Rehabilitation of the Atrophic Posterior Mandible with Short (4-mm) Implants: A Case Report

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This case report describes a successful implant-prosthetic rehabilitation of an atrophic posterior mandible with 4-mm-long implants. The patient refused to undergo any reconstructive surgery, and because the available bone up to the inferior alveolar nerve was only 5 mm or less, the patient received four implants of 4-mm length. Four months after implant placement, a provisional prosthesis was put in place; after another 4 months, this was then in turn replaced with a definitive prosthesis. The use of such short implants allows a fixed prosthetic solution without the need for vertically augmenting the mandibular bone. This procedure considerably reduces intra- and postoperative patient discomfort compared with reconstructive surgery for the placement of longer implants. The follow-up time was 1 year after implant loading. (Int J Periodontics Restorative Dent 2014;34:713–718. doi: 10.11607/prd.1733)

The need for prosthetic rehabilitation of a posterior atrophic edentulous mandible is a common clinical problem.¹ The ideal solution would be a fixed implant-supported prosthesis; however, this is often impeded by a deficiency in the height and width of the residual alveolar bone and the consequent superficialization of the inferior alveolar nerve that can occur subsequent to tooth extraction. It is clear that in such a situation, it can be difficult to insert implants of adequate length.² The alveolar ridge can be rehabilitated with endosseous implants, but a sufficient quality and quantity of alveolar bone is required to ensure the correct position of implants and a good esthetic outcome.²

When there is a situation of severe atrophy in the posterior mandible with adequate bone width but poor bone height (Seibert Class II⁻), the possible therapeutic solutions are to either vertically augment the bone height or to use short implants.

Several techniques are currently being used to vertically augment mandibular bone, including various vertical guided bone regeneration techniques.
(GBR) procedures,\(^5\) alveolar distraction osteogenesis,\(^5\) and onlay\(^7\) and inlay bone grafting.\(^8,9\) While it has been shown that it is possible to vertically augment bone with different techniques, the rate of complications and failures in the augmentation procedure is still too high (well over 20\%) to recommend widespread use of such procedures.\(^10\)

In fact, augmentation procedures are more technically demanding, can be associated with significant postoperative morbidity, can be more expensive, and may require hospitalization and longer rehabilitation periods (up to 1 year) for patients.\(^10,11\)

Short dental implants, having an intrabony length of 8 mm or less,\(^11\) can be used as an alternative to bone augmentation procedures to allow the placement of longer implants and may have a better long-term prognosis.\(^12\) There are some short-term studies on the effectiveness of dental prostheses supported by short implants compared with those supported by longer implants placed in augmented bone.\(^13-18\) Preliminary results of these randomized clinical trials (RCTs), which have a follow-up of up to 3 years after loading, suggest that 5- to 8-mm-long implants can be a viable or even better alternative to augmentation procedures, especially in the posterior mandible. The longest follow-up from an RCT on short implants (6.3 mm long) placed using a flapless technique and immediately or early loaded was 4 years, and the initial good clinical results were maintained.\(^19\)

Short implants may be a simpler, cheaper, and faster alternative to longer implants placed in augmented bone, and with less associated morbidity, if they can be shown to have similar success rates.\(^12\)

Yet, in the case of a residual bone height of 5 mm above the inferior alveolar nerve, the placement of implants of 5- or 6-mm length could involve a high risk of nerve damage. In these situations the possible therapeutic solutions are those of vertical bone augmentation with GBR, onlay, or a recently published new inlay technique in two stages.\(^20\) However, performing these techniques means an increase in cost, time, and morbidity. New 4-mm implants were recently introduced, and these could provide an interesting alternative in these cases of severe bone atrophy, allowing implant placement without the need for reconstructive bone surgery.

This case report describes a successful implant-prosthetic rehabilitation of an atrophic posterior mandible with less than 5-mm height above the inferior alveolar nerve using 4-mm implants, avoiding the need for any bone augmentation.

**Case report**

A 62-year-old systemically healthy man was referred to San Filippo Neri Hospital (Rome, Italy) for fixed prosthetic rehabilitation of the right posterior mandible.

Clinical and radiographic (panoramic radiograph and computed tomography [CT]; Figs 1 and 2) evaluations and dental casts showed Seibert\(^3,4\) Class II posterior mandibular atrophy.

CT images showed 5 mm preoperative mean residual bone height above the mandibular canal. The patient did not wish to undergo any surgical procedures to vertically augment the residual bone, but he wanted a fixed rehabilitation, so the authors proposed placing short (4-mm) implants (TwinKon, Tekka; Fig 3) to allow subsequent fixed prosthetic
rehabilitation of the affected region while avoiding vertical bone augmentation of the atrophic area.

The surgical procedure was performed under local anesthesia (4% articain, 1:100,000 adrenaline; Citocardin, L. Molteni & C. Dei Fratelli Alitti). A full-thickness crestal incision was made, and the soft tissues overlying the alveolar process were elevated in the posterior mandible (Fig 4).

Four Tekka implants (4 mm in length and 4 mm in diameter) were placed in the mandibular right second premolar and first, second, and third molar locations (Fig 5). The implants were transmucosal, made of commercially pure titanium with a roughened surface (sandblasted and doubly etched). The flaps were carefully sutured with Vicryl 4-0 (Ethicon). Radiographs and CT scans were taken after implant placement to verify the correct implant position (Figs 6 and 7).

A 2-g dose of amoxicillin with clavulanic acid was administered preoperatively, followed by 1 g twice daily for 5 days. Ibuprofen (600 mg) was prescribed to be taken as needed. A cold and soft diet and appropriate oral hygiene were recommended for 2 weeks. Sutures were removed 7 days after the surgical procedure. The postoperative recovery was uneventful (Fig 8).

Four months after implant positioning, an acrylic screw-retained reinforced provisional restoration (Fig 9) was placed; this was then in turn replaced by a definitive prosthesis after another 4 months (Figs 10 and 11).
Results

The patient was examined clinically each week in the first month after surgery and twice in the subsequent month. The healing process was uneventful. No neurosensory disturbance was recorded. A panoramic radiograph and CT scans were obtained immediately after the surgical procedure (see Figs 6 and 7). Four months after implant placement, an acrylic screw-retained reinforced provisional restoration was delivered (see Fig 9) and then in turn replaced by a definitive metal-ceramic prosthesis after another 4 months (Figs 10 and 11). One year after prosthesis placement, the implants didn’t show any clinical or radiologic problems (Fig 12).

Discussion

Bone augmentation procedures are widely performed to enhance atrophic alveolar ridges to enable optimal positioning of implants. While it has been shown that it is possible to vertically augment bone with different techniques, the number of complications and failures with the augmentation procedure is still too high (well over 20%) to recommend widespread use of such procedures. Furthermore, these surgical procedures can sometimes fail, resulting in a return to the initial situation of atrophy or worse and can lead to the loss of patient cooperation.

This study evaluates whether a 4-mm-long implant might be a viable alternative to augmentation procedures for placing longer implants when rehabilitating posterior atrophic jaws with implant-supported partial fixed prostheses. The authors were interested in assessing the clinical performance of very short implants.
Some recent RCT studies\textsuperscript{13-19} compared the inlay technique for augmenting vertical bone with the placement of short implants (5- to 7-mm) in the atrophic posterior mandible. Both techniques had good results, but the use of short implants had fewer complications, took less time, cost less, and produced less patient discomfort.

What techniques, then, can be used to rehabilitate the mandible with a residual bone height of only 5 mm or less? Performing the inlay technique with residual bone heights of 5 mm or less above the mandibular canal is associated with a high risk of trauma to the inferior alveolar nerve, even with the use of piezozurgical instruments,\textsuperscript{14,15} because an osteotomized bone segment of at least 2 to 3 mm in height must be raised to maintain bone graft vascularization.\textsuperscript{20} Piezosurgical instruments are 0.3 to 0.75 mm thick,\textsuperscript{21} and instrumentation cannot be as precise in the posterior regions. This means that the operator must allow an additional millimeter of space and thus must work very close to the inferior alveolar nerve. In two RCTs, Felice et al\textsuperscript{1} reported that 67% and 43% of patients experienced impaired inferior alveolar nerve sensitivity. To overcome this problem, a new two-stage inlay technique simplifies the procedure and reduces intra- and postoperative patient discomfort and the risk of nerve trauma.\textsuperscript{26}

Chaushu et al\textsuperscript{22} reported infection of the grafted site in 18 (13%) of 137 bone blocks. There were infections in 7 (39%) of 18 infected blocks resulting in total graft failure, and in 4 (22%) of 18, partial graft failure was noted. Recipient site complications associated with block grafting were due to infection, membrane exposure, incision line opening, and perforation of mucosa over the grafted bone.\textsuperscript{22} Probably one of the most frequent incidences of infection of grafted blocks occurs during its necessary shaping to adapt the block to the recipient site. Infection has been identified more frequently in the posterior mandible than all the other regions.\textsuperscript{22}

In another study by Nissan et al,\textsuperscript{23} an overall block graft success rate of 79.3% was reported. Higher success rates were reported for the anterior maxilla (95.6%), but a rate of only 87% was reported for the posterior mandible. In fact, most of the graft failures (71%) in this study occurred in the posterior mandible.

It is estimated that 9% to 17% of GBR procedures with autologous bone and nonresorbable titanium-reinforced membranes will be compromised. The use of resorbable barriers results in a complete failure in about 18% of cases.\textsuperscript{22-25}

Thus, complications or failures in vertical augmentation procedures are common, and when it is necessary to rehabilitate patients who have already undergone a failed surgical procedure or those patients who do not wish to undergo any invasive surgical procedure at all, the only possible option is the use of short implants.

The 4-mm length of these implants permits surgery to be avoided even with a residual bone height of 5 mm or less, reduces operative times and costs, and, most of all, reduces complications and postsurgical morbidity of patients. As the reliability of short implants is being increasingly established, it seems that the crown-implant ratio does not influence implant survival rate.\textsuperscript{3,27,28}

Conclusions

In atrophic posterior mandibles with 5 mm or less bone height, 4-mm implants represent a simplified approach that reduces operative times and costs as well as intra- and postoperative patient discomfort. An RCT is required to compare outcomes using these short implants and those obtained using vertical bone augmentation to place standard-length implants.

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References


