Alveolar Ridge Grafting:
Options and Techniques

Seung H. Yu, D.D.S.

Diplomate, American Board of Oral and Maxillofacial Surgery
Diplomate, National Dental Board of Anesthesiology
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Photograph Disclaimer

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Bone Grafting and CDT Codes

Grafting w/ Extraction
(=Socket Preservation, Ridge Preservation)

GTR – Membrane

D7953, Bone Replacement Graft for Ridge Preservation
CDT descriptor: “Osseous autograft, allograft or non-osseous graft is placed in an extraction or implant removal site at the time of the extraction or removal to preserve ridge integrity (e.g., clinically indicated in preparation for implant reconstruction or where alveolar contour is critical to planned prosthetic reconstruction). Membrane, if used should be reported separately.”

D4266, Guided Tissue Regeneration – Resorbable Barrier, Per Site
CDT descriptor: “This procedure does not include flap entry and closure, or, when indicated, wound debridement, osseous contouring, bone replacement grafts, and placement of biologic materials to aid in osseous regeneration. This procedure can be used for periodontal and peri-implant defects.”

D4267, Guided Tissue Regeneration – Non-Resorbable Barrier, Per Site
CDT descriptor: “This procedure does not include flap entry and closure, or, when indicated, wound debridement, osseous contouring, bone replacement grafts, and placement of biologic materials to aid in osseous regeneration. This procedure can be used for periodontal and peri-implant defects.”
Includes membrane removal.
Bone Grafting and CDT Codes

Bone Graft for Peri-implant Defect  D6103
Bone Graft at Time of Implant Placement  D6104

Alveolar Ridge Grafting
- Onlay Particulate Ridge Grafting (simple)  D7950
- Onlay Particulate Ridge Grafting (moderate)  D7950.1
- Onlay Particulate Ridge Grafting (complex)  D7950.2
- Onlay Block Ridge Grafting  D7950.3
- Ridge Split (Osteoperiosteal Flap)  D7950.4
- Distraction Osteogenesis  D7950.5

Harvest of Bone for Autogenous Grafting  D7295

D7950, Osseous, Osteoperiosteal, or Cartilage Graft of the Mandible or Maxilla – Autogenous or Nonautogenous CDT descriptor: “This code may be used for ridge augmentation or reconstruction to increase height, width and/or volume of residual alveolar ridge. It includes obtaining autograft and/or allograft material. Placement of a barrier membrane, if used, should be reported separately.”
- Commonly Termed “Guided Bone Regeneration”
Bone Grafting and CDT Codes

Bone Replacement Graft
(Periodontal Defect)
D4263 (First Site)
D4264 (Additional Site)

Bone Graft for Periradicular Surgery
(Endodontic Defect)
D3428 (Single Tooth)
D3429 (Additional Tooth)

D4263 / D4264, Bone Replacement Graft
CDT descriptor: “This procedure involves the use of osseous autografts, osseous allografts, or non-osseous grafts to stimulate periodontal regeneration when the disease process has led to a deformity of the bone. This procedure does not include flap entry and closure, wound debridement, osseous contouring, or the placement of biologic materials to aid in osseous tissue regeneration or barrier membranes. Other separate procedures may be required concurrent to D4263 and should be reported using their own unique codes.”
Bone Grafting and CDT Codes

Sinus Augmentation

D7951 (Lateral Open)
D7952 (Vertical)

D7951, Sinus Augmentation with Bone or Bone Substitutes via a Lateral Open Approach
CDT descriptor: “The augmentation of the sinus cavity to increase alveolar height for reconstruction of edentulous portions of the maxilla. This procedure is performed via a lateral open approach. This includes obtaining the bone or bone substitutes. Placement of a barrier membrane if used should be reported separately.”

D7952, Sinus Augmentation via a Vertical Approach
CDT descriptor: “The augmentation of the sinus to increase alveolar height by vertical access through the ridge crest by raising the floor of the sinus and grafting as necessary. This includes obtaining the bone or bone substitutes.”
Bone Grafting and CDT Codes

BMP

D4265

D4265, Biologic Materials to Aid in Soft and Osseous Tissue Regeneration
CDT descriptor: “Biologic materials may be used alone or with other regenerative substrates such as bone and barrier membranes, depending upon their formulation and the presentation of the periodontal defect. This procedure does not include surgical entry and closure, wound debridement, osseous contouring, or the placement of graft materials and/or barrier membranes. Other separate procedures may be required concurrent to D4265 and should be reported using their own unique codes.”
Socket Grafting

Do you really need it?
Literature

Level of evidence
Credibility of the journal
  - Impact factor
  - Peer review

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<th>Full Journal Title - GENERAL MEDICINE</th>
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JADA = 2.15
Effect of Alveolar Ridge Preservation after Tooth Extraction: A Systematic Review and Meta-analysis

G. Avila-Ortiz1*, S. Elangovan1, K.W.O. Kramer2,3, D. Blanchette2, and D.V. Dawson2

1Department of Periodontics, The University of Iowa, Iowa City, IA, USA; 2Division of Biostatistics and Research Design, Dows Institute for Dental Research, The University of Iowa, Iowa City, IA, USA; and 3Health Integrity, LLC, Easton, MD, USA; *corresponding author, gustavo-avila@uiowa.edu

Buccolingual width = 1.89mm (CI: 1.41-2.36)
Midbuccal height = 2.07mm (CI: 1.03-3.12)
Midlingual height = 1.18mm (CI: 0.17-2.19)
Mesial height = 0.48 mm (CI: 0.17-0.79)
Distal height = 0.24mm (CI: -0.05-0.53)
Options

GBR/Bone Graft (Allograft vs Autogeneous, Particulate vs Block)

Osteoperiosteal Flap (Ridge Expansion/Ridge Split)

Distraction Osteogenesis

BMP

Sinus Floor Augmentation (=Sinus Lift)
Types of Bone

Autograft (+osteocommunicative, +osteoinductive, +osteogenic)

Alloplastic material (+osteocommunicative, -osteoinductive, -osteogenic)

Xenograft – Anorganic bone (+osteocommunicative, -osteoinductive, -osteogenic)

Allograft (+osteocommunicative, ?osteoinductive, -osteogenic)
Autograft

Advantages:
- Osteogenic
- Abundant supply w/o significant supply cost

Disadvantages:
- Donor site morbidity
- Resorption
Autograft Donor Sites

Mandible
- Ramus
- Chin

Maxilla

Iliac crest (Hip)
- Anterior iliac crest
- Posterior iliac crest

Tibia

Rib

Cranium
Xenograft – Anorganic Bone

Advantages:
- Cheap(er)
- Maintains volume well

Disadvantages:
- Slow turn over
- Does not resorb?
Alloplast

Advantage:
- Maintains volume very well

Disadvantage:
- Does not resorb or resorbs very slowly
Allograft

Advantages:
- Remodels in 4-6 months
- Versatile

Disadvantages:
- Expensive
- Fast turn over?
- Transmission risk?
Allograft Sources

LifeNet Health

Medtronic (Osteotech)

Musculoskeletal Transplant Foundation (MTF)

Regenerations Technology, Inc. (RTI)
Allograft

Fresh

Fresh-frozen

Freeze-dried
Bone Mixture

Cortical bone: Structural integrity

Cancellous bone: Faster bone remodeling

Cortico-cancellous bone
Bone Preparation

Mineralized bone
- Freeze dried bone allograft (FDBA)

Demineralized bone
- Demineralized freed dried bone allograft (DFDBA)
Particle Sizes

50um

250um

500um

1000um

1500um

Ideal size: 100-1000um
Block Allograft
Membranes

PTFE
- Chemically inert, high temperature resistance,
  a low coefficient of friction and non-adhesive
- Non-resorbable

Collagen Membrane
- Type I/II collagen from bovine or porcine
- Resorbable

Collaplug and Collatape?
- Dressing, not a membrane
Osteoperiosteal Flap (Ridge Expansion/Ridge Split)

- Bone cut
- ~ 4 mm
- Difference in crestal bone level
- Book flap pivot angle
- Outfracture of facial plate

Ole Jensen. The Osteoperiosteal Flap.
Distraction Osteogenesis

https://pocketdentistry.com/42-bone-augmentation-alveolar-distraction-osteogenesis/
Bone Morphogenic Protein

\( \text{rh-BMP-2} = \text{Recombinant Human Bone Morphogenic Protein Type 2} \)

Different BMPs form different structures – bone, cartilage, embryonic organs, etc.

Only BMP-2 and BMP-7 are FDA approved for “bone grafting”

Isolated BMP gene recombined into the Chinese Hamster Ovary cell

FDA approval for dental/reconstructive procedure:
- Sinus lift
- Local alveolar ridge augmentation

Swelling
### BMP

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- Sterile rHBM-2
- Sterile Absorbable Collagen Sponge (ACS)
- Total Graft Volume
- Sterile Water for Injection

*Images of the BMP product with a box and vials.*
Bone Morphogenic Protein

Table 1 Contraindications for use of rhBMP-2 (Infuse®) and rhBMP-7 (OP-1)

- Pregnant women or women who are about to become pregnant
- Skeletally immature patients
- A site of a resected tumor
- Patients with a history of malignancy (OP-1)
- Patients with an active malignancy or patients undergoing treatment for malignancy (Infuse®)
- Warnings: Women of childbearing potential should be advised to take measures to prevent pregnancy for 1 year following treatment with OP-1 or rhBMP-2.
The use of rhBMP in spine surgery: is there a cancer risk?

Authors  
John G DeVine¹, Joseph R Dettori², John C France³, Erika Brodt², Robert A McGuire⁴

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¹ Eisenhower Army Medical Center, Ft Gordon, GA, USA  
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³ Department of Orthopaedics, West Virginia University, Morgantown, WV, USA  
⁴ Department of Orthopaedic Surgery and Rehabilitation, University of Mississippi Medical Center, Jackson, MS, USA

Evidence-Based Spine-Care Journal  
Volume 3/Issue 2 — 2012
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Gem-21S

rhPDGF-BB w/ beta-TCP

FDA Approval For:
  - Periodontal Defect
  - Periodontal Regeneration
Gem-21S

GEM 21S®
growth-factor enhanced matrix
PRP/PRF

Platelet rich plasma – Concentrated blood plasma, rich in platelet derived growth factors than whole blood by removing red blood cells

Platelet rich fibrin – Coagulated PRP
Sinus Floor Augmentation (Sinus Lift)


Dan Cullum. SROMS. Vol 18.4.
Bone Scraper
Mesh
Titanium
Resorbable
Successful Graft Requirements

Appropriate Surgical Technique

Healthy Host – Genetics, Periodontal Health

Vascular Bed

Infection Free Surgical Site

Immobility of Graft Material

Time
Predictability of Graft Success

Type of defect
- Horizontal bone defect
- Vertical bone defect

Bone defect configuration
- 1-wall, 2-wall, 3-wall, 4-wall Defect
- Buccal bone crest
- Palatal bone crest

Proximal bone height

Defect span
# Grafting Algorithm

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<td>2-Wall</td>
<td>1-Wall or Knife Edge</td>
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<td>Onlay Block Graft w/ Screws</td>
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<td>w/ Tent Pole Screws</td>
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<td>Osteoperiosteal Flap</td>
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Thank You!

Seung Yu, DDS
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206-595-1005