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ORIGINAL ARTICLE

Sinus lift: 3 years follow up comparing autogenous bone block versus autogenous particulated grafts

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Abstract *Background/purpose:* The aim of this prospective randomized controlled clinical trial was to compare vertical bone gain and bone resorption after sinus graft procedures performed either with particulate or with autogenous bone block.
Material and methods: Forty-one patients underwent sinus graft procedures with autogenous bone. They were randomly assigned to one group. The first group of 22 patients was treated with autogenous bone block with or without particulated bone, while in the second group of 19 patients sinus floor elevation was performed only with particulated autogenous bone. Linear measurements were recorded before surgery with a computed tomography scan at surgery and at 36 months after sinus lift grafting with a second computed tomography scan. To detect statistical differences Student *t* test was applied. Differences were considered significant if P values were < 0.05.
Results: There was a statistically significant difference in bone gain for the group treated with bone block grafts.
Conclusion: As a general clinical guideline the clinician should prefer, wherever feasible, en-block bone grafts for sinus floor augmentation procedures.

Introduction

Rehabilitation of the posterior maxilla with the placement of dental implants is often a challenging procedure due to the reduced bone volume. The loss of bone volume is a consequence of alveolar bone resorption which occurs immediately after extraction of teeth. The pneumatization of the maxillary sinus steadily continues throughout life and

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therefore the sinus usually becomes larger as the years pass.[1]

The prosthetic rehabilitation of the partially or completely edentulous maxilla without the placement of implants is still an alternative in cases of severely athropic maxilla when patients do not want to undergo a surgery. However, the patient's comfort and satisfaction are usually higher when it comes to implant-retained or -supported prosthesis.[2]

Alternative solutions, which avoid entering the sinus, are sometimes possible: short implants and tilted implants can be duly placed if the vertical bone height is suffiecient.[3]

Elevation of the maxillary sinus floor was presented by Boyne and James[4] in 1980. They proposed access to the maxillary sinus by drilling a bone window in the lateral sinus wall (lateral window approach), using a small, round bur, elevation of the maxillary sinus membrane, and insertion of autogenous particulated graft under the Schneiderian sinus membrane. This technique was performed when residual vertical bone height was $< 6-7$ mm.

Tatum[5] was one of the first to think of the sinus lift technique for implant-prosthetic rehabilitation, where the maxillary sinus was grafted using autogenous particulated iliac bone. Since then the original technique has undergone many modifications. Summers[6] presented a more conservative and less invasive approach than the conventional lateral approach of sinus floor elevation known as transalveolar or crestal technique. This procedure was originally applied when the residual vertical bone height was 6–7 mm, but still not enough to place a traditional implant.[7–10]

During the past few years, elevation of the maxillary sinus was performed with alternative techniques differing in the graft material (autogenous, allogenic, xenogenic, alloplastic), the donor site of autogenous bone (intraoral, extraoral), and the surgical technique.[11,12] If autogenous bone is chosen as a filler material, it can be particulated or en block. The block technique has often been challenged to bear a higher risk of infection and failure. Le Lorc'h-Bukiet et al[13] described a sinus lift procedure with a block graft harvested from the parietal bone. This technique, though very promising, is linked to a major surgical approach[14,15] and is hampered by an increase in morbidity.

The aim of the present randomized, prospective study was to evaluate long-term graft resorption in sinus graft procedures performed either with particulated or with autogenous bone block. A secondary endpoint was to assess whether block transplant would show a higher risk of failure. We performed a modified Tulasne technique for the harvesting of the bone block grafts as the donor sites differed from calvaria.

Materials and methods

Patient selection

The patients were selected for edentulous spaces in the posterior severely athropic maxilla. Inclusion criteria were a residual bone height 1–5 mm evaluated with preoperative computed tomography. In fact, residual bone height varied from a minimum of 1 mm to a maximum of 5 mm [mean, 2.73; standard deviation (sd) = 1.43].

The other inclusion criteria were Cawood and Howell[16] Class V–VI and age above 20 years (Table 1). Exclusion criteria were concomitant severe systemic disease, pregnancy, and bisphosphonate therapy.

Patients were randomly assigned to the block group (Table 2) or to the particulated group (Table 3) by coin flip after sinus preparation. Written informed consent was obtained from all the included patients. The Ethical Committee decided that no ethical vote was necessary for this study, as the two procedures are well-established clinical therapies. The trial was conducted in accordance with the Helsinki Declaration.

Surgical technique

Forty-one patients (27 men and 14 women) with a mean age of 53.20 years (sd = 9.27; range, 39–72) were treated because of a lack of vertical dimension of the alveolar

Table 1 Characteristics of the sample.

	Group 1 (bone block)	Group 2 (particulated bone)
Sample size	22	19
M/F	13/9	14/5
Mean age (y)	55.82 ± 9.85	50.16 ± 7.71
Mean residual bone height (baseline, mm)	2.73 ± 1.45	2.74 ± 1.45

F = female; M = male.

Table 2 List of patients who received the block graft (if in parentheses more than one block was harvested).

Patient	Size of the block graft
N1	1 × 1.5
N2	2 × 3
N3	1 × 2
N4	2 × 1
N5	2 × 2.5
N6	2 × 2
N7	2.5 × 2
N8	2 × 1
N9	1.5 × 3
N10	2 × 3
N11	(1 × 2), (1 × 1.5)
N12	(1.5 × 1), (1 × 1.5)
N13	(1 × 2), (1.5 × 1)
N14	(1 × 1), (0.5 × 1)
N15	2 × 1
N16	2 × 3
N17	3 × 1.5
N18	3 × 2
N19	1 × 1.5
N20	(1.5 × 1), (1.5 × 1)
N21	1.5 × 1.5
N22	1 × 2