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3D measurement for monitoring wound healing

Line Bisgaard Jørgensen MD, PhD student
Department of Endocrinology
Department of Plastic Surgery
Odense University Hospital

Introduction

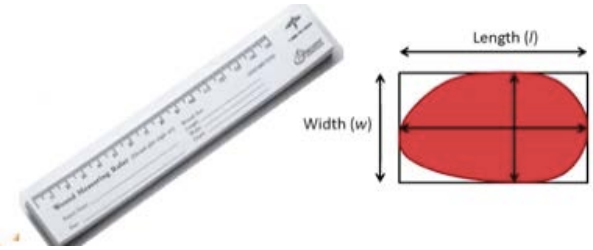
- Over 422 million people worldwide with diabetes
- ≈15% of diabetes patients develop diabetic foot ulcers
- Treatment of diabetic foot ulcers: €100 million in DK
- Risk of amputation

Wound measurement in clinical practice

- Predicting outcomes
- Monitoring the effect of treatment (e.g. clinical studies)
- Clinical decision support
- Improving patient compliance

Traditional measurement methods

Ruler method (length x width)



Planimetric method

2D image method

3D measurement methods

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ORIGINAL ARTICLE

Methods to assess area and volume of wounds – a systematic review

Line Bisgaard Jørgensen[1], Jens A Sørensen[2], Gregor BE Jemec[3] & Knud B Yderstræde[1]

1 Department of Endocrinology, Odense University Hospital and Faculty of Health Sciences, University of Southern Denmark, Odense, Denmark
2 Department of Plastic Surgery, Odense University Hospital and Faculty of Health Sciences, University of Southern Denmark, Odense, Denmark
3 Department of Dermatology, Roskilde Hospital and Faculty of Health Sciences, University of Copenhagen, Copenhagen, Denmark

- Lack of accuracy
- High cost
- Complex in handling

3D-WAM kamera

- Comprises:
  projector + 3 cameras

- Developed by Teccluster (Danish)

- To assess wound characteristics and measure wound size in 3D

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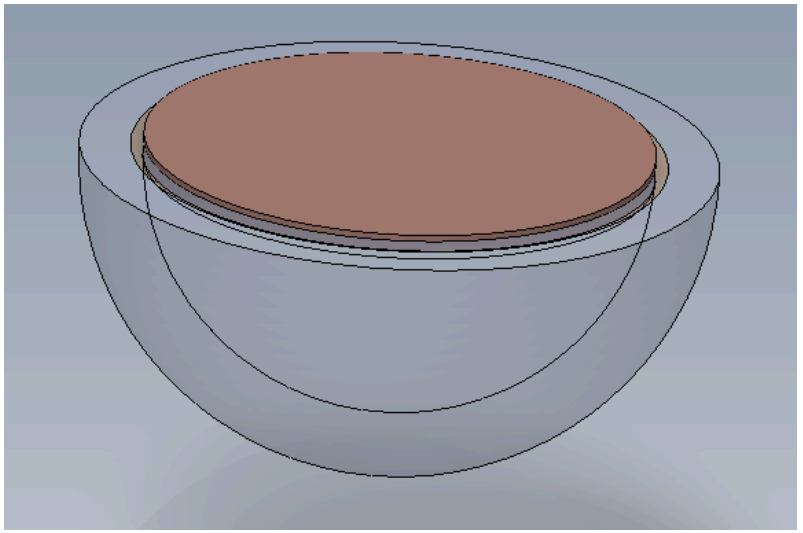
Wound measurements by the 3D image

- 2D area (surface area)
- 3D area
- Volume
- Perimeter



Study of wound characteristics

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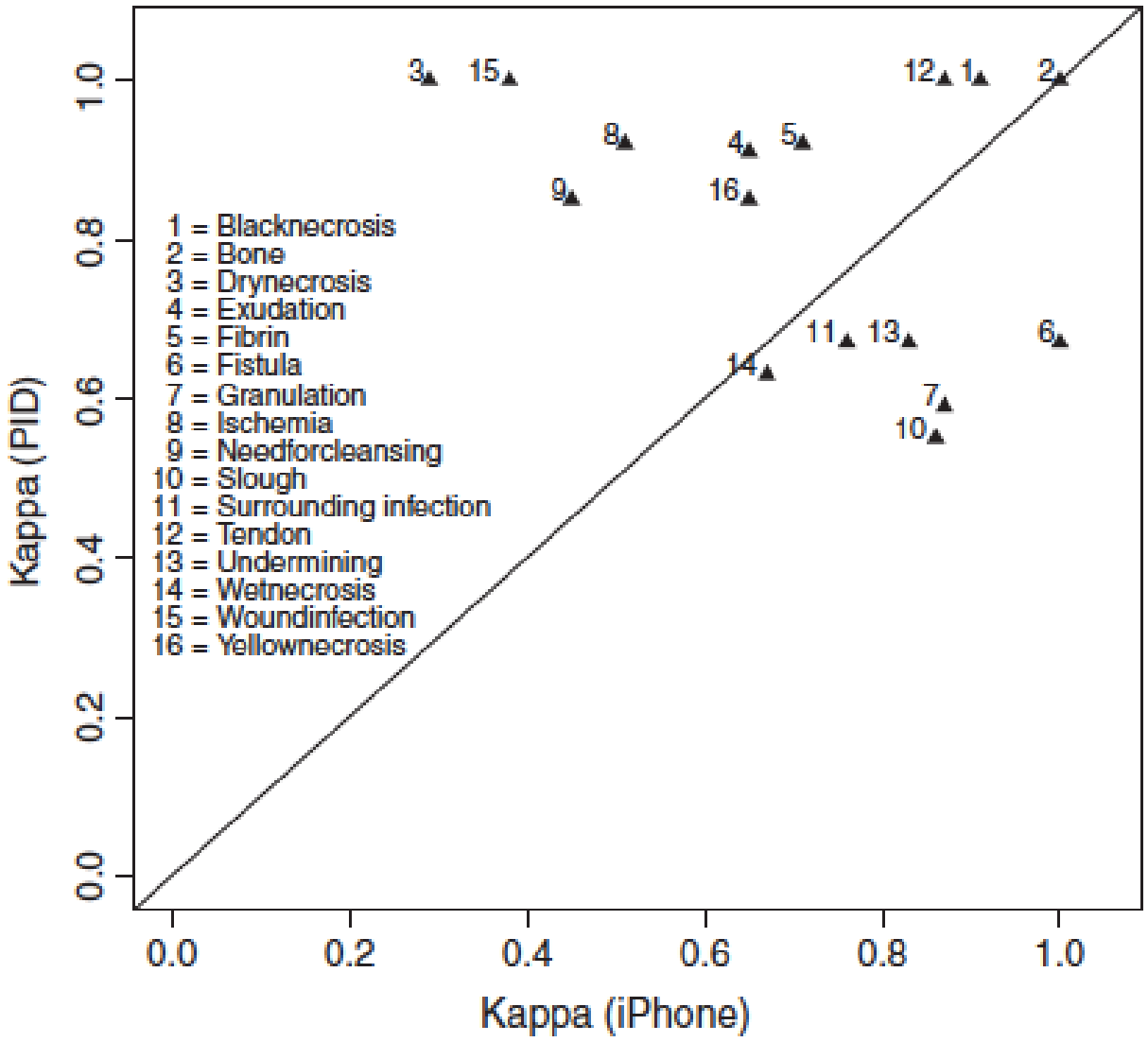
Validation of a new imaging device for telemedical ulcer monitoring

B. S. B. Rasmussen[1], J. Froekjaer[2], L. B. Joergensen[1], U. Halekoh[3] and K. B. Yderstraede[1]

[1]*Department of Medical Endocrinology, Odense University Hospital, Denmark, Odense, Denmark,*
[2]*Department of Orthopedic Surgery, Odense University Hospital, Denmark, Odense, Denmark and* [3]*Epidemiology, Biostatistics and Biodemography, University of Southern Denmark, Odense, Denmark*

Found a better correlation to clinical assessment (gold standard) compared to 2D images (iPhone 4s) assessed by kappa values.

Higher kappa values for the 3D images



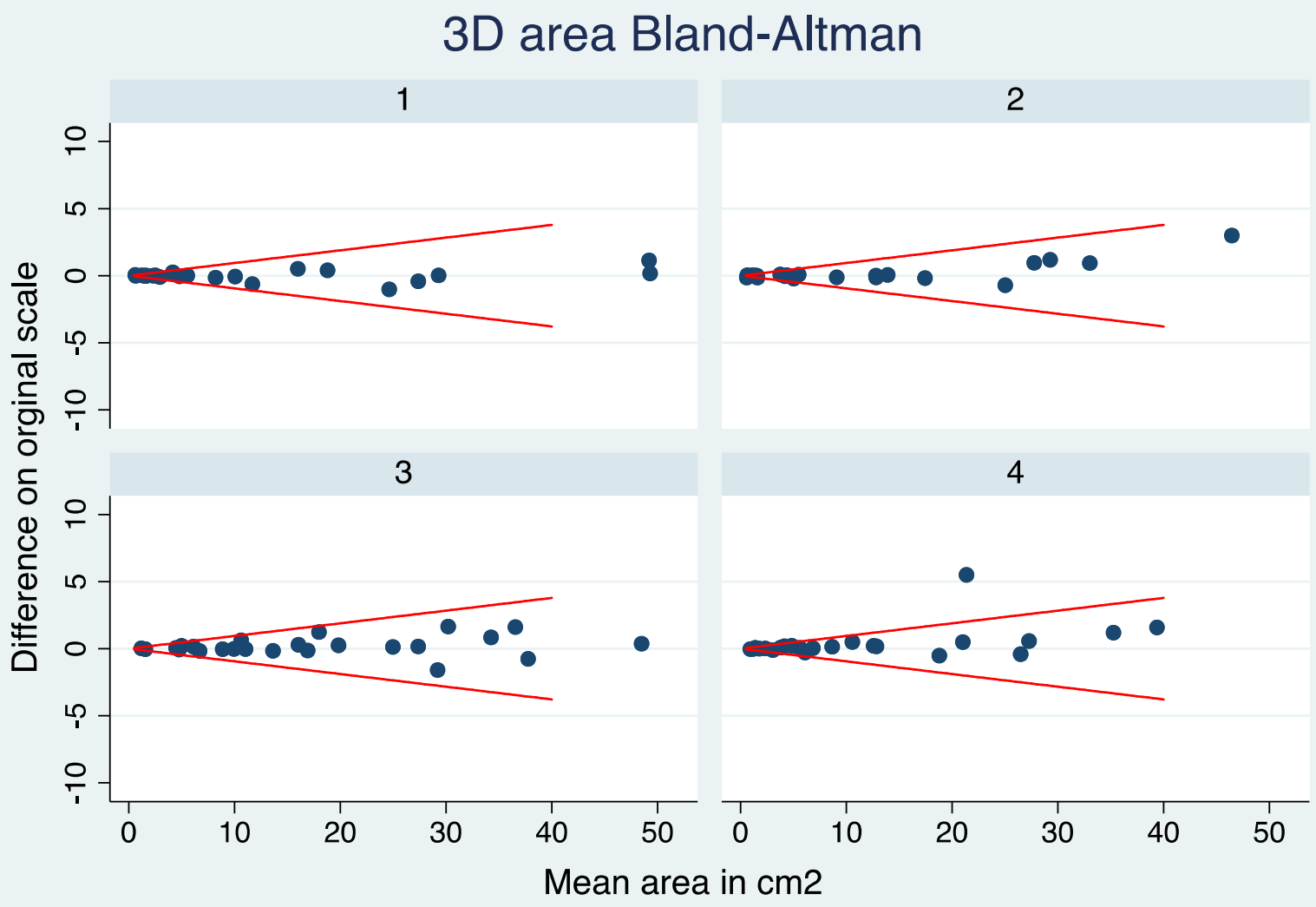
Aim:

- Estimate interrater variability (different clinicians)
- Estimate intrarater variability (same clinician)
- Compare with traditional methods (2D image and gel injection)

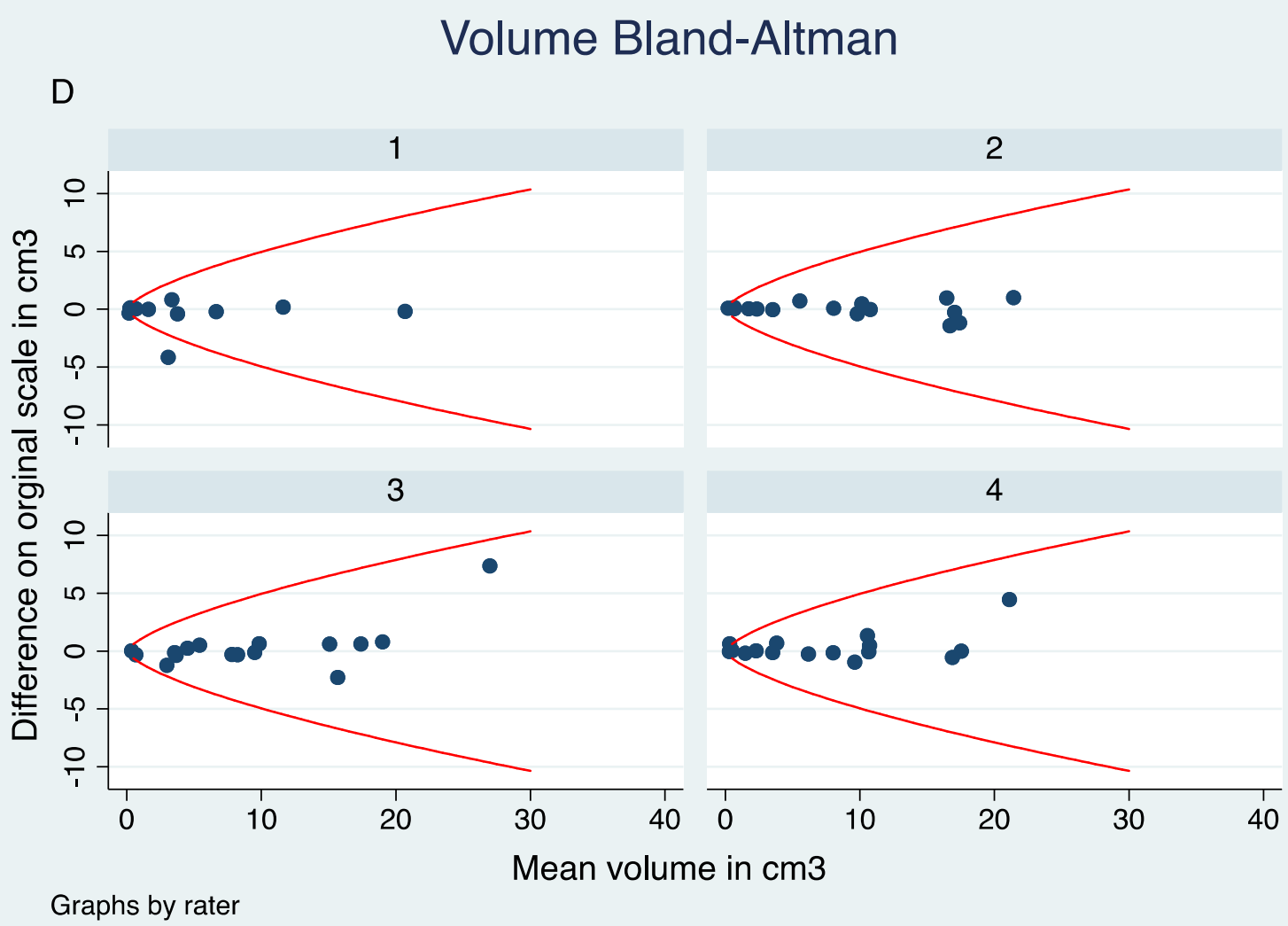
Study design

- Method comparison study
- 4 clinicians
- 48 wounds were measured by 2 clinicians with all 3 methods:
  - 2 x 3D image (192 measurements)
  - 1 x 2D image (96 measurements)
  - 1 x Gel injection (96 measurements)

Intrarater variability



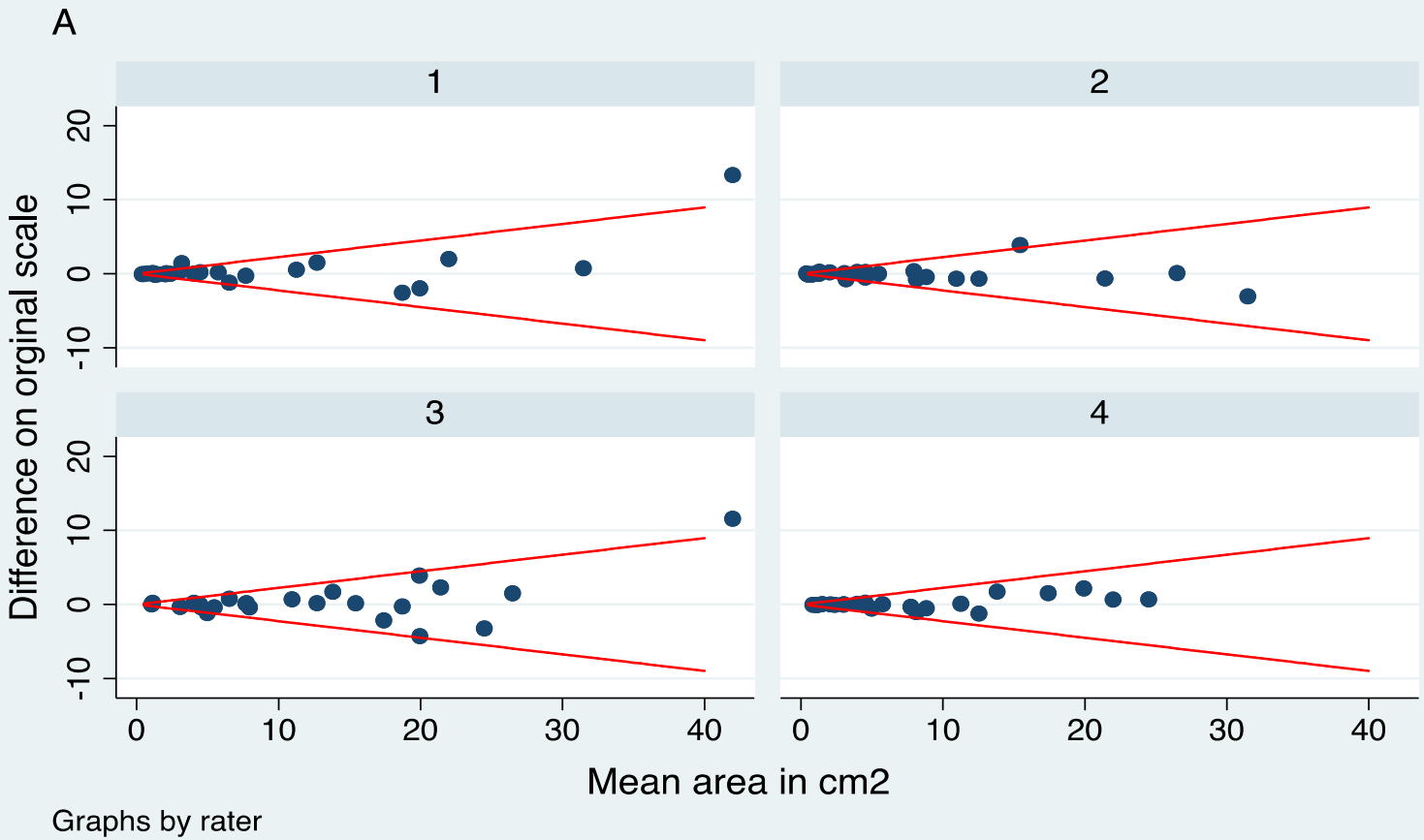
Intrarater variability



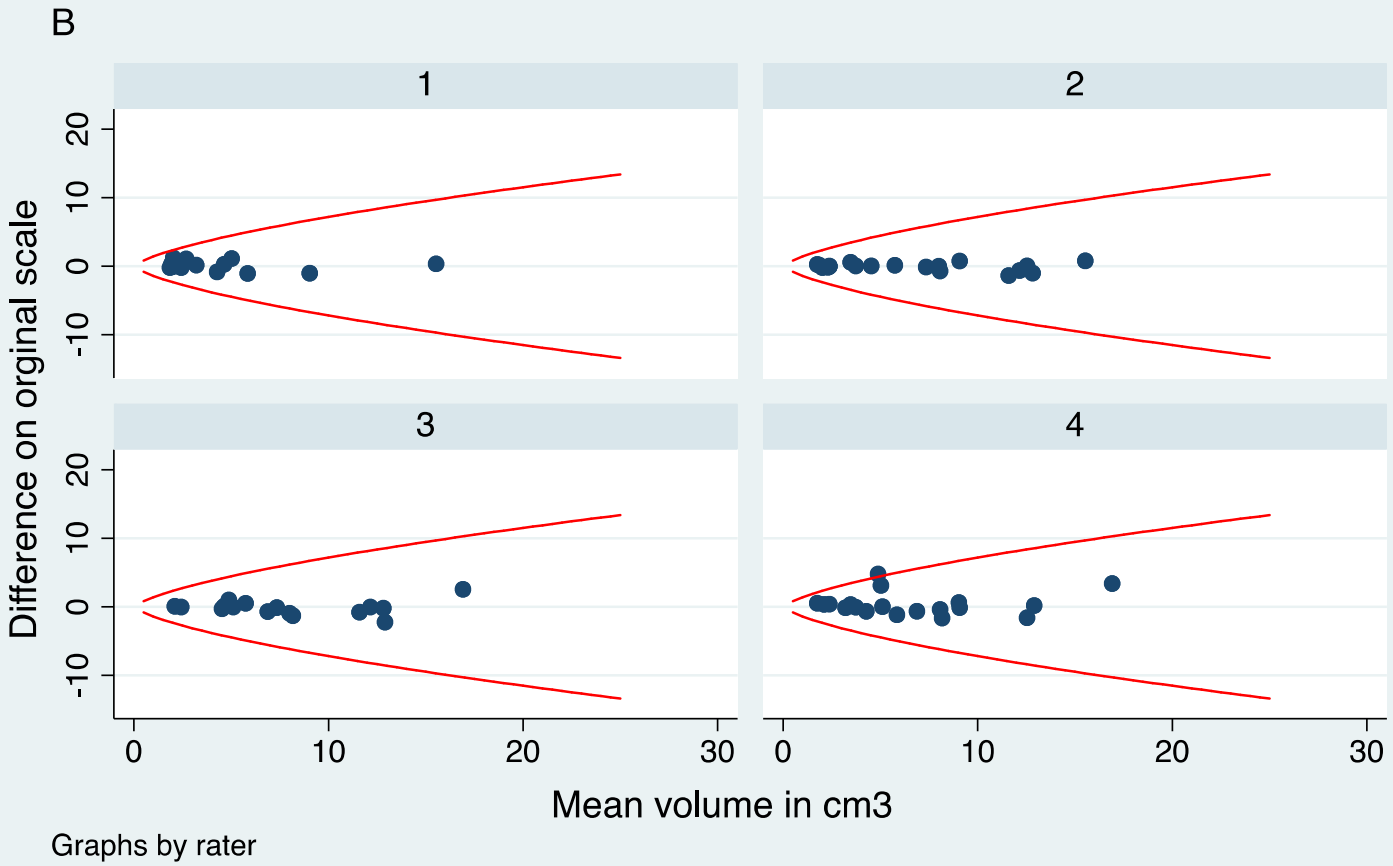
Intrarater and interrater variability

Wound measurement	Intraclass Correlation Coefficient (ICC_1)	Interclass Correlation Coefficient (ICC_2)
2D area	0.996	0.996
3D area	0.999	0.999
Perimeter	0.998	0.998
Volume	0.755	0.722

Method comparison– 2D area



Method comparison– volume



Strengths

- Wounds in different sizes and types were used
- Large sample size
- Useful in large, irregular wounds
- Wounds located on curved part of the body (e.g. heel)
- Electronic data to be used in telemedicine

Limitations

- Undermined wounds
- Moist and blood could potentially affect the 3D images (3D area and volume)
- Some user interpretation (outlining of the wound margin)
- Limitations in volume measurements (shallow, flat wounds or wounds located on a toe)
- Cost

Conclusion

- Four wound measurements with low intrarater and interrater variability
- The 3D measurements are comparable with traditional measurement methods (2D area and volume)
- Applicable for different wound types and sizes
- Potential for future use in telemedicine