about one millimeter of thin sinus floor

11_ Lateral access to the maxillary sinus for placement of the bone ring

12_ The two bone rings from the chin region in native blood.

The non-extended cortical portion of the left bone ring is easily visible. (see Part 1, Step 3)

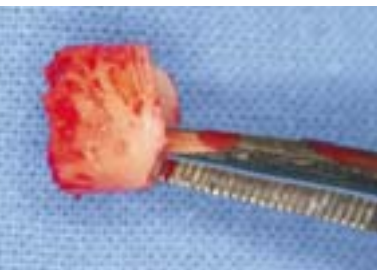
13_ Bone ring introduced into the maxillary sinus.

The cortical portion of the ring is aligned cranially for better adaptation to the sinus floor.

14_ The desired primary stability of the bone ring is achieved with the membrane screw.

15_ Clinical situation three years after loading

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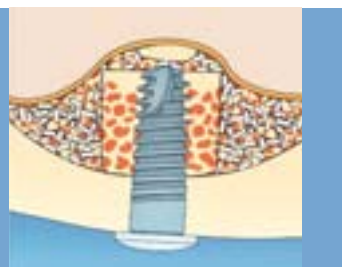
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SEVERE ATROPHY IN THE MANDIBLE

One of the strictest requirements in oral implant dentistry is vertical grafting of a heavily atrophied mandible. The ring technique can also be used here in a single session. The radiographic image gives a good example of the problem (Fig. 16). The distance to the mandibular canal was only five millimeters. Four Ankylos implants were placed at teeth 35/45 and 36/46 along with four bone rings from the chin region. As in the maxilla, the ring technique also led to good results with long-term success in the vertical grafting of the mandible (Fig. 17).

MISALIGNED CANINES

Retained canines cannot always be trained in the dental arch through orthodontic procedures. If this is the case, another solution must be found. If adequate space is available in the mesial-distal plane, a prosthetic span closure is suitable. If the adjacent teeth show no defect (Fig. 18), replacement of the canine with an implant-supported crown should be performed. Removal of the retained canine can cause a relatively large defect also in the

region of the alveolar ridge. Although one can wait for this to heal naturally, there are some disadvantages. To offset the expected bone loss, avoid atrophy, and keep the treatment time manageable, the ring technique offers a good alternative. For this indication, the bone ring is harvested from the palate (Fig. 19). The final restoration can be fabricated after six months of closed healing of the subcrestally placed Ankylos implant (Fig. 20).

CONCLUSION

We hope that we have been able in these three articles on the ring technique combined with the Ankylos implant to present an alternative to conventional, two-stage grafting procedures. An experienced prudent surgeon can obtain just as good results with the ring technique as with the conventional method. The ring technique has been successfully used worldwide in recent times. In the fourth and last part of this series colleagues from various countries will demonstrate with examples how successful the application of the ring technique has been. ■

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16_ A heavily atrophied alveolar ridge in the mandibular posterior region
 17_ The same region four years after insertion of the bone ring and implant loading
 18_ A large bone defect appeared after osteotomy of the misaligned tooth 13.
 19_ Because extraction from the palatal region was impossible the bone ring is extracted from the jaw.
 20_ The final restoration in situ



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