Iliac Crest Bone Graft Harvesting Techniques: A Comparison

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This study was undertaken to compare the morbidity of traditional iliac bone graft harvesting techniques for grafting alveolar clefts to minimally invasive techniques. Fifty-five age-matched patients, ages 6.5 to 16 years (mean, 11.2 years), 22 girls and 33 boys, were divided into three groups. The traditional bone window open harvesting technique served as the control group. Two different minimally invasive techniques, one that used a bone grinder and another that used a trephine, for bone harvesting were compared with the control. Both invasive techniques were statistically superior, $p < 0.05$, in terms of total time pain medication was necessary (mean of 12.0 hours for bone grinder, 17.6 hours for trephine, 26.0 hours for control), operative time for bone harvest (mean of 11 minutes for bone grinder and trephine, 20 minute for control), and mean incision length (2 cm for bone grinder and trephine, 5 cm for control). Patients exposed to the minimally invasive techniques had fewer complications, a trend toward earlier ambulation, and shorter hospital stays when compared with the bone grinder technique. The patients exposed to the bone grinder demonstrated earlier ambulation and fewer requirements for analgesia when compared with the trephine technique, although these results did not reach statistical significance. The trephine technique was useful when maxillary osteotomies were combined with alveolar bone grafting, because it provided structural bone grafts and cancellous bone. On the basis of these findings, the bone grinder is the preferred technique for harvesting alveolar bone grafts when no structural support is required. These authors no longer use the traditional bone window open harvesting technique. (*Plast. Reconstr. Surg.* 105: 34, 2000.)

There has been a great interest in the optimal donor site for obtaining alveolar bone grafts.[1,2] Among all of the potential donor sites the calvarium and the iliac crest have received the greatest attention.[3,4] Klein and Wolfe reported on a large series of patients who underwent harvesting of calvarial bone grafts with low morbidity.[5] LaRossa et al. compared calvarial bone to iliac bone in grafting alveolar clefts and determined that iliac bone was superior to calvarial bone.[6] Although other donor sites continue to be advocated, the anterior iliac crest is currently the donor site of choice in most centers.[7]

Several authors have reported that iliac bone can be harvested with minimal morbidity; however, complication rates, length of hospitalization, and postoperative regimens vary widely from study to study.[8–11] Most reports do not attempt to measure postoperative pain or time to unassisted ambulation. Furthermore, there are significant differences between the harvesting techniques in the various reports, making intrastudy comparisons difficult. Several authors have reported minimally invasive techniques, but their series have been relatively small without objective quantification of postoperative morbidity.[12–14] We were unable to locate a study in which two or more harvesting techniques were compared in terms of morbidity, time to ambulation, or pain control. In 1996, we began to look for alternatives to the traditional iliac crest bone window technique, as described by Wolfe and Kawamoto, for harvesting alveolar bone grafts that would result in shorter hospitalization and less morbidity.[15] We subsequently discovered that the Fritsch bone graft-set, developed for orthopedic applications, could be adapted for iliac crest bone harvesting, and we began to use it exclusively (Howmedica Leibinger, Inc., Dallas, Texas). Later, we used a disposable bone grinder, manufactured by Sulzer Spine-Tech (Minneapolis, Minn.), which is used in spinal surgery, for iliac

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crest bone harvesting. Although the nursing staff reported that the patients experienced less pain and ambulated soon after surgery, we had no measurable parameters to substantiate this impression. We undertook the current investigation to compare the morbidity of our traditional bone window technique (control) with the minimally invasive adaptation of the Fritsch bone harvest system (trephine) and the disposable Spine-Tech bone grinding harvester we are currently using.

MATERIALS AND METHODS

A total of fifty-five patients, 33 boys and 22 girls, ages 6.5 to 16 years (mean, 11.2 years), underwent alveolar bone grafting using the anterior iliac crest as a donor site. These patients were divided into three groups, matched for age and type of cleft to compare the bone harvesting techniques (Table I). For 21 patients, the control technique was used, and 21 patients underwent harvesting using the trephine technique, whereas 13 patients underwent harvesting using the disposable bone grinder. In all patients, the anterior superior iliac crest was selected for bone harvesting. After a satisfactory general anesthetic was administered, the patient was prepared and draped for sterile surgery; the area was injected with bupivacaine at both the subcutaneous and deep periosteal levels. All incisions were made approximately 2 cm medial to the iliac crest to avoid irritation of the suture line by clothing. The medial periosteum and attached musculature were incised and dissected off the bone with a Bovie hemocoagulator. The control group underwent harvesting as described by Wolfe and Kawamoto.[15] The trephine and bone grinder groups necessitated a small incision, 1 to 2.5 cm, and minimal dissection to insert the bone harvesting instrument (Figs. 1 and 2). Enough bone was harvested to completely fill the alveolar cleft up to the level of the normal floor of the nose. The gingival incisions were closed with absorbable sutures, and the patients were placed on a soft diet for 3 weeks. In all groups, the donor-site wounds were irrigated with antibiotic solution, and a 2 × 2 cm absorbable collagen sponge impregnated with bupivacaine was placed next to the bone graft harvest site. The periosteum was reapproximated with absorbable sutures, and the skin was closed with a combination of absorbable deep subdermal sutures and subcuticular sutures followed by skin approximating tapes. No drains were used in any of the groups. All patients were admitted to the hospital and were given intravenous analgesia, and when tolerating oral medications, Tylenol with codeine as needed. All patients received intravenous cephalothin while hospitalized and a 5-day oral course when discharged. Patients were not restricted in terms of activity.

TABLE I
Patient Data

Parameter	BW	FB	BG
n	21	21	13
Male (%)	13/21 (62)	12/21 (57)	8/13 (62)
Female (%)	8/21 (38)	9/21 (43)	5/13 (38)
BCLP (%)	8/21 (38)	11/21 (52)	4/13 (31)
UCLP (%)	13/21 (62)	10/21 (48)	9/13 (69)
Mean age @ operation	11.9 yr	11.7 yr	10.1 yr

BW, bone window (control); FB, trephine; BG, bone grinder; BCLP, bilateral cleft lip and palate; UCLP, unilateral cleft lip and palate.

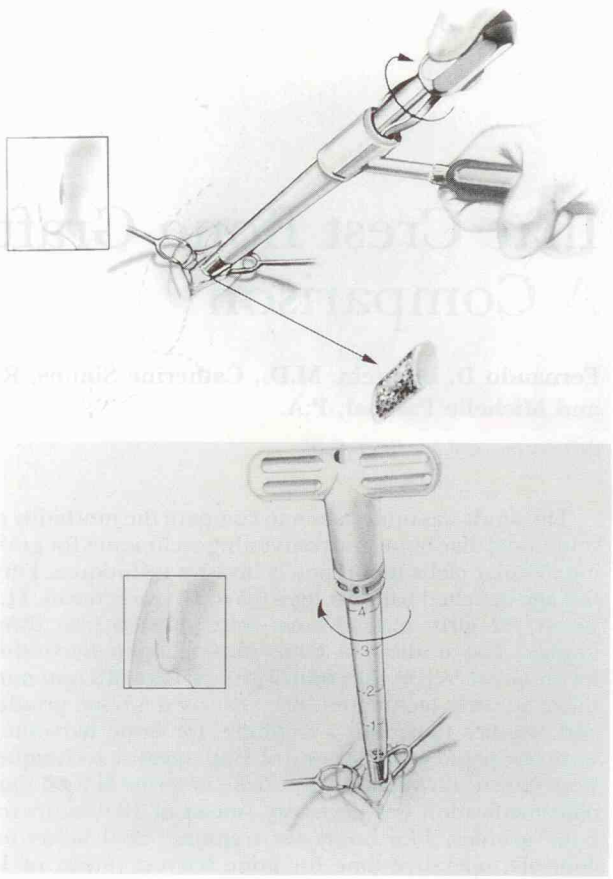

FIG. 1. (*Above*) Artist depiction of iliac crest bone harvesting by using the Fritsch bone harvest (trephine) system. The outer sleeve is held against inner table of iliac crest while a coring device is inserted and rotated to obtain a bone plug. (*Below*) Artist depiction of iliac crest bone harvesting by using the Spine-Tech grinding harvester. The grinding end of the harvester is pressed against the inner table of the iliac crest and rotated. The harvested bone fills the clear chamber.