GENERAL

atlas of oral and extraoral bone harvesting

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Atlas of Oral and Extraoral Bone Harvesting

Modern implant dentistry and maxillofacial reconstruction rely heavily on the availability of high quality bone graft material. Whether the goal is to augment a deficient alveolar ridge, restore a sinus floor, or rebuild a segmental defect, surgeons often turn to autologous bone harvested from either intraoral (oral) or extraoral (extraoral) donor sites. An atlas of bone harvesting provides a comprehensive reference that maps the anatomy, evaluates the advantages and drawbacks of each site, and guides clinicians through the most effective techniques and postoperative care. This article offers an in depth exploration of both oral and extraoral bone harvesting, blending anatomical detail with practical surgical pearls, all while keeping search engine optimized readability in mind.

Understanding the Role of Bone Harvesting in Modern Dentistry

Bone harvesting is the process of extracting bone tissue from one anatomical location (the donor site) and transferring it to another (the recipient site). Autologous bone, harvested from the patient themselves, remains the gold standard because it combines osteogenic, osteoinductive, and osteoconductive properties. In cases where the quantity or quality of available bone is insufficient, clinicians often combine autografts with allografts, xenografts, or synthetic substitutes to achieve optimal volume and density.

Successful bone grafting hinges on three key factors:

- Quantity: Enough bone must be harvested to fill the defect.
- Quality: The graft should contain viable osteogenic cells and a robust vascular network.
- Patient Morbidity: Harvesting should minimize pain, infection risk, and functional impairment.

With these principles in mind, surgeons evaluate a range of donor sites, each offering distinct benefits and trade offs.

Oral Bone Harvesting Sites

Oral sites are convenient because the surgeon can perform the harvesting and implantation in a single surgical session, reducing overall treatment time. However, the amount of bone that can be safely removed is limited, and the risk of compromising oral function must be carefully managed.

Maxillary Sinus Floor

The maxillary sinus floor is a common source of autogenous bone for sinus lift procedures. The procedure involves creating a window in the sinus membrane, extracting the bone, and placing it into the sinus cavity to elevate the membrane and increase vertical bone height.

- Quantity: Up to 5–6 /mm of bone can be harvested per site.
- Quality: Rich in cancellous bone, which facilitates rapid integration.
- Complications: Possible sinus membrane perforation, postoperative sinusitis, or graft migration.

Mandibular Ramus

Harvesting from the mandibular ramus yields a mixture of cortical and cancellous bone, ideal for reconstructing the posterior mandible or for bone augmentation in the lower jaw.

- Quantity: Up to 15 /mm of bone can be obtained from a single site.
- Quality: Dense cortical bone provides structural support.
- Complications: Nerve injury risk (inferior alveolar nerve), limited access in patients with reduced ramus height.

Alveolar Ridge

When the alveolar ridge itself is the source, the harvested bone is typically used to augment adjacent defects. This approach is most effective when the patient has a well formed ridge with sufficient thickness.

- Quantity: Limited to 3–4 /mm per extraction socket.
- Quality: Highly vascularized cancellous bone.
- Complications: Socket healing delay, potential for graft resorption.

Extraoral Bone Harvesting Sites

Extraoral sites allow for larger volumes of graft material, making them suitable for extensive reconstructions such as jawbone defects, large sinus lifts, or facial contouring. The trade off is a second surgical site, which may increase overall morbidity.

Iliac Crest

The iliac crest, located on the pelvis, is the most frequently used extraoral donor site. It offers a generous supply of both cortical and cancellous bone, making it ideal for long term implant stability.

- Quantity: Up to 30 /mm of bone per side.
- Quality: Combination of cortical and cancellous bone ensures structural integrity and rapid healing.
- Complications: Post operative pain, hematoma, gait disturbance, and donor site scarring.

Tibia

The tibial metaphysis provides a relatively low morbidity source of cancellous bone, often used in patients where pelvic harvesting is contraindicated.

- Quantity: Approximately 20 /mm of bone.
- Quality: Predominantly cancellous, suitable for grafting into non load bearing sites.
- Complications: Minor donor site discomfort, potential for wound dehiscence.

Rib

Rib harvesting is less common but useful for patients requiring a moderate volume of bone with a high cortical content, such as in facial reconstruction.

- Quantity: 15–20 /mm of cortical bone.
- Quality: Dense cortical structure provides excellent load bearing capacity.
- Complications: Risk of pneumothorax, chronic pain, and visible scarring.

Fibula

The fibula offers a long, thin segment of cortical bone ideal for reconstructing segmental defects, especially in the mandible or maxilla.

- Quantity: Up to 25 /mm in length.
- Quality: Dense cortical bone with a predictable vascular pedicle.
- Complications: Possible functional impairment, donor site morbidity.

Comparative Analysis of Harvesting Sites

Choosing the optimal donor site involves balancing several factors. The following table summarizes key considerations across common sites.

Site	Quantity (mm)	Quality	Patient Morbidity	Surgical Complexity
Maxillary Sinus	5–6	Cancellous	Low	Moderate
Mandibular Ramus	10–15	Cortical + Cancellous	Moderate	Moderate
Alveolar Ridge	3–4	Cancellous	Low	Low
Iliac Crest	25–30	Cortical + Cancellous	High	High
Tibia	15–20	Cancellous	Low	Moderate
Rib	15–20	Cortical	Moderate	High
Fibula	20–25	Cortical	Moderate	High

From this comparison, the iliac crest remains the most versatile donor site for large-volume grafts, while intraoral sites are ideal for smaller augmentations that can be completed in a single visit.

Techniques and Tools for Bone Harvesting

Conventional Osteotomy

Traditional saws or chisels are used to remove cortical bone from the donor site. While effective, this method can generate heat, potentially damaging osteogenic cells.

Piezocision and Piezoelectric Surgery

Piezosurgery employs ultrasonic vibrations to cut bone with minimal heat and precise control. It reduces postoperative pain and preserves surrounding soft tissue.

Micro Osteotomy

Micro osteotomy uses miniature instruments to harvest bone from the alveolar ridge or mandibular ramus, minimizing damage to adjacent structures.

Bone Harvesting Instruments

1. Bone Harvesting Saw: Designed for clean cuts in cortical bone.
2. Bone Harvesting Drill: Allows for controlled removal of cancellous bone.
3. Bone Harvesting Forceps: Facilitates the extraction of bone blocks.
4. Bone Harvesting Knife: Useful for fine shaping and trimming.

Choosing the right instrument depends on the donor site, bone density, and surgeon preference.

Post Operative Care and Potential Complications

Donor Site Pain Management

Effective pain control includes the use of non steroidal anti inflammatory drugs (NSAIDs), local anesthetic infiltration, and, in some cases, corticosteroid injections.

Infection Prevention

Strict aseptic technique, prophylactic antibiotics, and meticulous wound closure reduce the risk of infection. Patients

should be instructed to avoid trauma to the donor site for at least two weeks.

Scarring and Cosmetic Concerns

Minimally invasive incisions and careful suturing can minimize visible scarring. In the case of the iliac crest, placing the incision along natural skin creases helps conceal the mark.

Functional Impairment

Patients may experience temporary gait changes after iliac crest harvesting or mild weakness after tibial harvesting. Physical therapy may be recommended to expedite recovery.

Advances in Bone Harvesting

3D Imaging and Virtual Planning

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