The Use of a Trephine Biopsy Needle to Obtain Autogenous Corticocancellous Bone from the Iliac Crest: A Technical Note

Richard P. Kinsel, DDS1/Myron M. Turbow, MD2

In the absence of adequate bone height, augmentation of the maxillary antrum prior to placement of endosseous implants is a well-established procedure. Although there is a debate among clinicians as to which grafting materials are the most advantageous, autogenous bone is still considered by many to be the gold standard. Often patients require more graft material than is generally available from intraoral sites. This has led clinicians to utilize allografts, xenografts, or a combination of autologous and synthetic bone. Extraoral sites can provide a greater volume of autogenous bone than intraoral sites. However, harvesting extraoral donor bone is frequently associated with adverse consequences in excess of the primary objective (ie, the placement of endosseous implants in the posterior maxilla with minimal morbidity). A method for obtaining a significant volume of cortico-cancellous autogenous bone for augmentation of the maxillary antrum is described. The technique is efficacious and cost effective and results in minimal morbidity. (More than 50 references.) Int J Oral Maxillofac Implants 2004;19:XXX–XXX

Key words: autologous transplantation, bone transplantation methods, dental implants, ilium surgery, maxillary sinus surgery, osseointegration, trephining methods

Augmentation of the floor of the maxillary sinus where there is insufficient bone height in the posterior maxilla to facilitate placement of endosseous implants is a well-established procedure. This procedure, initially introduced by Tatum1 and subsequently modified by Wood and Moore,2 has shown predictable, long-term success.3–10 Although there is debate amongst clinicians as to what grafting materials are the most advantageous, autogenous bone is still considered by many to be the gold standard.11–15 The volume of graft material that can be obtained from intraoral sites is insufficient to obturate a large sinus space. This has lead many clinicians to utilize allografts, xenografts, or a combination of autogenous and synthetic bone.

Several studies have included histologic analysis of the use of nonautogenous bone substitutes in sinus augmentation procedures.16–21 A consistent finding is that the resorption and maturation of bone is delayed when autogenous grafts are combined with allografts or xenografts. Nishibori and colleagues17 compared demineralized freeze-dried bone (DFDB) and autogenous bone at 8 and 16 months postgrafting. They found that new bone formation of higher quantity and quality occurred with autogenous bone at both 8 and 16 months. Remnants of DFDB were present at 16 months. Haas and coworkers18 compared sinus augmentation with simultaneous implant placement in sheep using DFDB and autogenous bone histologically and histomorphometrically. A consistent finding was particles of DFDB surrounded by collagenous connective tissue and both mononucleated and multinucleated giant cells. Also, approximately 50% less bone-to-implant contact was found in the DFDB group than in the autogenous group. They
concluded that DFDB homografts and heterografts could not be recommended in place of cancellous autografts from the iliac crest for sinus elevations. Wallace and associates\textsuperscript{19} reported on their sequential histologic analysis of healing from 4 to 20 months where a mixture of 80% xenograft and 20% autogenous bone was used. They found that 12 to 20 months were required for complete remodeling of the graft material to vital bone, which was much longer than the healing period required using autogenous bone alone. Other researchers have reported similar results of delayed resorption and maturation with a smaller volume of viable bone.\textsuperscript{20–25}

Donor sites for autogenous bone can be either intra- or extraoral. The use of intraoral sites has been associated with less morbidity. Furthermore, general anesthesia or hospitalization are not required to harvest the bone.\textsuperscript{26} However, the volume of bone that can be harvested intraorally is limited. Other considerations are the complications and long-term morbidity of some intraoral sites such as the chin. Complications commonly result in significant disturbances of inferior alveolar nerve function and loss of pulpal sensitivity of the teeth near the donor site.\textsuperscript{27–31}

Common extraoral sites for augmentation of the maxilla are the anterior and posterior iliac crests.\textsuperscript{32,33} The advantages of posterior ilium bone for transplant include increased resistance to infection and excellent osteogenic potential. The posterior iliac crest is also an especially rich donor site for spongy bone; bone harvested from the anterior crest may be less suitable.\textsuperscript{34} In a cadaver study, Hall and associates\textsuperscript{35} compared the amounts of graft material present in the anterior and posterior ilium. The average volume of surgically available cancellous bone was found to be greater in the posterior ilium.

Use of the ilium as a source for autogenous bone has been extensively described. However, most of the surgical procedures are associated with adverse sequelae. Many authors have reported significant complications with harvesting block grafts from the ilium, the most common being postoperative pain and gait problems.\textsuperscript{36–40} Other serious sequelae include hematomas, seromas, parathesias, wound infections, fractures, and abdominal and urologic disturbances.\textsuperscript{41–45} The method for obtaining a significant volume of cortico–cancellous autogenous bone described in this report is efficacious and cost effective and results in minimal morbidity.

**MATERIALS AND METHODS**

A 4-inch, 8-gauge Jamshidi trephine biopsy needle (Cardinal Health, McGaw Park, IL) is used according to the technique described by Jamshidi and Swaim.\textsuperscript{46} Prior to the procedure, the surgeon determines that there are no contraindications to the bone extraction procedure or conscious sedation. The superior edge of the posterior iliac crest is the preferred site for extraction, but the anterior iliac crest also can be used. The patient lies either prone or supine, depending on the site to be used. The site for extraction is selected by palpation, and the skin is marked for reference (Fig 1a). The skin is prepared with a providone--iodine solution, which is removed with isopropyl alcohol (Fig 1b). Conscious sedation with intravenous midazolam (Versed) and meperidine (Demerol) or morphine is started at this time.\textsuperscript{47}

Using sterile technique, the previously marked and prepared sites are anesthetized by infiltration with 1% lidocaine using a –2-inch, 21-gauge needle. A 3- to 5-mm incision is made with a no. 15 scalpel blade into the skin over the site. The biopsy needle is inserted into the subcutaneous tissue through the incision with stylet in place. From the
posterior iliac spine, at a location 4 to 5 cm from the midline, the biopsy needle is inserted at a 20- to 30-degree angle toward the anterior iliac crest. From the anterior iliac approach, the biopsy needle is angled toward the posterior iliac crest (Fig 2). The biopsy needle is pushed down to the bone (Fig 3). After making contact with the cortex of the bone, the inner stylet is removed. The biopsy needle is advanced into the bone by rotating the needle in a clockwise-counterclockwise motion. The needle is advanced as deep as possible, pulled back 0.25 cm, and then pushed down again at a slightly different angle to free the core of bone from the surrounding tissue. The needle is withdrawn using a twisting motion similar to that employed during insertion. The tissue core is removed and placed in a sterile screw-top container containing a saline-saturated gauze pad for storage or transport.

The inner stylet is replaced into the biopsy needle and reinserted through the skin incision into the bone at a different angle. This process typically is repeated 3 to 4 times to obtain tissue cores measuring 1 to 4 cm in length (Fig 4). If needed, the same procedure is used on the opposite iliac crest with a new biopsy needle. Using both iliac crests, a total of 6 to 15 bone cores can be extracted.

If more tissue is required the anterior iliac crests can also be used. The patient, who is sedated, is rolled over from the prone to the supine position to continue bone harvesting from the opposite approach. For obese patients, the anterior iliac crest should be used because there is much less subcutaneous tissue and fat in this region. The Jamshidi biopsy needles are only 4 inches long and cannot penetrate deep enough into the bone through the posterior iliac crest approach in obese patients.

The procedure takes approximately 1.5 hours to complete in addition to the initial medical interview.

**DISCUSSION**

Obtaining autogenous bone from the ilium for periodontal and minor medical bone transplantation using a trephine biopsy needle has been described previously. This method, commonly used by medical oncologists, hematologists for evaluation of the medical patient with malignant lymphoma or Hodgkin’s disease, retrieves an adequate amount of well—compressed bone with limited surgical exposure while reducing postoperative pain, loss of muscle function, and possible paralytic ileus.

There are several different brands or types of bone marrow biopsy needles available. Whatever needle the participating surgeon prefers should be adequate. However, the volume of tissue is a critical factor. A larger bone needle will require fewer samples to be taken. For example, the Jamshidi needle is available in 3 sizes (13, 11, and 8 gauge). The largest, the 8-gauge needle, is used for the bone extraction process.

The exact sites of the iliac bone used are slightly different for the bone extraction procedure than...
those that are generally used for diagnostic biopsies. For the typical diagnostic biopsy, the flat area of the posterior pelvis may be easier to use. Since the cortex of the bone is thinner in the flat area, the procedure may be easier. However, for bone grafting to enhance a site for the placement of a dental implant, cortical bone can be used. In addition, the lengths of the cores obtained are much longer when cortical bone is used than from other sites [AU: Please clarify. At crestal sites of the ilium than at other sites?]. For this reason the lip of the superior edge of the iliac crest, where the cortex is thick, is used, and not the surface of the ilium bone.

Conscious sedation is commonly used for brief surgical procedures.53 [Au: Please add to ref list.] One of the authors (MMT) has performed more than 250 diagnostic bone marrow biopsies with almost no complications. A single patient had postbiopsy pain intense enough to require analgesics containing hydrocodone for 2 days. Less than 5% of his patients needed postbiopsy over-the-counter analgesics. Skin irritation occurred in an even smaller number of patients. There were no instances of excessive bleeding, hematomas, infection, long-lasting discomfort or pain, loss of mobility, fractured bone, or broken needles. All of the bone biopsies and extractions have been done as an outpatient treatment; hospitalization is not required.

The harvesting of bone for implantation requires many more entries into the bone than is required for diagnostic evaluation, thus increasing the potential risk for complications. Since the ilium is a relatively large bone, removing multiple cores of tissue does not weaken it. Weight-bearing movement such as walking should not produce a problem. Although there is a risk of infection or bleeding, the risk is very small. If a patient has a bone disease such as osteoporosis, there can be an increased risk of bone fracture, resulting in pain and impaired mobility. At least [AU: At least or up to?] 4 biopsy needles have been used during the procedure because the needle gradually becomes dull with repeated entries into the bone, thus compromising the ability to obtain adequate amounts of tissue easily. If one needed a large number of cores, it would require the use of both posterior and anterior iliac crests, and more than 4 needles would probably be needed.

CONCLUSION

The plethora of processed or synthetic bone substitutes is a response to the surgeon’s desire to avoid the disadvantages of harvesting autogenous bone (second surgical site, increased morbidity, and increased cost). However, many of these materials have been found to be lacking in osteogenic potential, remain intact for extensive periods of time, and result in decreased bone-to-implant surface contact. A method for obtaining adequate volumes of autogenous bone from the ilium specifically for sinus augmentation procedures in conjunction with placement of endosseous implants in the posterior maxilla has been described. This technique is a modification of the common diagnostic bone biopsy frequently performed by medical oncologists. The advantages include reduced risk and post–operative discomfort, the ability to harvest a significant amount of corti–cancellous bone without hospitalization, and reduced cost.

REFERENCES


