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Long-term retrospective evaluation of the peri-implant bone level in onlay grafted patients with iliac bone from the anterior superior iliac crest

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ABSTRACT

Objective: The purpose of the present study was to evaluate crestal bone level changes around dental implants after iliac bone augmentation in the long term.
Material and methods: A total of 32 partially edentulous/edentulous patients (mean age, 52 years; range, 22–70 years) and a remaining bone volume of less than 5 mm of the alveolar ridge underwent maxillary or mandibular iliac bone graft augmentation. All patients received spaced standardized radiological examination for evaluation of peri-implant crestal bone loss.
Results: The grafting procedure was successfully performed in all patients. A total of 150 implants were placed. The mean observation period was 69 months (range, 12–165 months; success rate for maxilla, 96%; success rate for mandible, 92%). The mean amount of crestal bone loss after 10 years was 1.8 mm. A significant difference between gender and crestal bone loss was shown, but no influence was found regarding the implant system, diameter of implant, and age of the patients.
Conclusion: In patients with atrophic jaws, a sufficient long-term reconstruction can be achieved with the combination of iliac onlay grafting and dental implants. The results demonstrate high success rates and a stable peri-implant bone level in the long term.

1. Introduction

The restoration of the oral function of extremely atrophied alveolar crests remains a task in oral and maxillofacial surgery. Severe atrophy of maxilla and mandible can be treated successfully with various augmentation procedures in combination with dental implant systems (Vermeeren et al., 1996; Reinert et al., 2003; Whitmyer et al.; 2003; Nelson et al., 2006a,b).

In patients with minimal residual bone, autogenous bone from the iliac crest remains the gold standard, providing the properties necessary for bone remodeling: osteoinduction, osteoconduction, and osteogenic potential (Lundgren et al., 1999; van der Meij et al., 2005; Chiapasco et al., 2007; Moses et al., 2007; Sbordone et al.; 2014). The authors showed an implant survival rate up to 98.7% within a 5-year period after iliac crest onlay grafting in the mandible (Boven et al., 2014). However, a vertical unpredictable bone loss with a severe discrepancy between the resorption rates is described in literature and may compromise the long-term survival of the placed implants (Adell et al., 1990; Nyström et al., 1996; Verhoeven et al., 2000, 2006; Bell et al., 2002; Verhoeven et al., 2006; Dasmah et al., 2012; Boven et al., 2014). van der Meij reported an average resorption of 15% of the initial graft after a follow-up to 7.9 years (van der Meij et al., 2005). In a 5-year follow-up after corticocancellous augmentation, an overall bone resorption rate of up to 50% has been described (Vermeeren et al., 1996; Verhoeven et al., 2006). Strategies to minimize bone resorption have been proposed (Wiltfang et al., 2014).

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The anterior iliac crest is a common donor site, with the superior–anterior rim of the iliac crest commonly presenting a large cortical segment (Ebraheim et al., 1997; Sömnez et al., 2013; Zaker Shahrak et al., 2014). Other authors prefer a posterior donor site to harvest a large portion of cancellous bone matched with a low complication rate (Wiltfang et al., 2005).

Long-term studies concerning dental implants placed in illiac onlay grafts exist, but an evaluation of the peri-implant bone level is rare (Verhoeven et al., 2006; Chiapasco et al., 2008, 2014; Sbordone et al., 2012; Boven et al., 2014).

The aim of this study was to evaluate crestal bone level changes around dental implants placed in onlay bone grafts harvested from the anterior superior iliac rim in the long term.

2. Material and methods

This study was approved by the local ethical committee of the Charité Medical University Berlin, Germany.

2.1. Study design and sample

In the period starting from 1998, 32 patients (22 female and 10 male) with a mean age of 52 years (range, 22–70 years) underwent maxillary or mandibular onlay augmentation with iliac bone grafts and were re-examined in 2012. All patients were partially edentulous or edentulous and showed a severe resorption of the alveolar ridge with a remaining bone volume of ≤5 mm in height.

In all of the patients, onlay grafting with corticocancellous bone from the anterior superior iliac crest was performed. The anterior ilium has a concave anterosuperior surface and presents a thick cortical rim (iliac tubercle) 2–3 cm posterior to the anterior superior iliac spine. In this study, corticocancellous bone blocks with a cortical rim of ≥4 mm were harvested from the median margin of the anterior iliac crest.

2.2. Exclusion criteria

Age less than 18 years, periodontitis, history of immunosuppression, irradiation, or chemotherapy, and participation in other studies were exclusion criteria.

2.3. Surgical procedure

Surgery for bone augmentation and implant placement was performed under general anesthesia. The harvesting of the iliac graft was performed as described (Fretwurst et al., 2015). After removal of the corticocancellous bone block from the inner table, additional cancellous bone was harvested with curettes. Ideally the harvested bone has a curved cortical wall and a cancellous internal part (Fig. 1). The size and contour of onlay grafts were limited to the size needed for an appropriate implant length (height, 9–16 mm).

Intraorally, a slightly palatal crestal incision along the edentulous alveolar crest with distal and median vertical releasing incisions was performed, and a mucoperiosteal flap was raised. In cases with a combination of onlay graft and sinus elevation procedures, a standard sinus floor elevation was performed with cancellous bone (Boyne and James, 1980). The corticocancellous bone blocks were contoured and fixed to the labial and occlusal aspect of the alveolar ridge, so that the cortical wall faces occlusal and vestibular. Each bone block was secured with multiple microscrews (Modus 1.5; Medartis, Umkirch, Germany).

The mucoperiosteal flap was passively mobilized and closed with a running suture and secured with four to five interrupted sutures (5-0 Monocryl; Ethicon, Norderstedt, Germany). All bone grafting procedures were performed according to a standard protocol. The patients were given an intravenous antibiotic regimen (clindamycin 600 mg) during the operation and oral antibiotics postoperatively (clindamycin 300 mg three times a day) for 7 days. All patients remained hospitalized for 2–3 days. The iliac sutures were removed after 10 days.

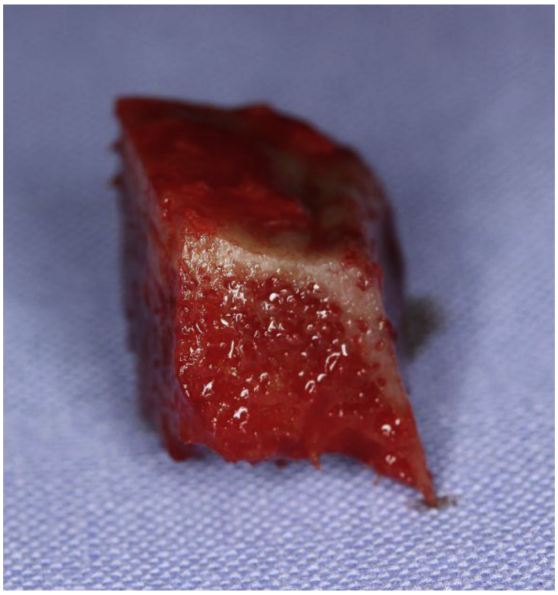

Fig. 1. Harvested corticocancellous iliac graft with two curved cortical walls and a cancellous internal part.

All patients were clinically evaluated after 1, 3, 10, and 30 days as well as after 3 and 6 months. The clinical evaluation included assessment of complications such as inflammation, mucosal erythema, wound dehiscences, and loss of bone grafts. Standardized radiographic examinations (orthopantomograms) were performed before and immediately after the surgical procedure, after 1, 3, 5, and 10 years.

2.4. Implant placement

After a healing period of 3 months, the previous incision line used in the grafting procedure was used for the preparation of a mucoperiosteal flap to remove the microscrews and to place the dental implants.

Among all 32 patients, a total of 150 implants were placed according to the manufacturer's surgical protocol; 99 were Camlog RootLine implants (Camlog Biotechnologies, Wimsheim, Germany), 28 were Straumann Tissue Level implants (Straumann AG, Basel, Switzerland), and 23 were Steri-Oss implants (Nobel Biocare Deutschland GmbH, Cologne, Germany). The Camlog and Steri-Oss implants were inserted equicrestally. All Straumann implants were placed with the smooth–rough border at the crestal bone level. The mucoperiosteal flaps were closed with a running suture and secured with random interrupted sutures (5-0 Monocryl, Ethicon, Norderstedt, Germany).

The time of unloaded healing of the implants was 12 weeks for maxillary implants and 8 weeks for mandibular implants. At loading, the stability of the implant was reassessed using a torque ratchet. If the torque value of the implant was >35 Ncm, then the prosthetic treatment was initialized. All patients received splinted prosthetic treatment. The patients were either restored with removable dentures seated on individually fabricated bars or with fixed bridges.