Breast Reconstruction
“Current Strategies and Future Opportunities”

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Department of Plastic Surgery

No Disclosures
Repair Partial Mastectomy Defects
I. When Should We Perform Oncoplastic Repair?
## Partial Mastectomy Reconstruction Complication Rates

<table>
<thead>
<tr>
<th>Reconstruction Type</th>
<th>Immediate Reconstruction BEFORE XRT</th>
<th>Immediate Reconstruction AFTER XRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Reconstruction</td>
<td>30%</td>
<td>42%</td>
</tr>
<tr>
<td>Immediate Reconstruction</td>
<td>26%</td>
<td></td>
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<table>
<thead>
<tr>
<th>Technique</th>
<th>Description</th>
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<tbody>
<tr>
<td>LTR</td>
<td>RANDOM BLOOD SUPPLY</td>
</tr>
<tr>
<td>BR</td>
<td>DERMOMUSCULAR PEDICLE</td>
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<tr>
<td>FLAP</td>
<td>AXIAL-BASED BLOOD SUPPLY</td>
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## Partial Mastectomy Reconstruction Complication Rates

<table>
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<tr>
<th>RECONSTRUCTIVE TECHNIQUE</th>
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### Partial Mastectomy Reconstruction Complication Rates

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## Partial Mastectomy Reconstruction

### Complication Rates

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II. Which Oncoplastic Techniques Should We Use and When?
A. Local Tissue Rearrangement Technique

- **C-Cup Breast Size**
  - Small Tumor
  - No Ptosis
  - Minimal Skin Resection

Breast Remodeling

C-Cup Breast, No Ptosis
Breast Remodeling: Case Example
Breast Remodeling: Case Example
Breast Remodeling: Case Example
B. Breast Reduction Technique

• Minimal Skin Resection or Located Within Wise Pattern

• C-Cup Breast Size
  – Small Tumor
  – Ptosis

• D-Cup Breast Size

Parenchymal Pedicle Design Based on Tumor Location

Reconstructive Zones: 1 - 7
D-Cup Breast, Ptosis
Parenchymal Pedicle Design Based on Tumor Location

Reconstructive Zones: 1 - 7
C. Local Flaps

- **Immediate Repair**
  - **LABC**
    - Need XRT, Regardless of Partial or Total Mastectomy
  - **Small-Breasted**
    - No Local Tissue Options

D. Delayed Repair
BEFORE XRT

• **Unexpected Deformity AFTER Partial Mastectomy**
2 Weeks After Partial Mastectomy?
Parenchymal Pedicle Design Based on Tumor Location

Reconstructive Zones: 1 - 7
Breast Reduction Technique
Repaired AFTER Partial Mastectomy BEFORE XRT
E. Type of Radiation Delivered

• Delayed Repair
  – Whole Breast Radiation
    • FLAP
  – Partial Breast Radiation
    • Breast Reduction/Local Tissue Rearrangement
Deformity AFTER “Whole” Breast XRT

50 Gy in 25 fractions PLUS tumor bed boost 10 GY in 5 fractions
Deformity AFTER “Whole” Breast XRT

Lattisimus Dorsi Flap
Deformity AFTER “Whole” Breast XRT

Postoperative Views
10 months
Deformity AFTER “Partial” Breast XRT

34 Gy over 5 days

Courtesy of Patrick Garvey
Deformity AFTER “Partial” Breast XRT

Postoperative Views
2 months

Courtesy of Patrick Garvey
III. Recommendations

• **Oncoplastic Repair BEFORE Whole Breast XRT**
  – Fewest Complications
  – Local Tissue Rearrangement or Breast Reduction Technique
  – **Immediate BEFORE XRT or Delayed BEFORE XRT?**
III. Recommendations

A. Immediate BEFORE XRT
   • Localized Disease
   • Negative Intraoperative Tumor Margin

B. Delayed BEFORE XRT
   • Multifocal or Multicentric Disease
   • Uncertain Intraoperative Tumor Margin
III. Recommendations

Intraoperative Tumor Margin

- Availability
- Reliable Assessment

Extent of Local Disease

- Mammography
  - Microcalcifications (none, localized, or diffuse)
- Ultrasonography
  - Focality (focal, multifocal, or multicentric)
III. Recommendations

C. Delayed AFTER Whole Breast XRT
   - Highest Complications
   - FLAP or AFG

D. Delayed AFTER Partial XRT
   - Local Tissue Rearrangement
   - Breast Reduction Technique
III. Recommendations

- Preferred Technique: Breast Size, Relative to Tumor Size
  - A- or B-Cup Breast
    - Consider Nipple Sparing Mastectomy with Immediate Reconstruction
    - Locally Advanced will Need PMRT → Consider Immediate Flap for Partial Mastectomy
  - C-Cup Breast → ”Breast Remodeling Technique”
  - D-Cup Breast Or Larger → ”Breast Reduction Techniques”
    - Design Based on Tumor Location
Breast Reconstruction
After Mastectomy
Immediate Reconstruction
Immediate Reconstruction
Delayed Reconstruction
Delayed Reconstruction
Implant-Based Breast Reconstruction

- Two-Stage Implant
- One-Stage Implant
Two-Stage Breast Reconstruction
Tissue Expander Followed By Permanent Implant
Two-Stage Breast Reconstruction
Tissue Expander Followed By Permanent Implant
Two-Stage Implant
Example of Outcome
Two-Stage Implant: 2\textsuperscript{nd} Stage

Additional Enhancements

ADM: Acellular Dermal Matrices
Two-Stage Implant: 2\textsuperscript{nd} Stage

Additional Enhancements

FAT GRAFTING
One-Stage Implant
Permanent Implant Inserted At Mastectomy
Example of Outcome

Lateral Breast Incision
Microsurgical Breast Reconstruction
TRAM/DIEP Flap Breast Reconstruction
Pedicled TRAM Flap
Free (Microvascular) TRAM Flap
Free & Pedicled TRAM Flap
ABDOMINAL DONOR SITE
VARIATIONS ON BLOOD SUPPLY TO FLAP
Muscle Sparing Free TRAM Flap
Perforator Flaps

- **DIEP**: Deep Inferior Epigastric Perforator Flap
- **GAP**: Gluteal Artery Perforator
Abdominal Wall Perforators
Deep Inferior Epigastric Perforator
Deep Inferior Epigastric Perforator (DIEP) Flaps
Free DIEP Flap

- Comes from Same Place of TRAM
- Same as Free TRAM, EXCEPT “No” Muscle Utilized
- Potentially “More” Fat Necrosis, Than Free TRAM
- More “Technically” Complex

Case Example #1: DIEP Flap
Case Example #2: DIEP Flap
Case Example #2: DIEP Flap
Conclusions

**DIEP FLAPS**

- No Rectus Muscle or Fascia with Harvest of Flap
  - Avoids Need for Synthetic Mesh
  - Allows for Primary Repair of Fascial Incision of Anterior Rectus Sheath
- Decreased Risk of Bulge or Hernia Formation
Background: GAP Flap
Case Example: Redesigned GAP
Case Example: Redesigned GAP
Conclusions

GAP FLAPS

- Most Complex Technique
- Radiated Breasts
- Previous Tummy Tuck or Liposuction
- Previous TRAM Flap
Strategies for Breast Reconstruction for Patients Who May or Will Require Postmastectomy Radiation Therapy
THE NEW REALITY

Increasing Use of Radiation Therapy

• Patients with Early-Stage Breast Cancer
• Survival Advantage

Increasing Use of Mastectomy, Decreasing Lumpectomy
THE PROBLEM

• Unable to Identify Need for Radiation Increasing Use of Radiation Therapy
  – Early-Stage Breast Cancer

• Immediate Reconstruction BEFORE Radiation
  – Ruin Reconstruction/Interfere Radiation

• Delayed Reconstruction AFTER Radiation
  – Lose Skin Sparing Mastectomy/Poor Cosmetic Outcome
  – Awake Mastectomy Without Breast
Negative Affects on Breast Implants
Negative Affects on Autologous Tissue
<table>
<thead>
<tr>
<th>MDACC Strategy</th>
<th>POSTMASTECTOMY RADIATION (PMRT)</th>
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<tbody>
<tr>
<td>• Patients Awake From Mastectomy with Breast</td>
<td></td>
</tr>
<tr>
<td>• Skin-Sparing Mastectomy</td>
<td></td>
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<tr>
<td>• Avoid Interference With Radiation Delivery</td>
<td></td>
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<tr>
<td>• Avoid Radiation Damage to Definitive Breast Reconstruction</td>
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Delayed-Immediate Breast Reconstruction May Require PMRT

Consultation with Breast Surgeon
CLINICAL STAGE I & II

77 Patients Between June 2002-July 2008 Evaluated Preoperatively Multidisciplinary Breast Cancer Team
“CONSIDERED INCREASED RISK” POSTMASTECTOMY RADIATION

DELAYED-IMMEDIATE BREAST RECONSTRUCTION PROTOCOL


Delayed-Immediate Breast Reconstruction


**STAGE 1**

Skin-Sparing Mastectomy & Subpectoral (*Saline-Filling*) Tissue Expander

Postoperative Radiation Oncology Consultation

ASSESSMENT OF FINAL PATHOLOGY
Delayed-Immediate Breast Reconstruction


**STAGE 1**

Skin-Sparing Mastectomy & Subpectoral (*Complete Saline-Filling*) Tissue Expander

Postoperative Radiation Oncology Consultation

ASSESSMENT OF FINAL PATHOLOGY

No Postmastectomy Radiation Therapy

**STAGE 2**

DEFINITIVE BREAST RECONSTRUCTION

TRAM

DIEP

GAP

L.D.-Implant

Implant ONLY
**Delayed-Immediate Breast Reconstruction**


**STAGE 1**

Skin-Sparing Mastectomy & Subpectoral (*Complete Saline-Filling*) Tissue Expander

Postoperative Radiation Oncology Consultation

**ASSESSMENT OF FINAL PATHOLOGY**

- **No Postmastectomy Radiation Therapy**
- **Postmastectomy Radiation Therapy**

**STAGE 2**

**DEFINITIVE BREAST RECONSTRUCTION**

- **TRAM**
- **DIEP**
- **GAP**
- **L.D.-Implant**

- **Implant ONLY**

- **Deflate Expander BEFORE Radiation**
- **Re-inflate Expander AFTER Radiation**

- **“SKIN-PRESERVING” DELAYED BREAST RECONSTRUCTION**
Delayed-Immediate Breast Reconstruction

*May Require PMRT*

**Clinical Staging:** T2N1

*Inamed, Style 133MV, Saline Textured Tissue Expander,* 500 cc

**Intraoperative Saline Fill Volume:** 500 cc

**Permanent Pathology:** T2N2
Delayed-Immediate Breast Reconstruction

May Require PMRT

Deflation for PMRT, 1 Day Before CT Simulation for Treatment Planning
Delayed-Immediate Breast Reconstruction

*May Require PMRT*

“Skin-Preserving” Delayed DIEP Reconstruction

**Time Intervals:**

- Completion XRT → Initiate Re-Inflation: 14 days
- Start Re-Inflation → Complete Re-Inflation: 11 weeks
- Completion Volume After Re-Inflation: 500 cc
- Completion XRT → Delayed Reconstruction: 5 months
Delayed-Immediate Breast Reconstruction Avoids Pitfalls of Expansion After PMRT

• Mastectomy Incision Heals Before PMRT
  – Reduces RISK Expander Exposure
• Internal-Lined Cavity Surrounding Expander Formed Prior to PMRT
  – Ease of Re-Inflation after PMRT
  – Protects Against Seroma-Related Problems
Delayed-Immediate Breast Reconstruction

*May Require PMRT*

“Skin-Preserving” Delayed DIEP Reconstruction

**Time Intervals:**

- Completion XRT → Photograph: 61 months
- Delayed Reconstruction → Photograph: 56 months
- Mastectomy & Stage 1 → Delayed Reconstruction: 27 months
<table>
<thead>
<tr>
<th>Delayed-Immediate Breast Reconstruction</th>
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<table>
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<tr>
<th>Overall Complication Rates</th>
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<tbody>
<tr>
<td><strong>STAGE I</strong></td>
</tr>
<tr>
<td><strong>STAGE II</strong></td>
</tr>
<tr>
<td>Skin-Preserving Delayed After XRT</td>
</tr>
<tr>
<td>Overall Tissue Expander Loss</td>
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*77 Patients Between June 2002 and July 2008*
Delayed-Immediate Breast Reconstruction

Concluding Points

• British Columbia Study (20 Year Follow-Up Analysis) concluded benefits conferred by PMRT were of similar magnitude for patients with 1 to 3 lymph nodes and for patients with 4 or more lymph nodes

• MA-20 Trial

• With Lowering Threshold for PMRT, Almost All Patients Will Be At Risk for Requiring PMRT
• Alternative:

Reverse progress of last 20 years to when all patients received delayed breast reconstruction
Delayed-Delayed Breast Reconstruction

Known Preoperatively to Require PMRT
Delayed-Delayed Breast Reconstruction

- **Neoadjuvant Chemotherapy**

  - Multidisciplinary Breast Teams: Stage III or IIB

  - "Skin-Preserving" Modified Radical Mastectomy & Subpectoral (Saline-Filling) Tissue Expander

  - Deflate Expander BEFORE Radiation

  - Postmastectomy Radiation Therapy

  - Re-inflate Expander AFTER Radiation

  - "SKIN-PRESERVING" DELAYED BREAST RECONSTRUCTION
## Delayed-Delayed Breast Reconstruction

### Exclusions for Delayed-Delayed

1. **Inflammatory Breast Cancer**

2. Patient MAY NOT Need PMRT

3. Extensive Breast Skin Excision

4. Radiation Oncologist Not Comfortable with Delivering XRT with Deflated Expander

5. Patient Not Desire Breast Reconstruction
Delayed-Delayed Breast Reconstruction
Known to Require PMRT

“Skin-Preserving” Delayed Latissimus Reconstruction

Clinical Staging:
Right Breast Ductal Cancer: T2 (4 cm) N1M0
Delayed-Delayed Breast Reconstruction

Known to Require PMRT

“Skin-Preserving” Delayed Latissimus Reconstruction

POD # 15

_Inamed Style 133MV, Saline Textured Tissue Expander:_ 600 cc

_Intraoperative Saline Fill Volume:_ 600 cc
Delayed-Delayed Breast Reconstruction

Known to Require PMRT

“Skin-Preserving” Delayed Latissimus Reconstruction

Postoperative Views: 6 weeks
Delayed-Delayed Breast Reconstruction

Known to Require PMRT

“Skin-Preserving” Delayed Latissimus Reconstruction

Radiation Treatment: 3 Field Technique

Saline Volume During PMRT: 300 cc
Delayed-Delayed Breast Reconstruction
 Known to Require PMRT

“Skin-Preserving” Delayed Latissimus Reconstruction

3 months After Completion of Radiation Treatment

Saline Re-Inflation: 2 Weeks After Completion of PMRT
 -Single Office Visit (replace 300 cc → 600 cc)
Delayed-Delayed Breast Reconstruction

“Skin-Preserving” Delayed Latissimus Reconstruction

3 Months After Post-Mastectomy Radiation Therapy

**Procedures:**

1. Latissimus Dorsi Myocutaneous Flap with Immediate Nipple Reconstruction (Buried De-Epithelialized Skin Island)
2. Silicon Gel Implant (Smooth, Round, Moderate Profile) 300 cc
Delayed-Delayed Breast Reconstruction

“Skin-Preserving” Delayed Latissimus Reconstruction

Postoperative Views: Prior to Revision/Symmetry Procedure

Completion XRT → Delayed Reconstruction: 3 month

Completion XRT → Photograph: 4 months

Delayed Reconstruction → Photograph: 1 month
Delayed-Delayed Breast Reconstruction

Known to Require PMRT

“Skin-Preserving” Delayed DIEP Reconstruction

Clinical Staging: T2N3M0
Delayed-Delayed Breast Reconstruction

*Known to Require PMRT*

“Skin-Preserving” Delayed DIEP Reconstruction

**Inamed Style 133MV, Saline Textured Tissue Expander:** 400 cc

**Intraoperative Saline Fill Volume:** 350 cc
Delayed-Delayed Breast Reconstruction

Known to Require PMRT

“Skin-Preserving” Delayed DIEP Reconstruction

Radiation Treatment:  3 Field Technique

<table>
<thead>
<tr>
<th>Location</th>
<th>Energy (MeV)</th>
<th>Dose (Gy)</th>
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<tbody>
<tr>
<td>Left Chest Wall</td>
<td>6/15</td>
<td>50</td>
</tr>
<tr>
<td>Internal Mammary Nodes</td>
<td>12</td>
<td>50</td>
</tr>
<tr>
<td>Supraclavicular &amp; Axillary Region</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>Skin Boost</td>
<td>10</td>
<td>10</td>
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Delayed-Delayed Breast Reconstruction

*Known to Require PMRT*

“Skin-Preserving” Delayed DIEP Reconstruction

**Time Intervals:**
- **Completion XRT → Initiate Re-Inflation:** 15 days
- **Start Re-Inflation → Complete Re-Inflation:** 6 weeks
- **Completion Volume After Re-Inflation:** 420 cc
Delayed-Delayed Breast Reconstruction

Known to Require PMRT

“Skin-Preserving” Delayed DIEP Reconstruction

Postoperative Views

Completion XRT → Delayed Reconstruction: 11 months

Completion XRT → Photograph: 39 months

Delayed Reconstruction → Photograph: 34 months
Fate of Radiated Skin?

• Gets Better With Time, As Opposed to Worse with Radiated Breast Reconstructions

• Different Local Healing Environment Created
  – Non-Radiated Flap ↔ Radiated Skin
Preliminary Results
Histology of Radiated Breast Skin Biopsies
Technical Advantages Over Standard Delayed

• Decreases Skin Requirements
  – ALLOWS: Bilateral Hemi-TRAM
  – ALLOWS: Standard-Sized Latissimus Flap Skin Island
  – ALLOWS: Implant ONLY Reconstruction

• Need for Revision, UNCOMMON
  – In Contrast: Standard Delayed
  – In Contrast: Radiated FLAP or Implant

• If Revision Required, Uncomplicated
  – Flap Not Radiated

• No Wound Healing Problems at Interface
  (Reconstructed Breast ↔ Radiated Chest Wall)
## Delayed-Delayed Breast Reconstruction

*Known to Require PMRT*

### Comparison of Complication Rates with Standard Approaches to Breast Reconstruction*

<table>
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<th></th>
<th>Skin-Preserving Delayed Reconstruction</th>
<th>Standard Delayed Breast Reconstruction</th>
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<tbody>
<tr>
<td>Overall Complication Rate</td>
<td>26%</td>
<td>38%</td>
</tr>
<tr>
<td>Wound Healing Problems</td>
<td>4%</td>
<td>10%</td>
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*Prospective Database: Matched Group Operated On Between Dec 2003 – May 2008*
Recurrence Free Survival by Surgery Group

- Delayed-Delayed (E/N = 5/41)
- Standard Delayed (E/N = 7/41)

P-value = 0.871
Delayed-Delayed Breast Reconstruction

Concluding Points

“New Reconstructive Perspective”

• Preserves Breast Skin
  – Stage III Breast Cancer

• Patients Awake from Mastectomy WITH a Breast
  – Instead of 1 to 2 Years
  – Lessens Psychological Impact
Thank You