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# Visualizing Microcirculation

## EasyLDI for Breast Reconstructions

Less necrosis with better intra-operative decision making

# The Big Picture

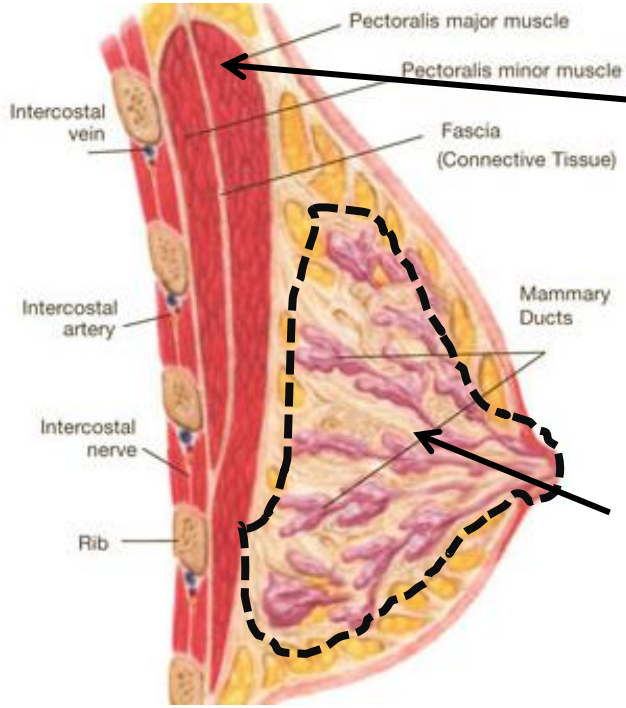
## Objective Intra-Operative Decision Making

**Goal:** Significantly reduce perfusion related complications (e.g. **necrosis**)

| | |
|---|---|
| **Skin sparing Mastectomy** | • Train surgeons to assure sufficient perfusion of skin envelope without compromising oncologic result. |
| **Implant based: One or two stages?** | • Decide intra-op. based on perfusion of skin envelope.<br>• Trim inadequately perfused skin flap zones.<br>• Validate resulting perfusion by placing a spacer.<br>• Back-up with two stages upon weak perfusion. |
| **Autologous Tissue (DIEP, TRAM, ...)** | • Choose strongest perforator.<br>• Optimize flap design and trimming decisions.<br>• Validate efficacy of venous & arterial anastomosis<br>• Have nurses monitor and document flaps post surgery. |

# Implant Based Breast Reconstruction

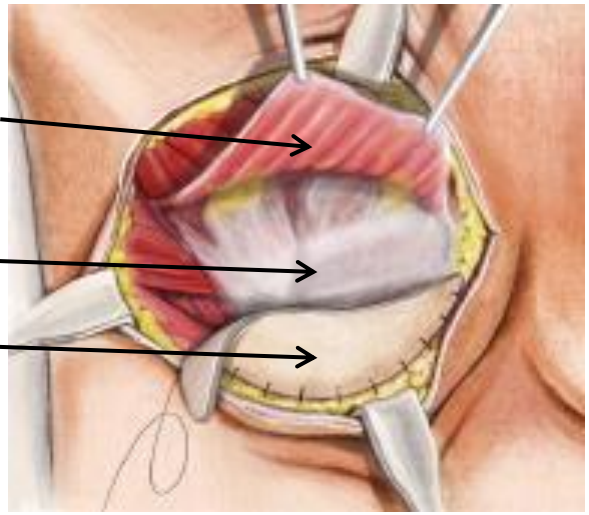
# How does it work?

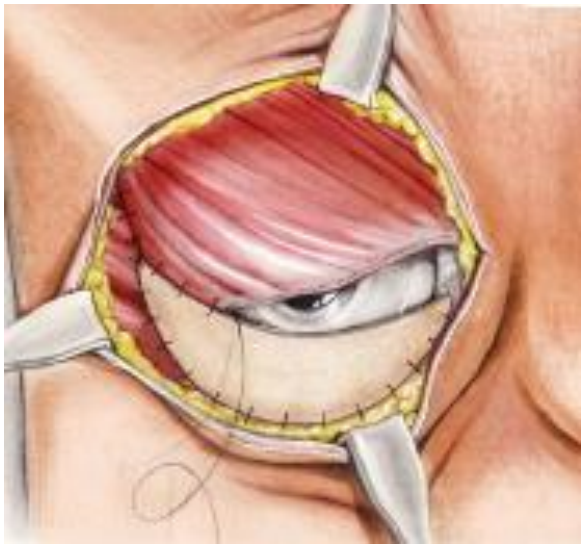



Pectoralis muscle

Silicon implant

ADM

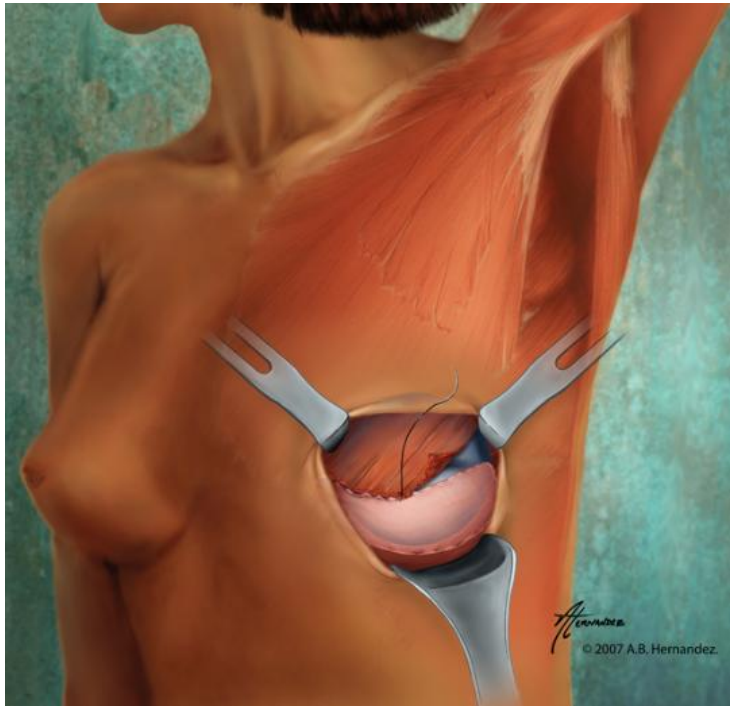


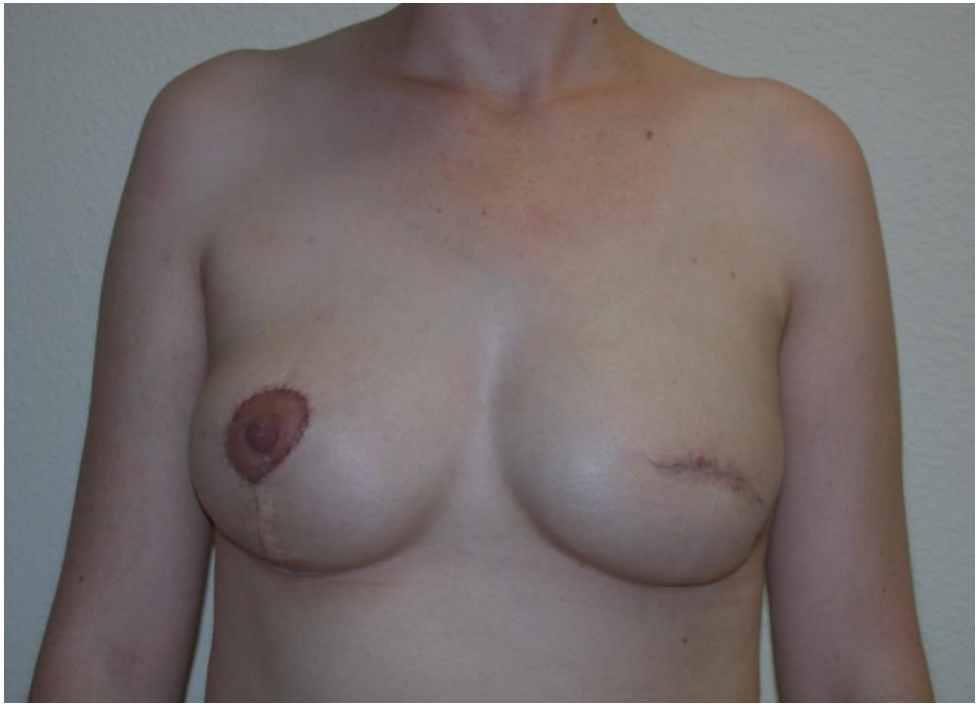


**80% of all breast reconstructions**

- Remove cancer
- Dissect pectoralis & insert implant
- Stretch muscle over top half, use acellular dermal matrix to cover the bottom half

# What is the clinical outcome?



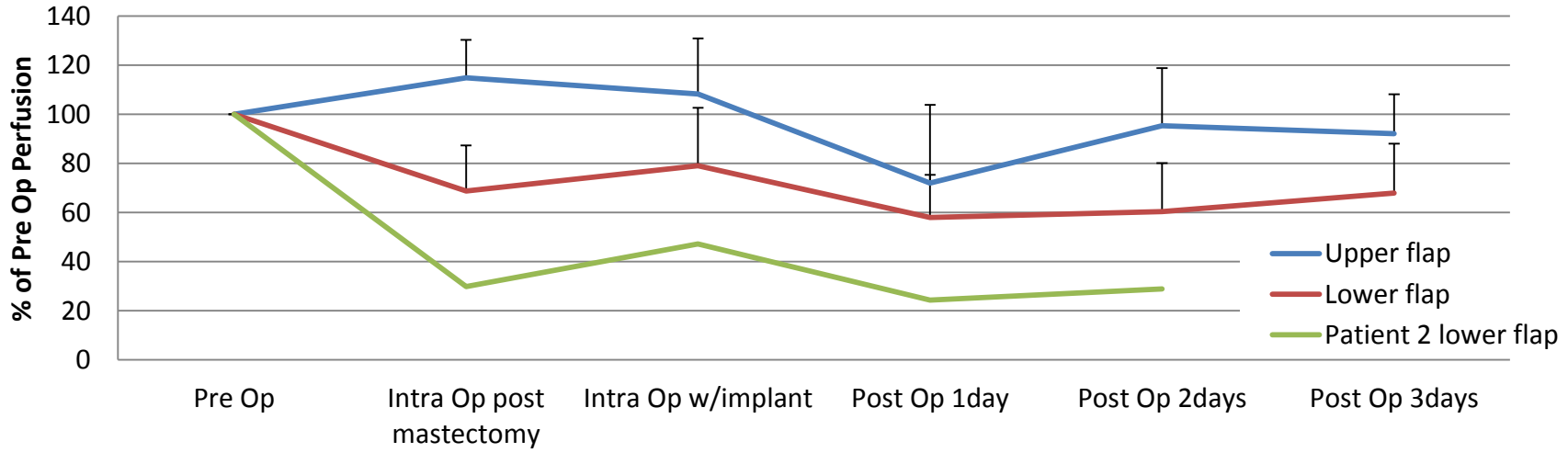



- Excellent esthetic results
- Cheaper and shorter than delayed or microsurgery based procedures
- Still high complication rates, particularly for less experienced people

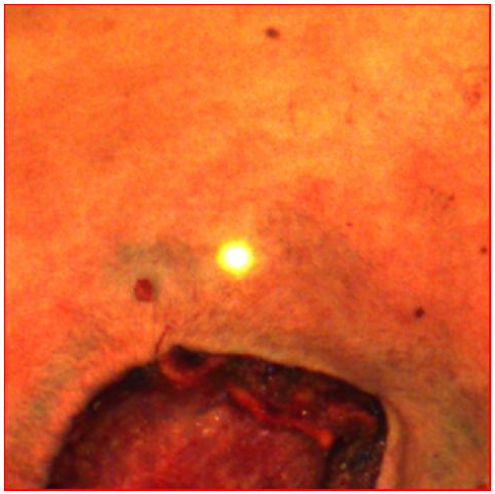
# Clinical Validation

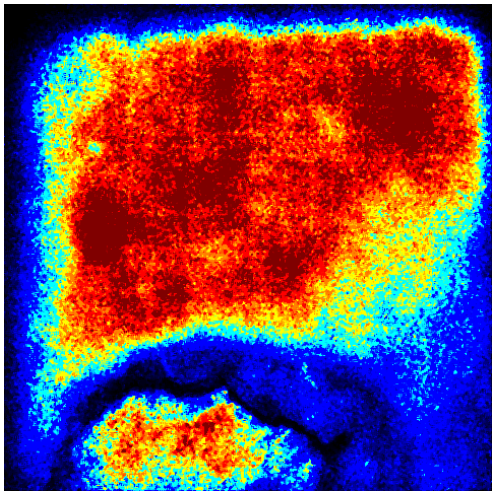
## Pilot Study with Dr. Michael Scheflan, Tel Aviv (inventor of TRAM)

- **Procedure:** Skin sparing mastectomy to immediate implant
- **Challenge:** Accurate **intra-operative decision making** because of 10% - 40% necrosis of skin envelope
- **Result:** Necrosis control with optimized intra-operative decision making between one stage direct-to-implant or two stage tissue-expander-based breast reconstruction (requiring second surgery)



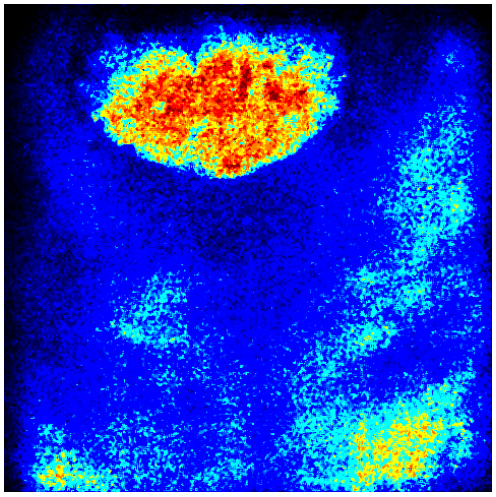
# Intra-Operative Decision Making





Evaluation of **skin envelope** after mastectomy.

← **Homogeneous** skin perfusion up to the edge of the incision



← **Weak** skin perfusion indicating increased risk of flap failure

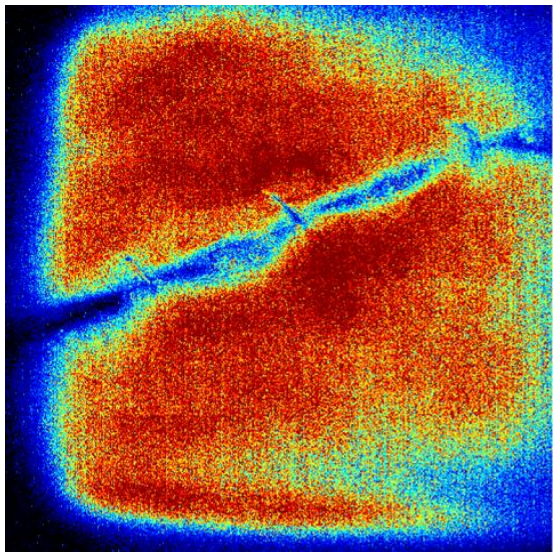
**Conclusion**: Prevent necrosis by using expander

# Autologous Breast Reconstruction

# Example: DIEP Flaps

**Intra-Operative Decision Making and Post-Operative Monitoring.**

- Which **perforator** to choose?
- What **flap design** to make?
- Is **anastomois** successful?
- Remains perfusion **stable** after surgery?



# DIEP: Objective decisions at all time

**Before detaching the perforators**

- Which perforator?
- Flaps design?

**After anastomosis**

- Perfusion on pre-detachment level?
- Flap perfusion similar to peripheral tissue?
- Perfusion up to the flap edge?

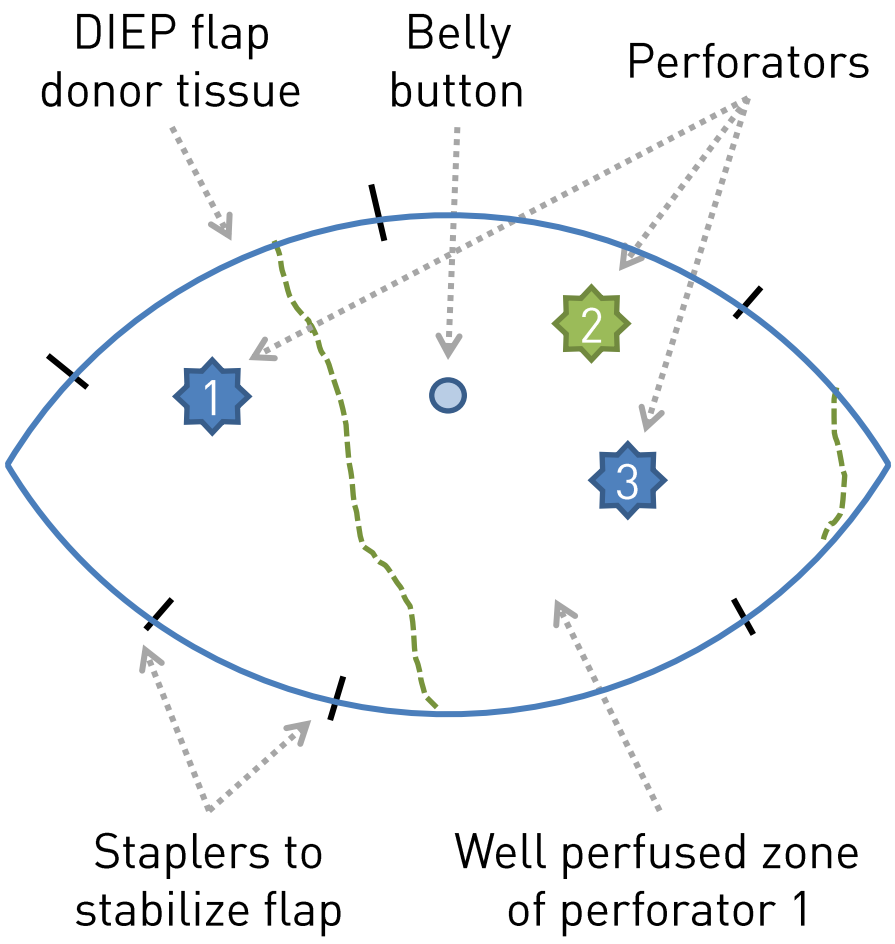
**After suturation**

- Revalidate flap perfusion as additional stress from suturation can decrease perfusion.

**Post-operative monitoring**

- Regular checks by nurses
- Objective, repeatable
- Detect thrombosis before clinical assessment

# DIEP: Which perforator and flap design?



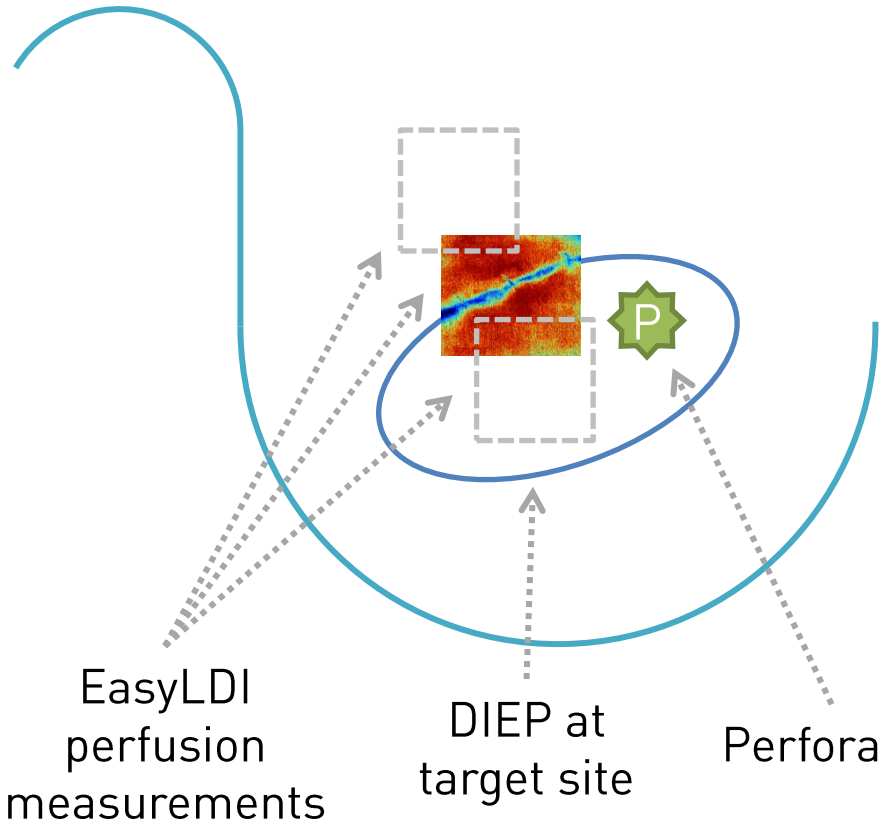

**Process**

1. Clamp all perforators except for 1
2. Assess perfusion power of perforator
   i. Measure perfusion over open perforator as reference
   ii. Move camera over flap and compare to reference
   iii. Draw edge on patient where perfusion is 60% of reference
3. Clamp and assess next perforator. Wait 30 seconds.

**Example**

- Perforator 2 open, 1 & 3 clamped
- Dashed lines show 40% decreased perfusion compared to perforator 1

# DIEP: Validate Anastomosis




**Process**

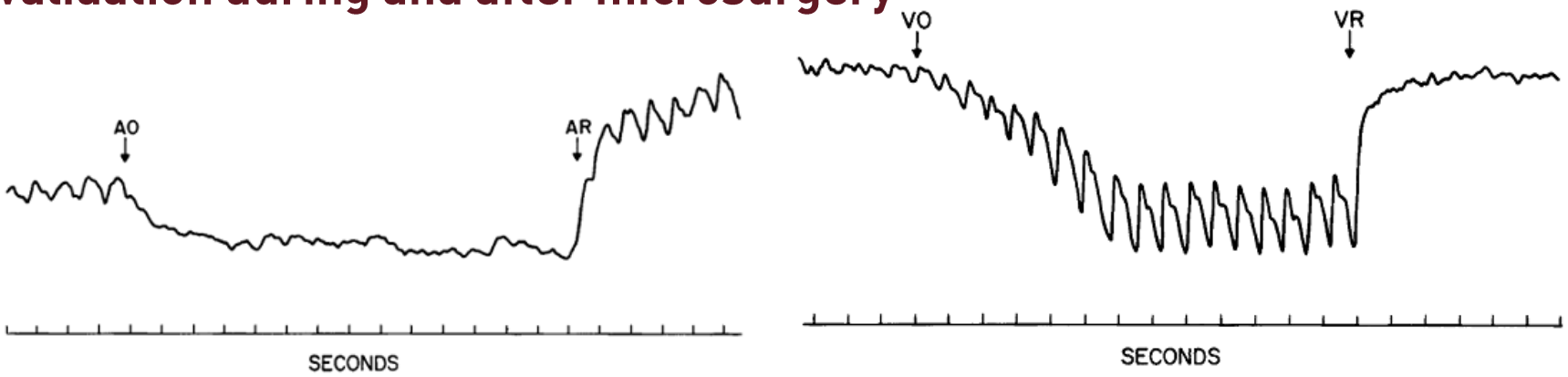
1. Position DIEP flap and fix it with staplers
2. Measure perfusion on flap and compare with pre-harvesting value
3. Check edge of flap
4. Compare with peripheral tissue

**Validation**

- Repeat measurements after suturation which causes increased stress and pressure on flap and vessels

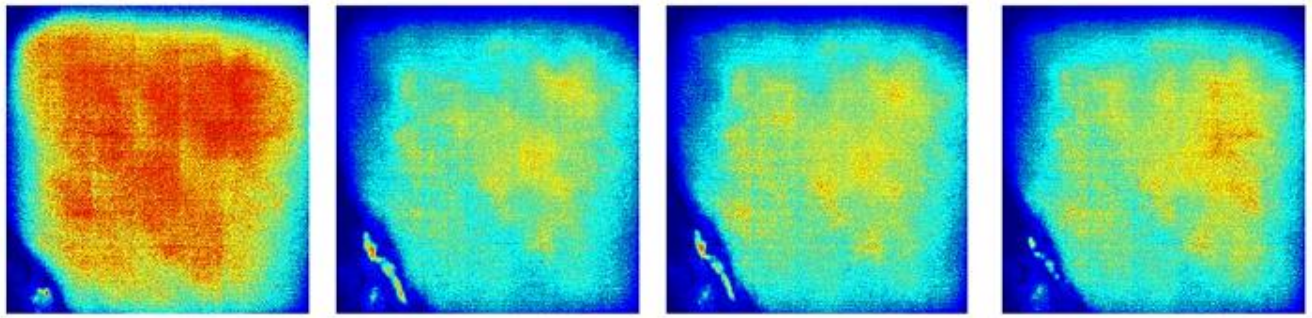
# Arterial or Venous Congestion?

## Validation during and after microsurgery




Concept already demonstrated by Fischer et al, Microsurgery 7:67-71, 1986

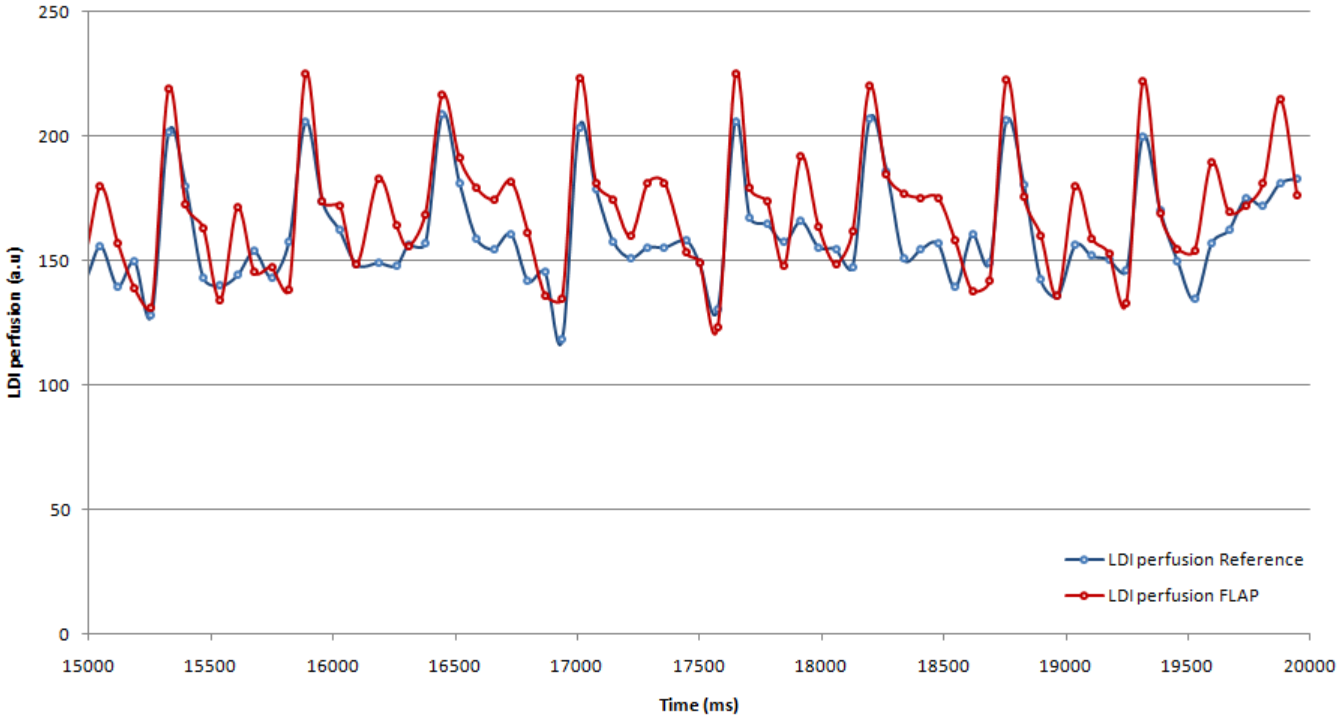
## Example Arterial Clamp

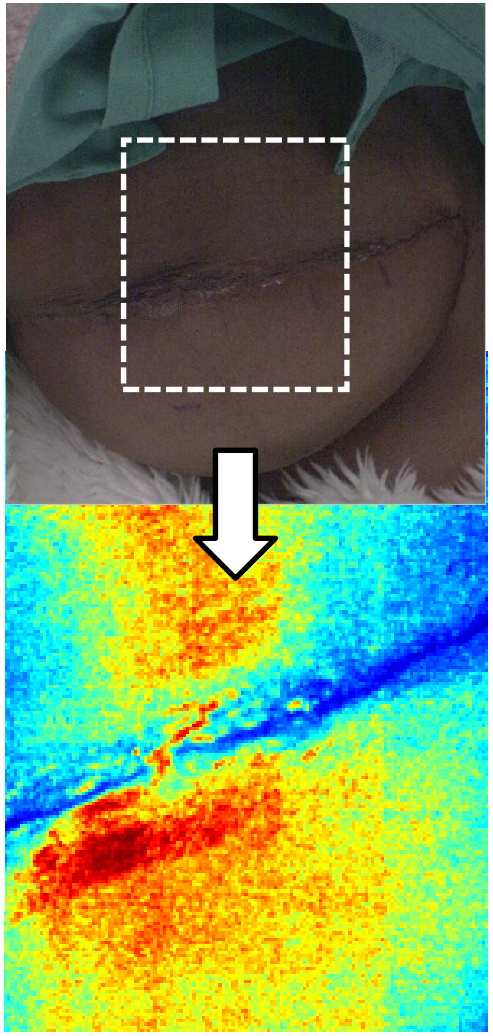


*Before clamp* | *During clamp* | *10s after clamp removal* | *2 min after clamp removal*

# DIEP: Anastomosis Example

- Compare peripheral tissue with flap



- Particularly useful on dark or tanned skin