

Morbidity after harvesting of autologous pelvic bone

A Prospective longitudinal study

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Introduction

The industry offers numerous biological and synthetic bone replacement materials and partly pays great advertising expenses to place them on the market. The autologous bone graft, on the contrary, applied with outstanding success in oral and maxillofacial surgery for decades, has no lobby. Is the application of autologous bone grafts, which needs to be harvested beforehand in a second surgery, outdated under these circumstances?

To anchor dental implants in the jawbone successfully, sufficient vertical and transversal bone substance must be available.¹ If there is not enough bone substance, either you have to abstain from inserting implants or you have to create the necessary requirements. The quality value of materials for eliminating the bone deficit is defined by their biological potency and biomechanical properties.²

The autologous bone graft is the only material so far that complies with the condition necessary for

successful bone augmentation according to Garg et al., namely osteogenesis, osteoinduction, and osteoconduction in equal measure.³ Besides intra-oral donor areas like the chin, the retromolar region, zygomatic buttress, and calvaria, mainly the tibial head as well as the anterior and posterior iliac crest bones are suited in particular for larger bone deficits.⁴⁻⁸ We do not, however, want to discuss the numerous bone replacement materials, BMP, stem cell fractions, or PRP, available on the market in this study.^{9,10}

Patient population and method

The purpose of this prospective longitudinal study is to examine the morbidity after harvesting and transplanting autologous pelvic bone to eliminate jawbone deficits.

69 adult patients (37 f/32 m) aged between 31 and 73 years (average age at the time of the intervention 57.8 years, median age 52.5 years) who had undergone harvesting of autologous bone

Fig. 1a: Bone deficit region 15–18, alveolar bone thin as an eggshell.

Fig. 1b: St. p. lateral sinus lift with consolidated bone before implant insertion.



Fig. 1a



Fig. 1b

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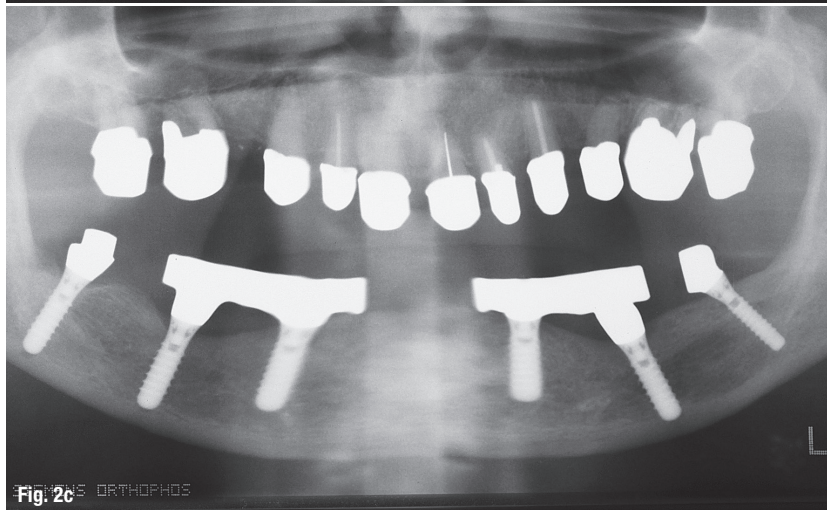
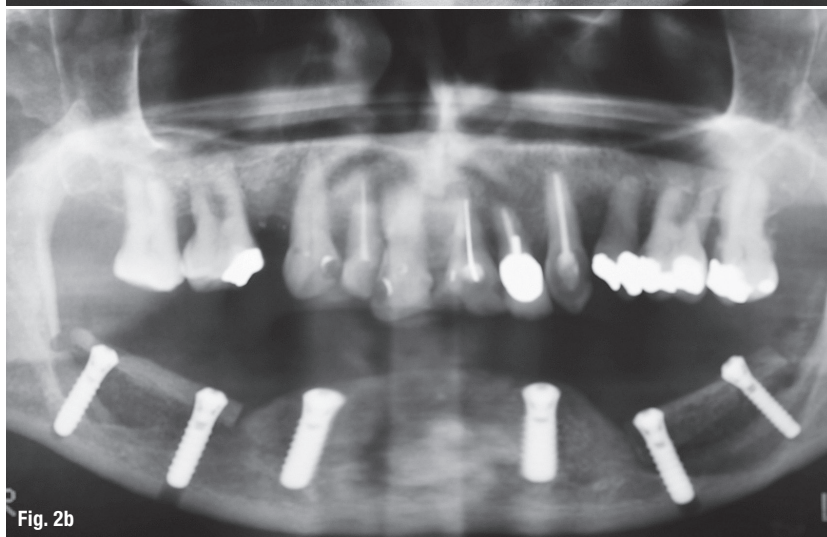
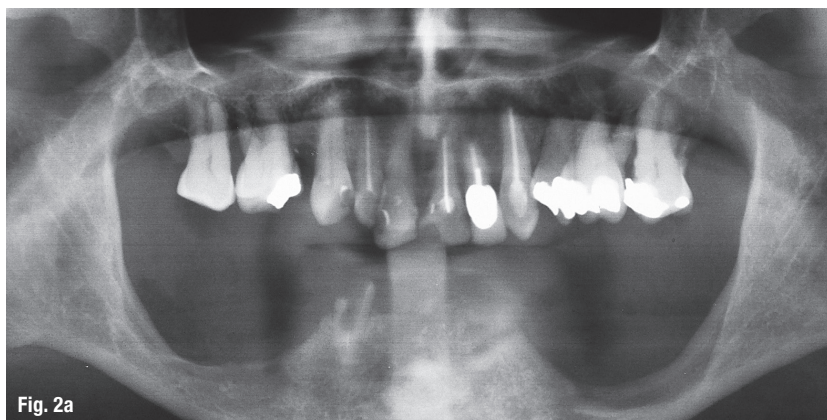


Fig. 2a: Bilaterally advanced atrophy of the alveolar ridge in the lower jaw with an insufficient prosthetic bed. – **Fig. 2b:** St. p. nerve lateralisation and onlay osteoplasty with cortical/cancellous bone flakes from the iliac crest bilaterally in the lower jaw, fixation of bone flakes with implants 35, 37, 45, 47, implant insertion 33, immediate implant insertion after extraction 43. – **Fig. 2c:** St. p. osseous consolidation and prosthetic supply.

graft from the anterior iliac crest bone between 2002 and 2010 participated in the study. The surgery was indicated on the grounds of the dimension of the available jawbone deficit (Figs. 1 & 2), considering its localisation as well. Criteria for exclusion were heavy nicotine (more than ten cigarettes/day) and drug abuse, diabetes mellitus

requiring insulin, coagulation disorders, and bone diseases.

All interventions were executed under short-term antibiotic prophylaxis (Cefotiam [Spizef®], Grünenthal GmbH or Clindamycin [Sobelin®], Pfizer) under general anaesthesia by the same surgeon, exposing at first the donor site of the anterior iliac crest bone in a minimally invasive procedure, i.e. by making a 3 to 4 cm long skin incision along the Langer lines and subcutaneously, if possible without cutting muscles, nerves, and vessels. By creating two periosteal flaps, the periosteum was pushed aside over the iliac crest bone. Using a micro-oscillating saw, cortico-cancellous bone blocks were removed or, by means of a hollow drill, cylinders from the cancellous bone. The periosteum was thoroughly adapted and closed; the wound was sutured in layers. A continuous subcutaneous suture was made (Fig. 3). Suction drainage was obtained from regularly. Before the final transplantation, the cortico-cancellous bone was modelled to fit the graft bed and stored intermediately in venous autologous blood; amorphous cancellous bone was homogenised and stored intermediately in venous autologous blood as well until fitted in the graft bed (Fig. 4).

According to the specified follow-up schedule, check-ups took place the following day, after one, two, and three postoperative weeks and in the course of the prosthetic treatment, at the latest after six months. Then, further follow-ups took place within the bounds of the semi-annual implant examinations. The results were recorded in writing. They were analysed by means of a checklist comprising intraoperative injuries such as haemorrhages, injury of nerves (e.g. genitofemoral nerve, lateral cutaneous nerve, iliohypogastric nerve), and peritoneal perforation. Possibly persisting sensibility disorders like complete failure of sensibility or paraesthesia (e.g. burning sensation) were grouped with intraoperative complications. In addition, infections, impaired wound healing, secondary haemorrhages, possibly available pains, their intensity (analogue scale between 1 and 10) and duration as well as motor function limitations were registered. Finally, the quality of the scar was assessed and the subjective opinion of the patient on the result of the treatment obtained.

Results

Intraoperative complications like heavy vascular bleeding requiring ligature did not appear in any of the cases and were not expected because of the patients anatomy. Almost regularly, however, postoperative suffusions in various intensities occurred, albeit with no clinical relevance. Transections of

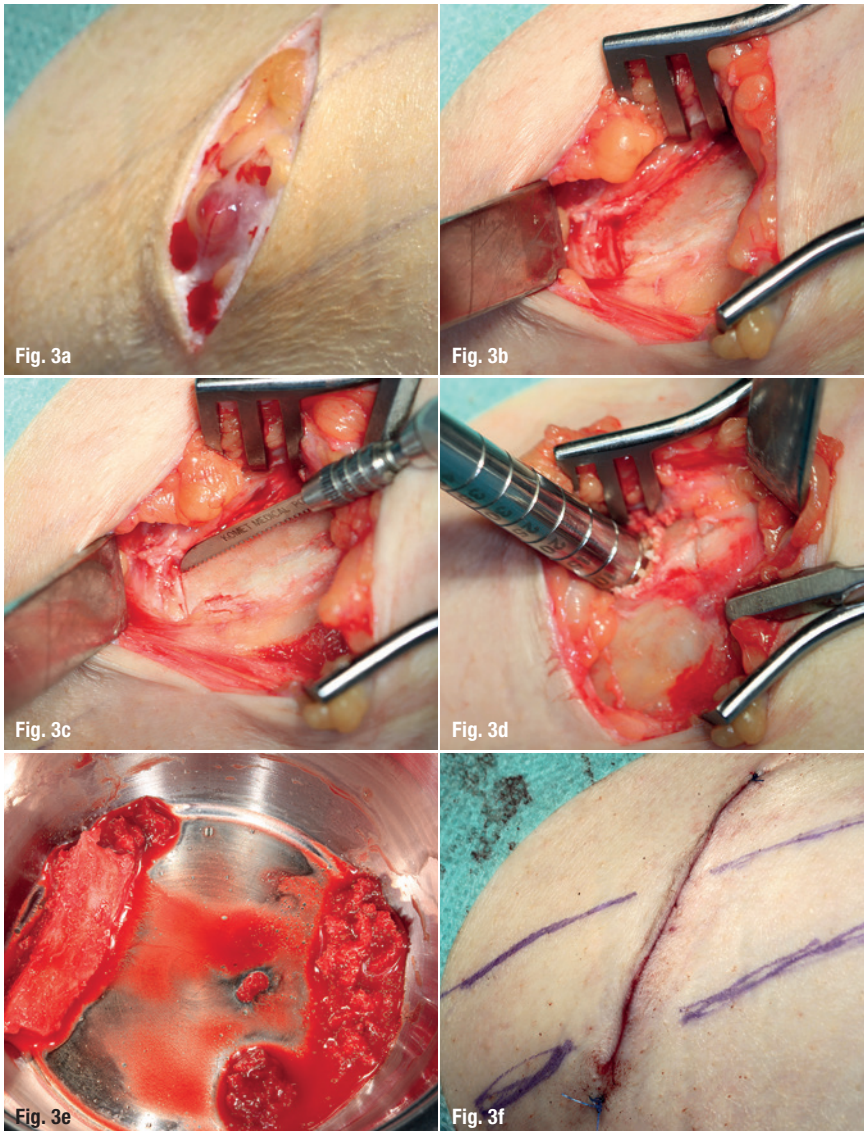


Fig. 3a: Skin incision along the Langer lines perpendicularly to the iliac crest. – **Fig. 3b:** Representation of the iliac crest. – **Fig. 3c:** Harvesting of a cortical/cancellous bone flake using the oscillating saw. – **Fig. 3d:** Harvesting of cancellous bone cylinders using the hollow drill. – **Fig. 3e:** Cortical/cancellous bone flake and homogenised cancellous bone. – **Fig. 3f:** Continuous subcutaneous suture.

motor or major sensitive nerve branches and the associated functional failures were not recorded. Peritoneal perforations, for example by the hollow drill, were theoretically possible, but did not occur either. Infections, impaired wound healing, or secondary haemorrhages requiring intervention did not occur.

Postoperatively, a sensibility disorder tending to remission (hypoesthesia) of the donor site was noticed only in two patients (1.38%) within the first three weeks. Eleven (14.2 %) patients did not suffer from any postoperative pain of the donor site. 58 (85.8 %) patients stated to suffer from pains of the pelvic donor site when they

came out of anaesthesia. Within two weeks, the major share of the patients did not feel any pain of the donor site anymore (Fig. 5). In no case were the pains described as unendurable.

Temporary movement restrictions, e.g. when standing up or climbing stairs, occurred relatively frequently with 62.32% (43 patients), but were individually and subjectively overlaid, amongst others with regard to the dimension of the intervention. In any case, they disappeared completely after two weeks at the latest.

All patients were satisfied with the aesthetic result of the donor site. 65 (94.2 %)

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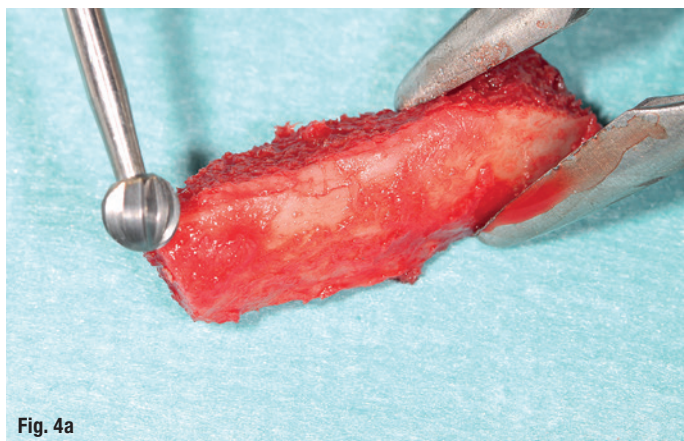


Fig. 4a

Fig. 4b

Fig. 4a: Processing of the bone block.

Fig. 4b: Intermediate storage of grafts in venous autologous blood.

said the result was very good, four (5.8%) said it was good. None of the patients stated any impairment of any kind. All patients would undergo bone harvesting from the iliac crest again.

Discussion

The success of autologous bone for jawbone augmentation with its low morbidity and complication rate is well known.^{11–15} Not for nothing is it called the gold standard. Compared to bone created in laboratories, it provides more reliable results.¹⁶ Compared to Straumann BoneCeramic® (BoneCeramic®, Straumann AG; hydroxyapatite and tricalcium phosphate), BioOss® (BioOss®, Geistlich; bovine bone) and Puros® (Puros®, Zimmer Dental; allograft cancellous particles), the vital autologous bone performs best and yields the best *de novo* bone formation.¹⁷ The success rate is high as well in combination with other materials.^{12, 18}

The necessity to perform pelvis surgery under general anaesthesia and the fact that the patient should be monitored at the hospital at least for a short time makes the harvesting of pelvic bone appear laborious, however. In addition, there may be general medical and individual reservations against opening a second operating field.

Besides the easily accessible anterior iliac crest, for which the patient does not need to be repositioned for the jawbone augmentation, there are further options. When harvesting bone from the dorsal part of the iliac crest, however, repositioning of the patient causes a substantial loss of time. All other donor sites mentioned above are associated with a limitation of available material, so that they are suited to fill only minor defects in contrast to the iliac crest, where sufficient quantities of cortical and cancellous bone are available.

Within the scope of the present prospective longitudinal study, the anterior iliac crest was chosen

exclusively as the donor site of autologous bone. The same experienced surgeon always harvested the graft, thus ensuring a standardised and speedy procedure. In addition, as the patient did not need to be repositioned, a second team could expose and prepare the graft site simultaneously. This can neither be realised effectively by the procedure of intra-oral bone harvesting nor by harvesting of material from the posterior iliac crest. The timesaving is remarkable and certainly has an effect on the hygienic situation.

Within the scope of this study, the jawbone situation is not addressed in detail. We may remark, however, that no graft loss occurred in the transplant bed. This correlates with the patients' assessment to undergo the surgery again.

Serious intraoperative complications, secondary haemorrhage, infections, or impaired wound healing did not occur, certainly also because of the strict exclusion criteria like nicotine abuse and diabetes requiring insulin.

Subjective paraesthesia and short-time temporary functional impairments when standing up or climbing stairs were predominant. The evaluation of surgery-related pain, in this case focused on the pelvic region, is difficult, as pain is an individual, subjectively-biased sensation that is usually modulated by means of analgesic medication in particular after surgeries. Usually and in this study, the intensity of available pain is given by the patient him-/herself on an analogue scale ranging from 1 (minimum) to 10 (maximum). This information is also a measure of the analgesic effectiveness and can therefore not be used in the strict sense (Singh et al. 2009, Fasolis et al. 2012)^{19, 20}. Improved postoperative analgesia bears great potential after all. We drew the conclusion by administering an additional long-lasting local anaesthetic at the end of the operation (Carbosthesin®, AstraZeneca; Bupivacaine). The effect is promising.

Pain duration

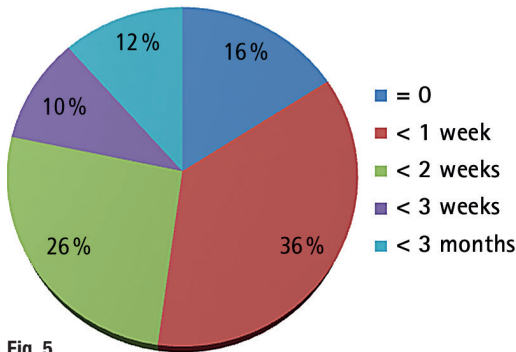


Fig. 5

All patients rated the aesthetic result of the donor site as very good or at least as good. At the time of the final examination, none of the patients reported any complaints that might be attributed to the surgery.

Conclusion

According to the analysis of our results, in particular in view of the low morbidity of the donor site, we can confirm the excellent suitability of autologous pelvic bone to eliminate deficits of the jawbone when indicated accordingly.²⁰ If larger quantities are

needed, the autologous pelvic bone is still the method of choice despite the drawback of the second intervention. The chances of healing and the resistance against infections are unexcelled due to the great ontogenetic power of the fresh, vital autologous bone. The method guarantees assured success, the results are well predictable. The "gold standard" term is still justifiable.

Editorial note: A list of references is available from the publisher.

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