1. To present an overview of alveolar ridge augmentation techniques used to reconstruct lost bony architecture of the mandible and maxilla

2. To present complete clinical cases of ridge deformities secondary to trauma, pathology or natural tooth loss and successful reconstruction of these cases

3. To stress the importance of constant communication between the surgeon, the restorative dentist and the patient to avoid/minimize pitfalls in implant surgery

4. To utilize the most advanced 3D imaging technology and laboratory techniques available to ensure the highest predictability of the desired outcome

Objectives:

Treatment Considerations

- Health history
- Chief complaint (patient’s desires)
- Clinical examination
- Radiographic examination
- Clinical records/photographs
- Study models

Clinical Examination

- Remaining Dentition
- Occlusion
- Inter-arch Space
- Periodontal Status
- Bone Morphology

Implant Bed – Bone Quality

Bone Density Classification by Black & Jaffe

<table>
<thead>
<tr>
<th>Bone Density</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Low density</td>
</tr>
<tr>
<td>Fair</td>
<td>Moderate density</td>
</tr>
<tr>
<td>Good</td>
<td>High density</td>
</tr>
<tr>
<td>Excellent</td>
<td>Super high density</td>
</tr>
</tbody>
</table>

Implant Bed – Bone Quality
Implant Bed – Bone Quantity

Class I - Dentate
Class II - Immediately post extraction
Class III - Well-rounded ridge form adequate in height and width
Class IV - Knife-edge ridge form adequate in height and inadequate in width
Class V - Flat ridge form inadequate in height and width
Class VI - Depressed ridge form with some basalar loss evident

Cawood and Howell, (1988)

Treatment Considerations

- Type of graft material
- Source of graft material
- Rigid vs. non-rigid fixation

Types of Graft Material

Autogenic Graft
1. “Gold Standard” for Grafting
2. Preserves osteogenic cell viability
3. Avoidance of histocompatibility issues

Allogenic Graft
1. Lack of need for donor site and a secondary incision
2. Can induce healing through osteoconduction, osteoinduction, or a possible combination of both processes
3. Examples include Raptos, Puros, Neocrain, DBM Putty

Xenogenic Graft
1. Most popular material is bovine in origin
2. Deproteinized to eliminate the organic properties and reduce antigenic properties
3. Healing occurs through osteoconduction
4. Examples include Straumann Xenograft, Bio-Oss

Growth Factors
PRP, BMP-2, PDDR, etc.

Graft Properties

- Osteogenic
  - new bone formation from existing cells
  - Autogenous bone only true osteogenic material
- Osteo-conductive
  - Scaffold for vascular tissue ingrowth and eventual bone formation
- Osteo-inductive
  - Promotes differentiation of stem cells to osteoblasts which then deposit osteoid matrix
BMP 2

History:
- Recombinant-produced natural signaling protein that induces de-novo bone formation (osteoinduction)
- In 2007, INFUSE® received FDA approval for use in sinus augmentation and alveolar ridge defects

Mechanism of Action:
- Implanted at the site of defect (absorbable collagen sponge +/- mesh)
- Chemotaxis of mesenchymal stem cells occurs
- Mesenchymal stem cells differentiate into osteoblasts due to binding of BMP-2 to cell surface receptors of stem cells
- Bone matrix begins to form around the osteoblasts and goes on to mature and mineralize as normal anatomic bone

Advantages:
- Avoids donor site access and less surgical morbidity

Disadvantages:
- Cost $$$
- Handling properties and containment
Barrier Membranes

Purpose:
- to prohibit the penetration of cells, primarily epithelial, through its structure
- There are five criteria which are considered to be important in the design of barrier membranes used for GBR
  1. Biocompatibility
  2. Cell occlusion properties
  3. Integration by the host tissue
  4. Space making capacity
  5. Clinical manageability
Sources of Autogenous Bone

**Intraoral**
1. Mandibular ramus
2. Maxillary tuberosity
3. Mandibular symphysis

**Extraoral**
1. Iliac crest (anterior vs. posterior)
2. Costal bones
3. Cranum
4. Tibial Plateau

Rigid vs. Non-rigid Fixation

- Lin et al. (1989) demonstrated that there is a significant difference in the residual graft volume between rigid and non-rigidly fixed grafts in areas of high motion that are subjected to high shear and tensile forces.
- Block bone grafts must be rigidly fixated!
- Allograft particles in combination with barrier membranes when used in ridge augmentation can be stabilized using tacks

Membrane Fixation Tacks

Bone Fixation Kit

Mandibular Symphysis

**Volume:**
4.80 ml; Average block size: 20.9 x 9.9 x 6.9 mm
Symphysis Graft

- Provides autogenous cortical block for alveolar ridge reconstruction
  - Dense cortical bone; sparse cancellous
  - Resists resorption
- Blocks can be up to 8 cm if coronoid process included
  - Typical dimensions 1-4 cm length, 1 cm width, 0.5 cm depth

Mandibular Symphysis

Intra-op Complications
1. Bleeding
2. Mental nerve injury
3. Soft tissue injury
4. Block bone fracture
5. Bicortical harvest with lingual cortical plate fracture

Post-op Complications
1. Pain, swelling, bruising, hematoma
2. Infection < 1%
3. Vestibular wound dehiscence (vestibular incision)
4. Gingival recession (sulcular approach)
5. Neurosensory deficits (lip, chin) < 1% permanent
6. Dysesthesia of anterior mandibular dentition (transient 53%, permanent < 1%)

Ramus/Coronoid Process

- Provides autogenous cortical block for alveolar ridge reconstruction
  - Dense cortical bone; sparse cancellous
  - Resists resorption
- Blocks can be up to 8 cm if coronoid process included
  - Typical dimensions 1-4 cm length, 1 cm width, 0.5 cm depth
Mandibular Ramus

Intra-op Complications
1. Bleeding
2. IAN and lingual nerve injury
3. Soft tissue injury
4. Block bone fracture
5. Mandibular fracture

Post-op Complications
1. Pain, swelling, bruising, hematoma
2. Infection < 1%
3. Trismus (~60% may last 3-4 weeks)
4. Neurosensory deficits (~8% and < 1% permanent)

Anterior Iliac Crest

Harvest Volume: 50 – 75 cc of uncompressed bone
Anterior Iliac Crest

Intra-op Complications
1. Bleeding
2. Pelvic fracture/instability
3. Perforation into peritoneal cavity

Post-op Complications
1. Pain, swelling, bruising, hematoma
2. Infection < 1%
3. Itching at the site of the scar
4. Abdominal hernia
5. Neurosensory deficits (Upper lateral thigh)
6. Gait disturbances (temporary)
7. Post-op ileus
Harvest Volume:
20 – 25 cc of uncompressed bone

Sinus Floor Elevation & Augmentation

Techniques
1. Sinus intrusion osteotomy ("indirect")
   - Bone condensation
2. Lateral approach ("direct")
   - Caldwell Luc sinus window

Indirect Sinus Lift
- Flap/exposure
- Osteotomy – 2mm short of sinus floor
- Osteotome elevation of sinus floor
- Bone Augmentation
- Implant placement
Internal Sinus Lift

Direct Sinus Lift
- Full thickness flap
- Adequate exposure
- Osteotomy
  - Diamond bur
  - Piezo
- Membrane intact!!
- Graft placement
- Membrane?

Direct Sinus Lift with Transverse Septum

CASE 1
38 year old Male
In need of GBR prior to Implant Placement
Simple case of LRA

Intra-Cortical Penetrations

Collect blood & mix with particulate Graft to carry easier

create Membrane Template with sterile sheet, tinfoil, paper...
always reflect MEMBRANE first, then apply particulate graft.

maintain Membrane reflected until complete graft placement.

Tuck membrane well under palatal full thickness flap.

always use Non-Resorbable Sutures; remove after 2 weeks.

CASE 2

60 year old Male
In need of GBR prior to implant placement.
CASE 3
Marked Guided Bone Regeneration (GBR)

Implant: Nobel Conical Connection RP

CASE 4
CASE 7

Implant Planning

#12
#13
#14
#16

Implant Planning

#21
#23
#24
#26