

# Wound Measurements

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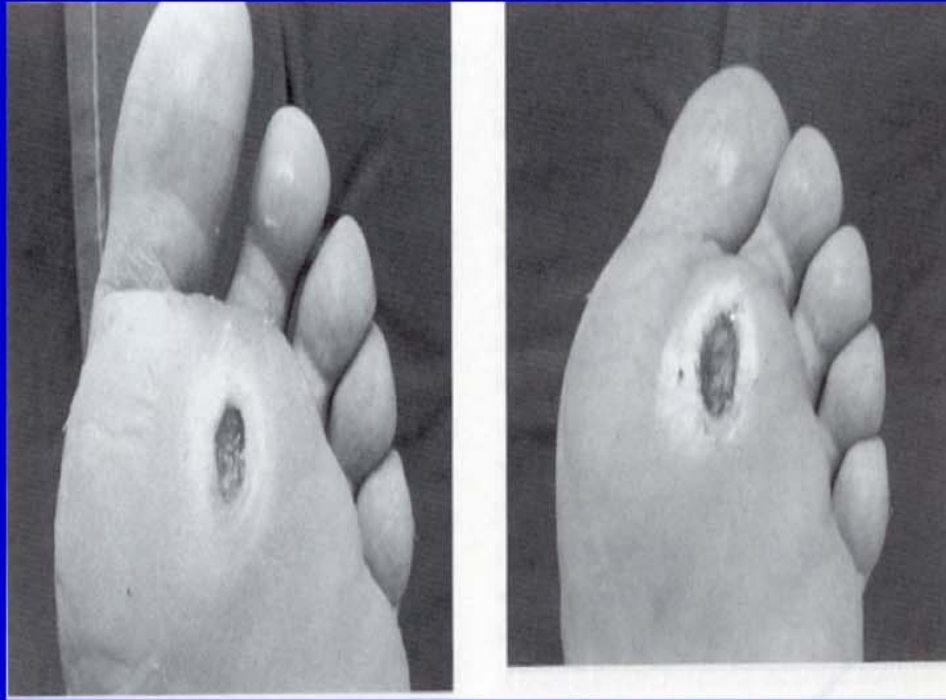
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# Why measure wounds?

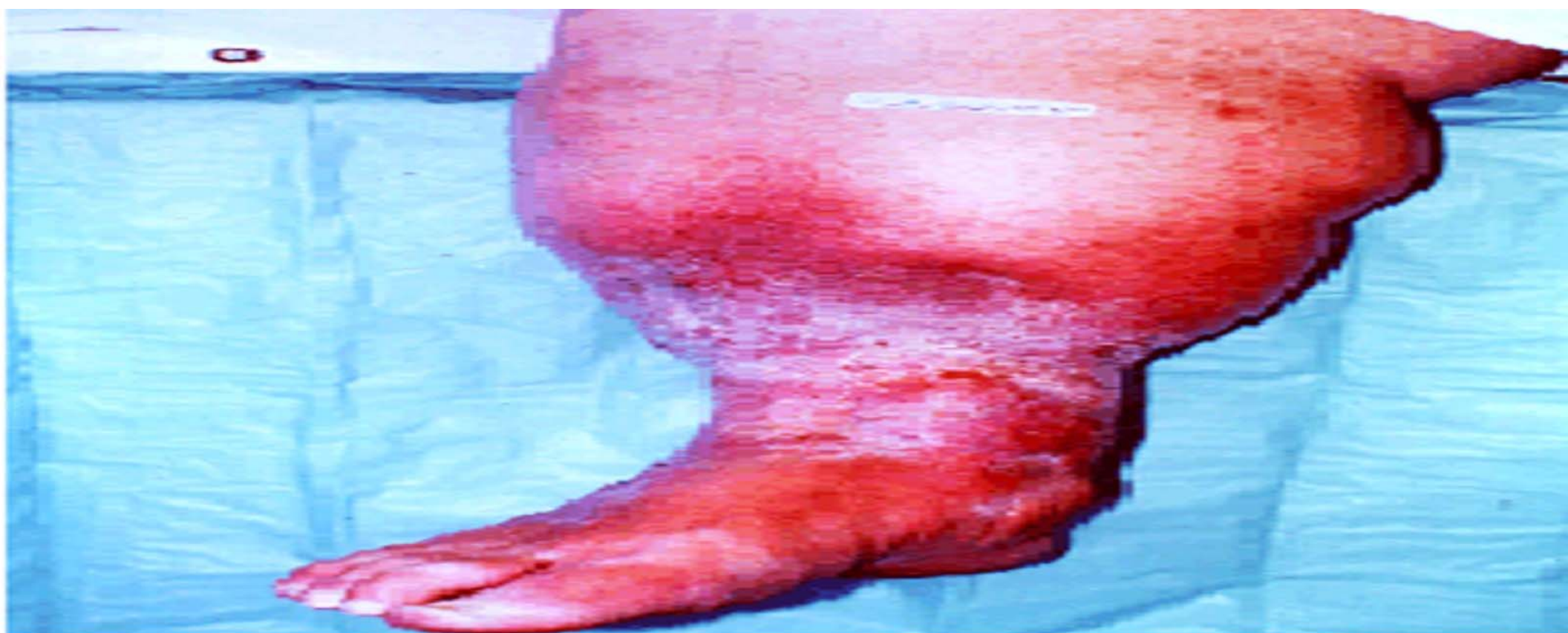
- Why not clinical assessment alone?





Baker N et al IJLEW 2002; 1(2): 87-92





### **Advanced lipodermatosclerosis**

In advanced cases of lipodermatosclerosis, fibrosis binds the skin to the underlying tissue. Significant leg edema, erythema, and hyperpigmentation are present. Courtesy of Patrick C Alguire, MD.

# Why measure wounds?

- Why not clinical assessment alone?
- In order to have an objective record of the outcome of treatment.
- The simplest measurement of wound status is its size.
- This may be derived from the area, perimeter, length along superior inferior and anterior posterior axes.
- Wound volume is another measure of its size. Only in neuropathic wounds and some pressure ulcers is the wound volume measurements known to be useful (Reiber G 1991).

## What to do with the measurements?

- Monitor progress with treatment
- Predict healing



# Techniques

- Area
  - Traces of wound contour
  - Measurement of wound perimeter from traces
  - Photography
  - Digital photography
- Volume
  - From casts made of inert material (negative volume). Derive volume by measuring displacement of water. Once made a cast can be stored for ever. Useful in big trials.
  - From certain digital photography techniques



## Romanelli M, Dini V and Mani R

196

M. Romanelli et al.

**Fig. 11.1** Portable laser scanner for digital wound image analysis



This objective characterization allows numerical measures to be assessed according

# Romanelli M, Dini V and Mani R

**Fig. 11.2** Non invasive tristimulus colorimeter for wound bed color assessment



## Eykona Wound Measurement System





# Chronic Wound Healing





Critical ischaemia of the right forefoot in  
a diabetic with PAD

X-ray of the same forefoot →



## What to do with the measurements?

- Monitor progress with treatment
- Predict healing



## Surrogate markers in venous and diabetic foot wounds

- Gelfand and Margolis analysed 56,488 wounds (29,189) patients with venous leg ulcers.
- Median wound size 189 sq mm, median wound duration 3/12.
- Log healing rate, log wound area ratio, % change in wound area were all valid and discriminated between healers and non healers at both 12 and 24 weeks.
- JID 2002; 119(6): 1420-25.

Margolis DJ et al conducted a similar study on diabetic neuropathic foot ulcers. From areas measured at 2,4,8 weeks they concluded that surrogate measures log healing ration, log wound area ratio, % change in wound area discriminated well between healers and non healers at 12 and 24 weeks respectively.

Diabetes Care 2003; 26: 1696-1700.

A “healed wound” is generally the accepted outcome for all chronic wound studies. However, wound healing is a multidimensional process such that it may not be appropriate to assume that all therapies should or could heal a wound. Therefore, we encourage the use of other patient specific or wound specific outcomes, including but not limited to diminished pain, improved quality of life, reduced wound size, removal of necrotic tissue, diminished exudates, decreased bacterial burden/infection, graft take for studies of wound technologies. Technology based evidence of healing may be derived from dimensional assessments of area/perimeter/axial length and in the case of diabetic neuropathic wounds, volumes<sup>1</sup>. Measurements for these assessments may be based on contact tracings and planimetry or photography and planimetry<sup>12</sup>. There is demonstrable benefit when carers are empowered with wound measurement data<sup>16</sup>.

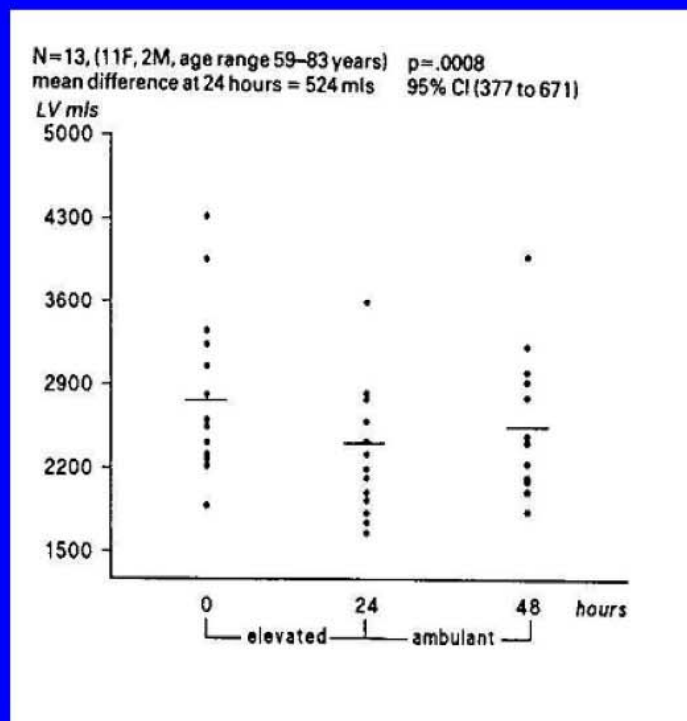
1. Gellfand JM, Hoffstadt O and Margolis DJ. Surrogate end points for the treatment of venous leg ulcers. *Journal of Investigative Dermatology* 2002; 119(6): 1420-25.

2. Kurd SK, Hoffstad OJ, Biker WB and Margolis DJ. Evaluation of the use of prognostic information for the care of individuals with venous leg ulcers or diabetic neuropathic foot ulcers. *Wound Repair and Regeneration*. 2009; 17: 318-325



Water plethysmograph

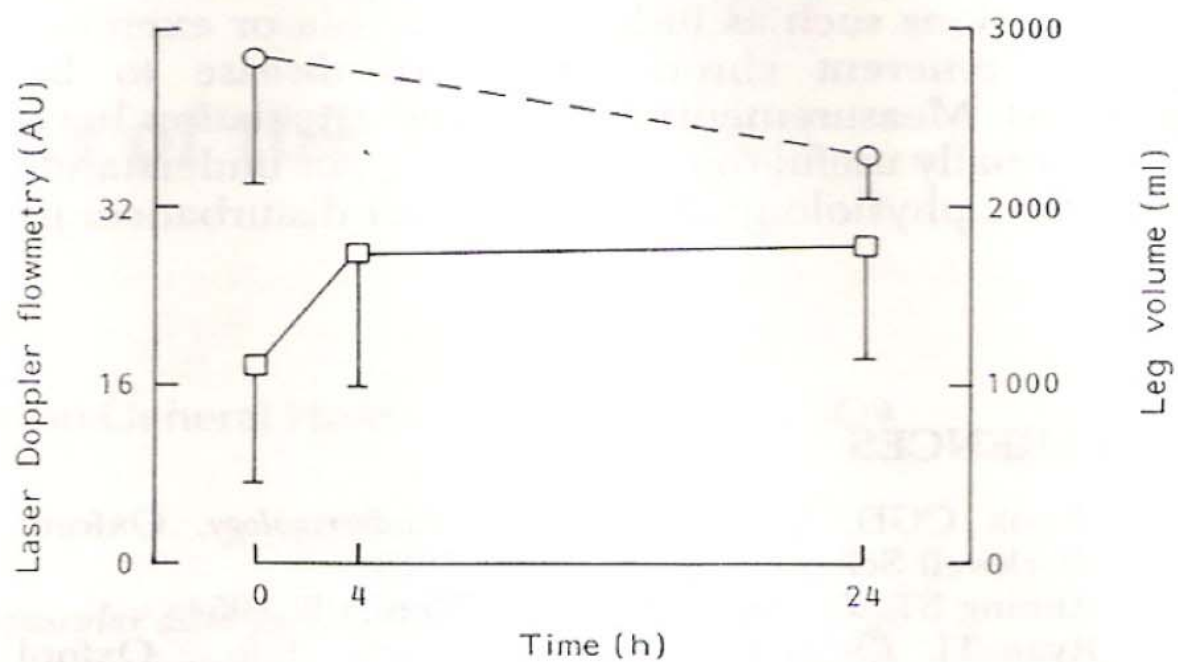




- LDF response at ulcer edge increased at 24 hours ( $p = 0.002$ )
- TcPO<sub>2</sub> increased (ns). LDF and TcPO<sub>2</sub> well correlated ( $r = 0.7$ ,  $p = 0.006$ )

Phlebology; 1992 (7) :31-35

Mean  $\pm$  1 SD of groups



**Figure 2** Change in LDF response ( $\square$ ) and limb volume (LV) ( $\circ$ ) during leg elevation

# Wound Measurements

- Physical measurements of wounds are essential to monitor progress and to predict healing.
- Measurements may be made using tracings – derived from photographs.
- Several very high quality systems are commercially available.
- It is important to have a reproducible technique and inter-rater reliability for management as well for research.