How should we measure endothermal energy LEED v EFE: which technique is better?

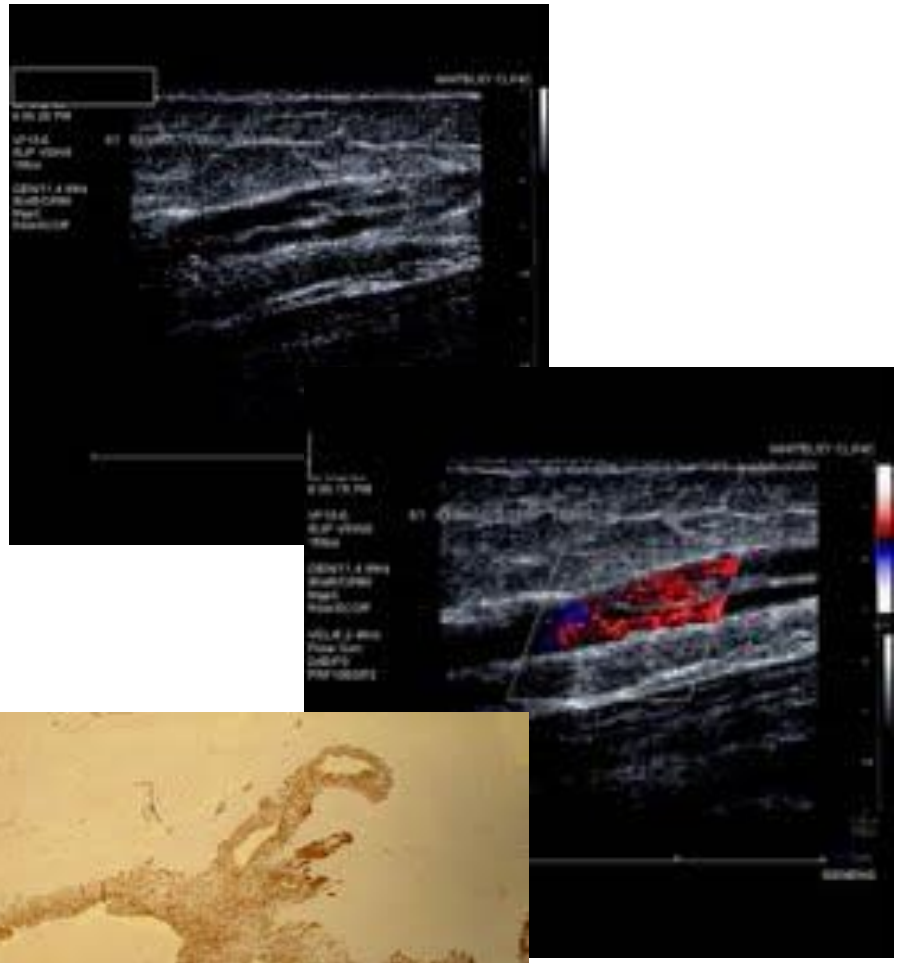
Mark S Whiteley
Tim J Fernandez-Hart

The Whiteley Clinic, Bond Street London, Guildford, Bristol and Birmingham
info@thewhiteleyclinic.co.uk

Aim of treatment

- 1] Stop truncal reflux
- 2] Prevent recurrence of truncal reflux
- Stripping replaced by Thermoablation
  NICE CG168

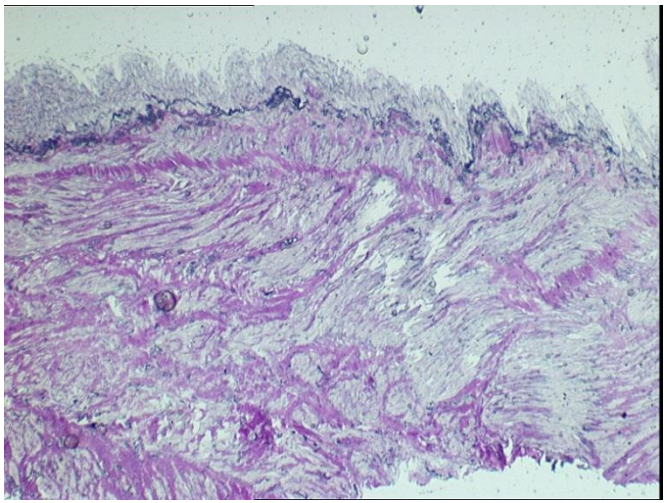
NICE National Institute for Health and Care Excellence



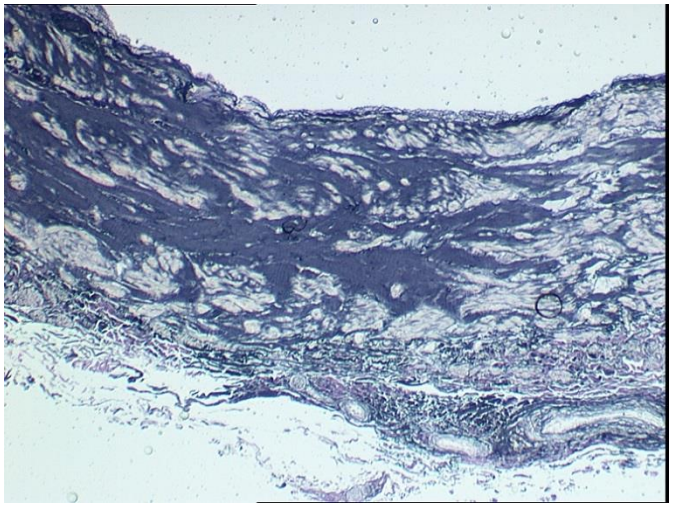
Munasinghe A et al
BJS 2007

Hypothesis – Thermoablation

- Require transmural damage of vein wall for fibrosis and long term ablation



EVG Stain



* Mark S Whiteley, Judy Holdstock
Percutaneous radiofrequency ablations of Varicose Veins (VNUS Closure)
In: Roger M Greenhalgh ed, Vascular and Endovascular Challenges . London; BibaPublishing 2004. p 361- 381

2004

- LEED – Linear Endovenous Energy Density

Proebstle T, Krummenauer F, Gül D, Knop J. Dermatol Surg 2004; 30(2 pt 1): 174–8.

Nonocclusion and Early Reopening of the Great Saphenous Vein After Endovenous Laser Treatment Is Fluence Dependent

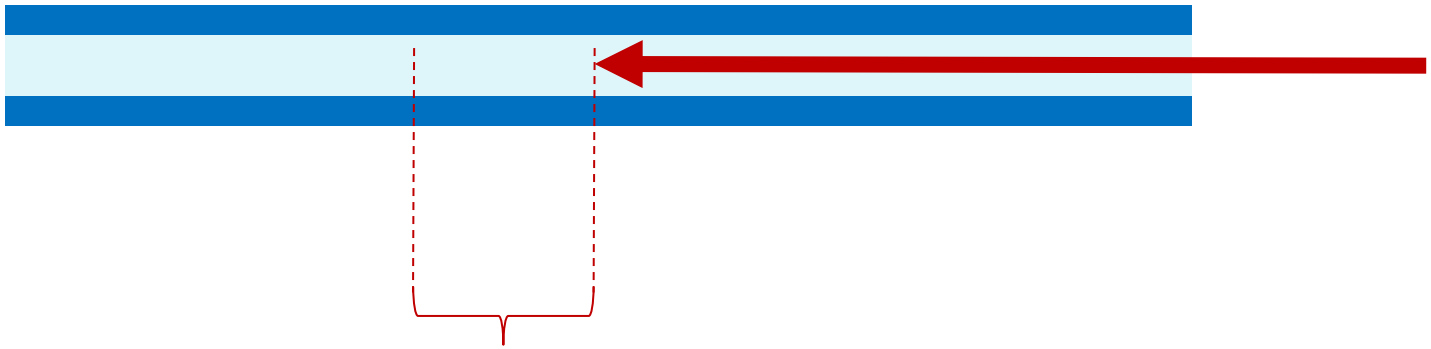
THOMAS M. PROEBSTLE, MD, MSc,* FRANK KRUMMENAUER, PHD,† DOENDUE GÜL, MD,* AND JUERGEN KNOP, MD, PHD*

*Department of Dermatology and †Department of Medical Biometry, Epidemiology and Informatics, University of Mainz, Mainz, Germany

Linear Endovenous Energy Density

- Power = Watts = Joules / sec

Linear Endovenous Energy Density

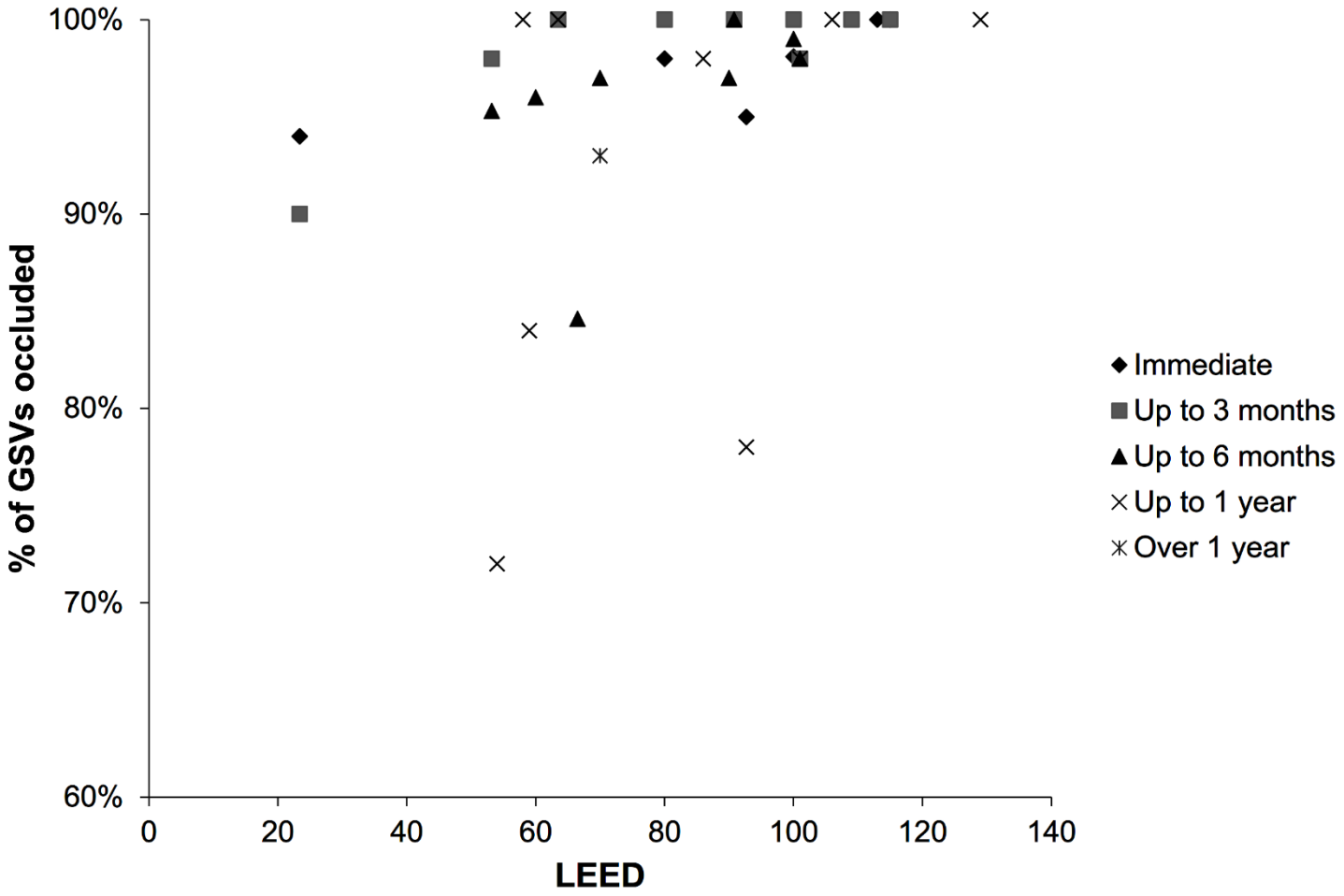


- Pull back speed = cm / sec
  - BUT to make easier to monitor
- Number of seconds per cm = sec / cm

Linear Endovenous Energy Density

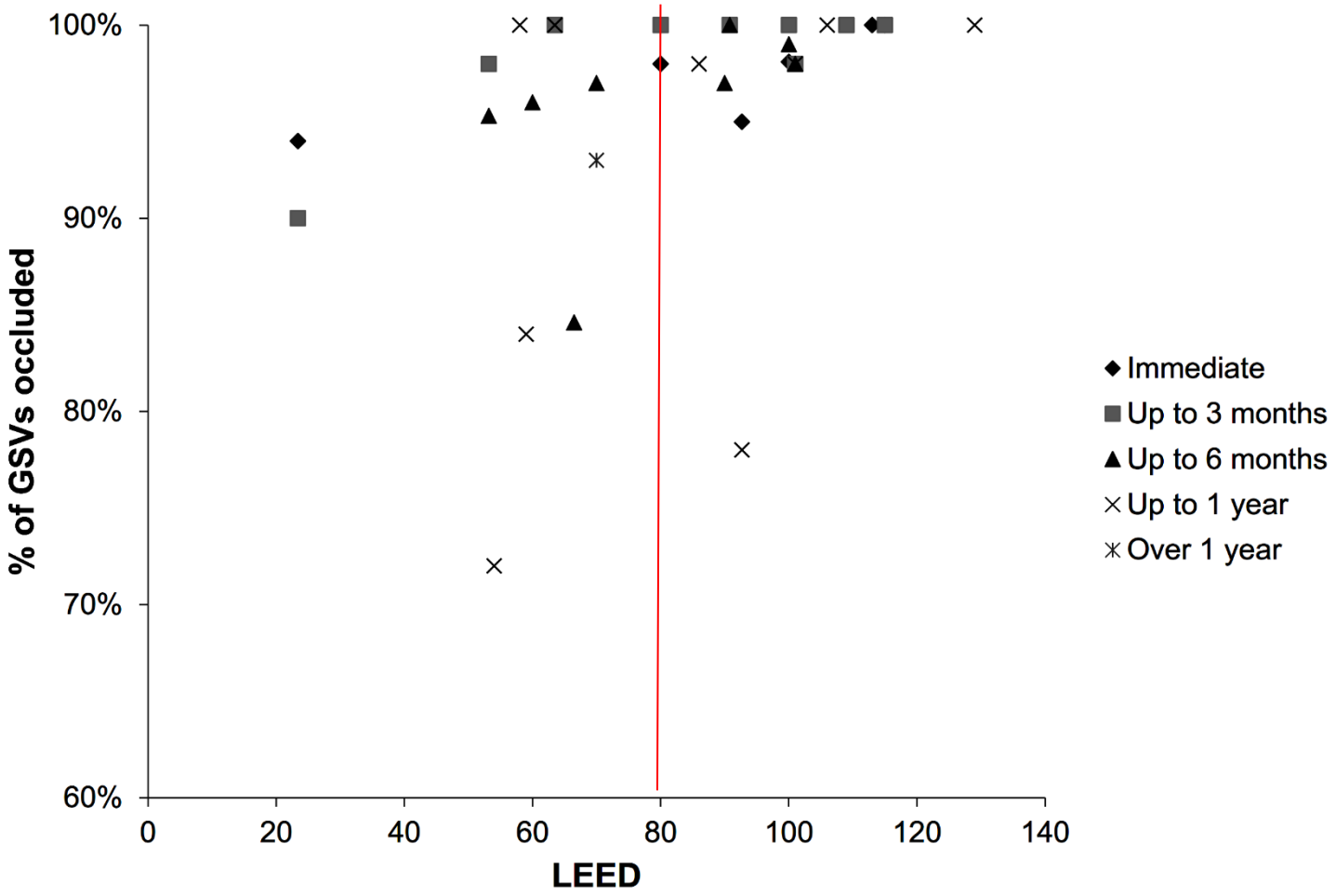
- LEED = Power x pull back in sec / cm
- LEED = J / sec x cm / sec
- LEED = J / ~~sec~~ x ~~sec~~ / cm
- LEED = J / cm

LEED v "Closure"



Cleese A, Whiteley MS
Unpublished 2014

LEED v "Closure"



Cleese A, Whiteley MS
Unpublished 2014

Endovenous Fluence Equivalence

- EFE = 2006

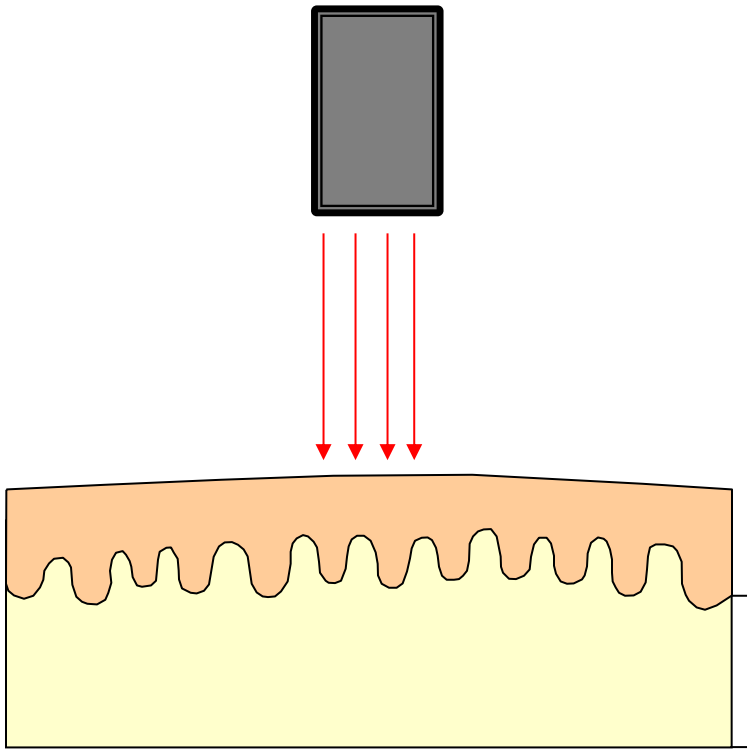
From the American Venous Forum

Reduced recanalization rates of the great saphenous vein after endovenous laser treatment with increased energy dosing: Definition of a threshold for the endovenous fluence equivalent

Thomas Michael Proebstle, MD, MSc,[a] Thomas Moehler,[b] and Sylvia Herdemann, MD, [a,b] *Heidelberg and Mainz, Germany*

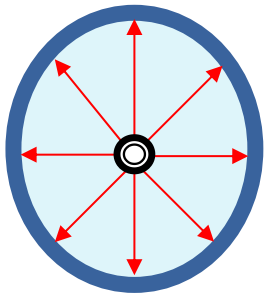
Endovenous Fluence Equivalence

- Laser energy usually measured on a surface
  - = Fluence J/cm^2



Endovenous Fluence Equivalence

- Laser energy usually measured on a surface
  - = Fluence J/cm^2



= Inner surface area of vein

Surface area of a cylinder:

= **length x (Π d)**

Relationship of LEED and EFE

LEED = J / cm

EFE = J / (Length x Π x diameter)

<u>Considering 1 cm of vein</u>

LEED = J

EFE = J / (Π x diameter)

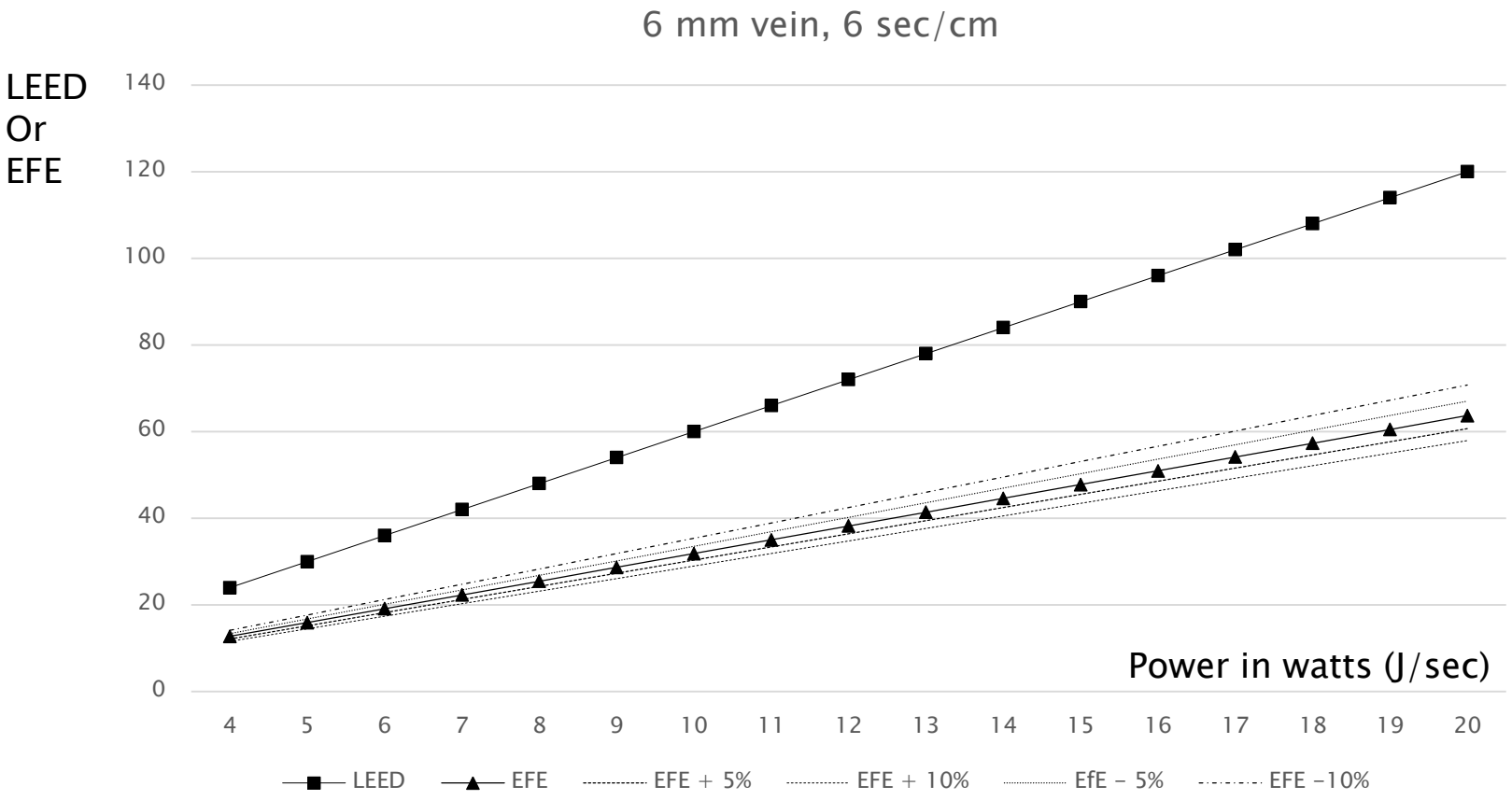
<u>Re-arranging</u>

EFE = LEED / (Π x diameter)

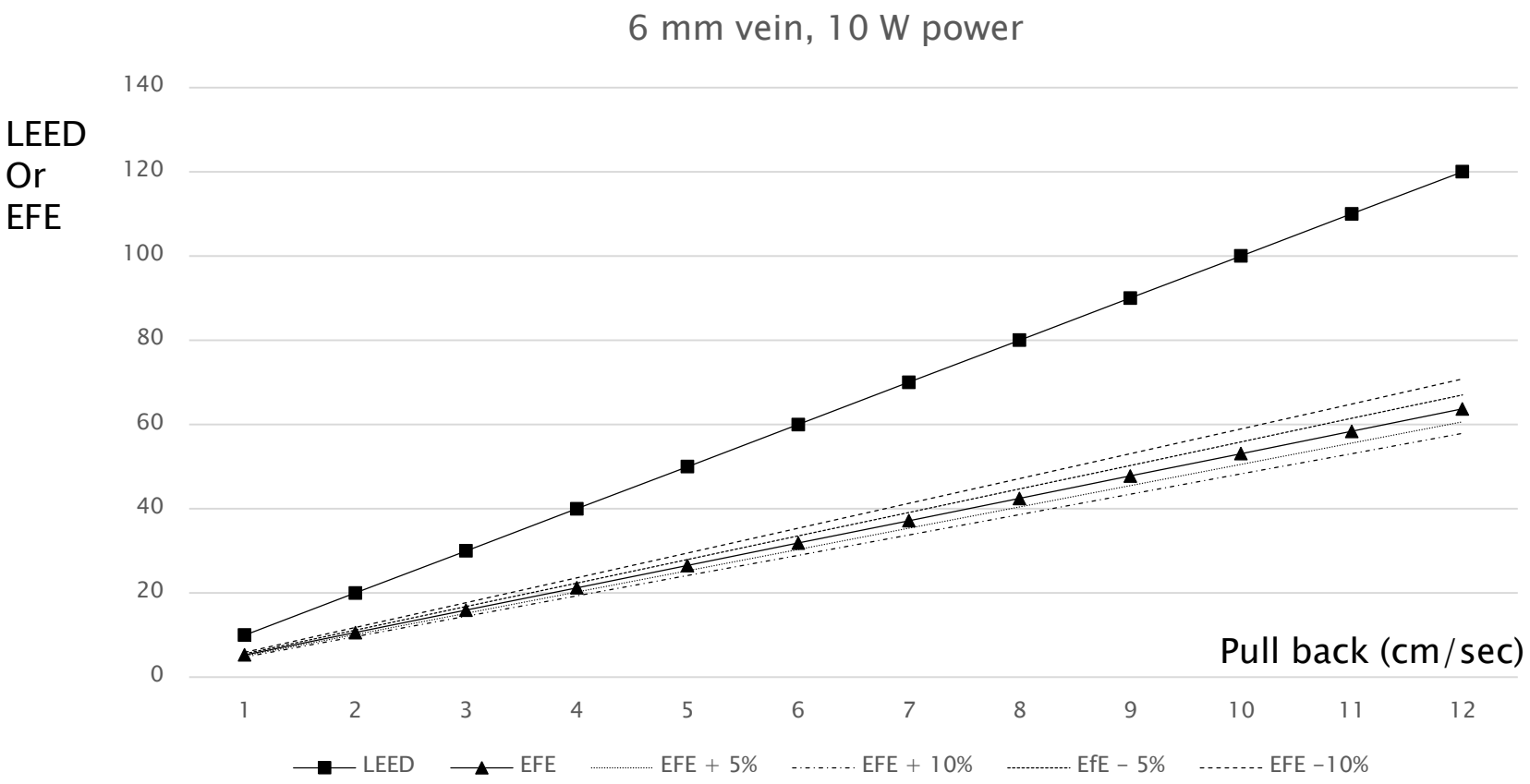
Errors in EFE

- Veins are not uniformly cylindrical
- Diameter can change with temperature, hormonal cycles, patient position and other environmental factors
- There is a measuring error with any ultrasound measurement
  - Therefore we calculated +/- 5% and 10% errors

Power


6 mm vein, 6 sec/cm
LEED
Or
EFE
140
120
100
80
60
40
20
0
Power in watts (J/sec)
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
LEED
EFE
EFE + 5%
EFE + 10%
EfE – 5%
EFE –10%

Pull back


6 mm vein, 10 W power
LEED
Or
EFE
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
11
12
Pull back (cm/sec)
LEED
EFE
EFE + 5%
EFE + 10%
EfE – 5%
EFE –10%

Vein size

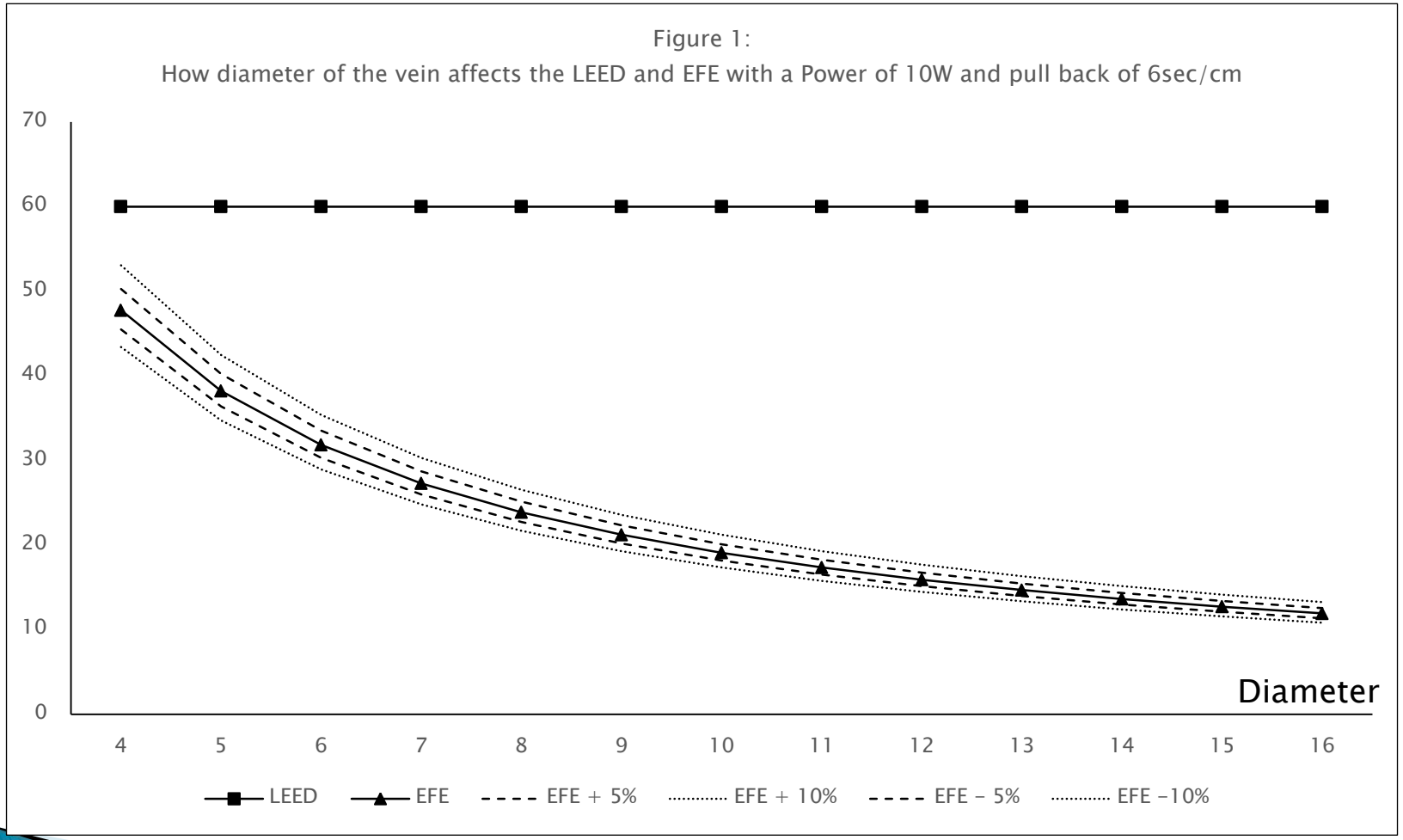


Figure 1:
How diameter of the vein affects the LEED and EFE with a Power of 10W and pull back of 6sec/cm
LEED Or EFE
70
60
50
40
30
20
10
0
Diameter
4
5
6
7
8
9
10
11
12
13
14
15
16
LEED
EFE
EFE + 5%
EFE + 10%
EFE – 5%
EFE –10%

Conclusions

- EFE is an advance on LEED
  - takes into account vein size
  - helps tailor treatment to vein
- Currently quote to 0.1 decimal place
  - Needs to be quoted with an error range
- Practically more difficult to use intra-operatively