Journal of Cranio-Maxillo-Facial Surgery 44 (2016) 364–368

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

Donor site morbidity of anterior iliac crest and calvarium bone grafts: A comparative case-control study

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ARTICLE INFO

Article history:
Paper received 6 October 2015
Accepted 30 December 2015
Available online 8 January 2016

Keywords:
Morbidity
Iliac crest
Calvarium
Bone grafting
Maxilla
Complications

ABSTRACT

Purpose: Notwithstanding its donor site morbidity, autogenous bone graft harvesting is still considered the gold standard for cases of extreme resorption of the alveolar ridge. The aim of this study was to assess donor site morbidity of calvarium and anterior iliac crest harvesting.
Material and methods: A total of 27 edentulous patients who had undergone calvarial bone harvesting were matched with 27 edentulous patients in which anterior iliac crest bone was harvested. All patients had been treated between March 2011 and December 2013. Patients were matched according to age, sex, and duration of follow-up. Donor site morbidity was assessed by medical records, patient questionnaires, and physical examination. Patients were recalled to assess persisting morbidity of the harvesting procedure.
Results: Exposure of the dura occurred in three patients in the calvarial group. Postoperative pain (based on a visual analog scale) after harvesting was significantly higher in the anterior iliac crest group. Scars were significantly longer and contours deficits were significantly more prominent after calvarial harvesting, although not bothersome to the patients. Long-term pain was negligible in both groups, and satisfaction with the procedure did not differ.
Conclusion: Both harvesting techniques were accompanied by low long-term donor site morbidity and high patient satisfaction.

1. Introduction

Implant-supported dentures have widely been recognized as a treatment option in edentulous patients with compromised retention of their conventional dentures (Abraham, 2014; Adell et al., 1981). In cases of extreme resorption of the maxillary alveolar ridge, pre-prosthetic augmentation surgery is often needed to provide a basis for implant placement. A common bone grafting procedure to allow for implant placement in such cases is maxillary sinus floor elevation surgery (Raghoebar et al., 2001). Commonly, particularly when a large graft is needed, autogenous bone is still considered the gold standard in bone grafting (Zouhary, 2010).

The anterior iliac crest is most used as a donor site for bone augmentation in cases of severe resorption. Access to the anterior iliac crest is relatively easy; iliac crest harvesting can be set up in a two-team surgical approach to reduce surgery time; and this donor site can provide large amounts of cortical and cancellous bone (Mertens et al., 2013). The major drawback of this procedure is its donor site morbidity, with chronic donor site pain and sensory disturbances being common (Dimitriou et al., 2011).

Calvarial bone grafts provide an alternative to iliac bone grafts (Tessier, 1982). The outer cortex of the posterior parietal calvarial bone provides an abundant amount of cortical bone, and copious amounts (>10 cm^3) of cancellous bone can be harvested from the diploic space (Schortinghuis et al., 2012). When compared to iliac

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http://dx.doi.org/10.1016/j.jcms.2015.12.019
1010-5182/

crest bone harvesting, the morbidity of calvarial harvesting is thought to be lower, but neurologic sequelae may interfere with the safety of the procedure (Kline and Wolfe, 1995; Tessier et al., 2005). With the introduction of a safer harvesting technique, as described by Kellman (1994) and modified by Schortinghuis et al. (2012), the risk of intracranial complications is minimized.

Despite the reported data on donor site morbidity accompanying various bone grafting sites (Tessier et al., 2005; Zouhary, 2010; Touzet et al., 2011; Dimitriou et al., 2011; Scheerlinck et al., 2013; Riachi et al., 2014.), the debate as to which donor site is preferable is still open. Therefore, the aim of this comparative study was to assess donor site morbidity and patient satisfaction with anterior iliac crest and calvarial bone grafts used for pre-implant augmentation procedures.

2. Material and methods

2.1. Patients

This retrospective case control study included consecutive edentulous patients with extreme maxillary atrophy with an indication for pre-prosthetic maxillary augmentation surgery to provide a basis for implant placement. All included patients underwent augmentation surgery between March 2011 and December 2013 with either autogenous calvarial or anterior iliac crest grafts. The patients were treated at the departments of Oral and Maxillofacial Surgery of the Scheper Hospital Emmen (SZE), the Refaja Hospital Stadskanaal (REF), or the University Medical Center Groningen (UMCG).

In SZE and REF, calvarial harvesting was the routine pre-prosthetic augmentation procedure. At UMCG, the anterior iliac crest was the routine donor site. The calvarial bone was harvested with the technique of Schortinghuis et al. (2012). The anterior iliac crest bone was harvested according to the technique of Kalk et al. (1996).

All patients were asked to complete a questionnaire and were recalled for a clinical follow-up. In REF and SZE, a total of 28 consecutive patients meeting the inclusion criteria had been treated with calvarial harvesting. At UMCG, a total of 58 consecutive patients meeting the inclusion criteria had been treated with anterior iliac crest harvesting. To create equal-size homogenous groups, patients from the calvarial group were matched to consecutive patients from the anterior iliac crest group according to duration of follow-up, age, and sex. Patients were chosen on the basis of the order of the referred criteria.

The study was approved by the Medical Ethical Committee (METc) of the University Medical Center Groningen, reference SH2014-2.

2.2. Evaluation

2.2.1. Medical records

Patients' demographics, perioperative, and postoperative complications concerning the donor site were retained from standardized medical records.

2.2.2. Questionnaire

All patients were asked to complete a mail-in, cross-sectional, custom-made questionnaire before the follow-up session. In this questionnaire, a variety of topics were assessed (Appendix A). Postoperative donor site pain and patient satisfaction were measured by the use of a 10-cm visual analog scale (VAS), ranging from no pain (0) to the worst pain imaginable (10) and from very unsatisfied (0) to very satisfied (10).

2.2.3. Physical examination

Physical examination during follow-up was limited to the donor site area, and was assessed by an independent investigator (K.K.) in the same hospitals as those in which the patients had undergone their operations. The following variables were assessed in all patients: contour deficits, tenderness, sensibility, and length of the scar. In the calvarial group, alopecia around the donor site, defined as evident hair loss next to the scar, was assessed in addition.

The contour of the donor site was examined in a standardized manner. In the iliac group, the anterior superior iliac spine was localized, and the iliac crest was palpated dorsally. In the calvarial group, the calvarium was palpated on the operated parietal side of the head. Contour deficits were noted as subtle or evident deficits. Patients were asked whether the examination of the donor site was accompanied by tenderness or pain.

Tactile sensibility of the donor site was tested by lightly touching the skin with the use of a piece of cotton wool, during which test the patients were blinded and had to identify the number of contacts. Furthermore, superficial pain was tested by the use of a sharp and dull instrument. The patients were blinded and had to discriminate between a sharp needle and a dull cotton bud.

2.3. Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS, version 22, IBM, Chicago, IL, USA). For composing two homogenous groups, the Student t test was used in the case of a parametric variable, the Mann–Whitney U test was used in the case of a nonparametric variable. The Pearson χ^2 test was used to compare the categorical variable sex between groups. Concerning the outcome data, the Pearson χ^2-test (or, if necessary, Fisher exact test) was used to compare dichotomous variables. For comparison of categorical variables with an outcome scale greater than 2, the Fischer–Freeman–Halton exact test was used. Comparison of the means of continuous variables, pain experience, scar length, and satisfaction rate was tested with the Mann–Whitney U test. With regard to pain experience, the Pearson r test was used to assess correlations with age, body mass index (BMI), and follow-up duration. Significance was set at the α level of 0.05.

3. Results

Of the 28 eligible patients who underwent operation at either SZE (n = 13) or REF (n = 15), 27 were willing to join our study. These 27 calvarial bone patients were matched to 27 anterior iliac crest patients who underwent operation at UMCG. None of the patients had undergone a previous operation at the donor site. The clinical characteristics of both groups are listed in Table 1. Perioperative morbidity, early postoperative complications, and late postoperative complications specified by donor site are presented in

Table 1
Clinical characteristics of the calvarial and anterior iliac crest groups.

	Calvarium		Anterior iliac crest	
	n = 27		n = 27	
Sex				
Male	14		12	
Female	13		15	
	Median	IQR	Median	IQR
Age (years)	60	56–66	61.6	55–67
BMI (kg/m^2)	25.6	22.9–31	26.3	23.4–28.2
Follow-up (years)	2.4	1.1–2.9	2.5	1.4–2.9

BMI, body mass index; IQR, interquartile range.