

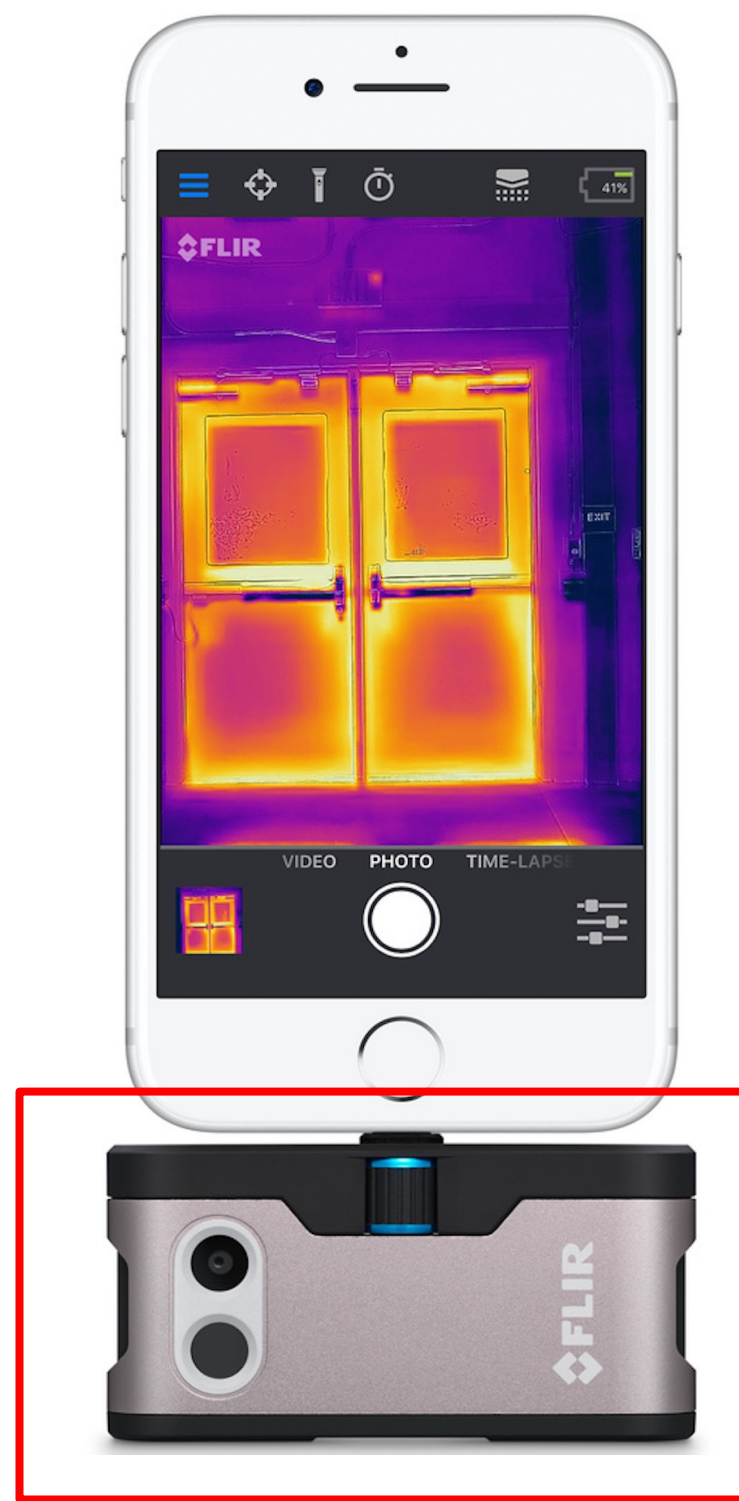
The Utility of Smartphone-Based Thermal Imaging in the Management and Monitoring

of Microvascular Flap Procedures: A Systematic Review and Meta-Analysis

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Background

- Flap reconstructions are complex procedures commonly performed post-mastectomy in breast cancer patients.
- 137,808 flap reconstructions were performed in the United States in 2020, a 75% percent increase from the year 2000 according to the American Society of Plastic Surgeons.
- The need for proper flap perfusion is essential in minimizing complications such as fat necrosis, contracture, and flap failure which commonly requiring additional operations and increase morbidity risk.
- Smartphone-based thermal imaging (SBTI) has been reported to be an easy-to-use, contactless, cost-friendly alternative to standard imaging modalities for identifying flap perforator vessels, monitoring flap perfusion, and detecting flap failure.

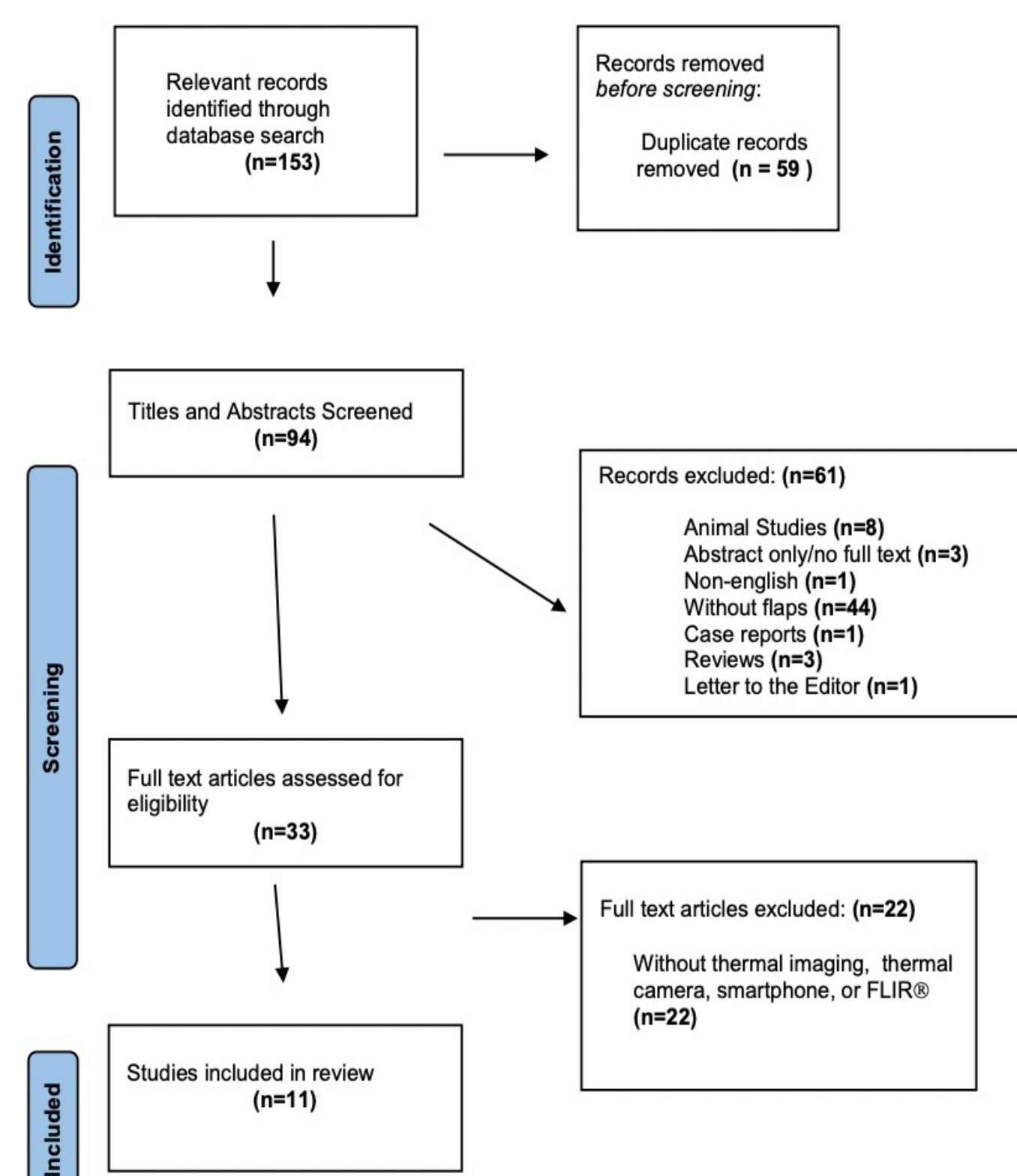


Device: FLIR One®
Manufacturer: Teledyne FLIR
Price: \$229.99

Purpose

- To evaluate SBTI's accuracy in perforator identification, and secondarily evaluate SBTI's utility in flap perfusion monitoring as well as ability to predict flap compromise, failure, and survival.

Methods



- PubMed database searched for relevant articles published since inception
- PRISMA guidelines
- Title, abstract, full-text screening, and data extraction performed using Covidence®
- Meta-analysis performed using Cochrane's Review Manager® v. 5.1

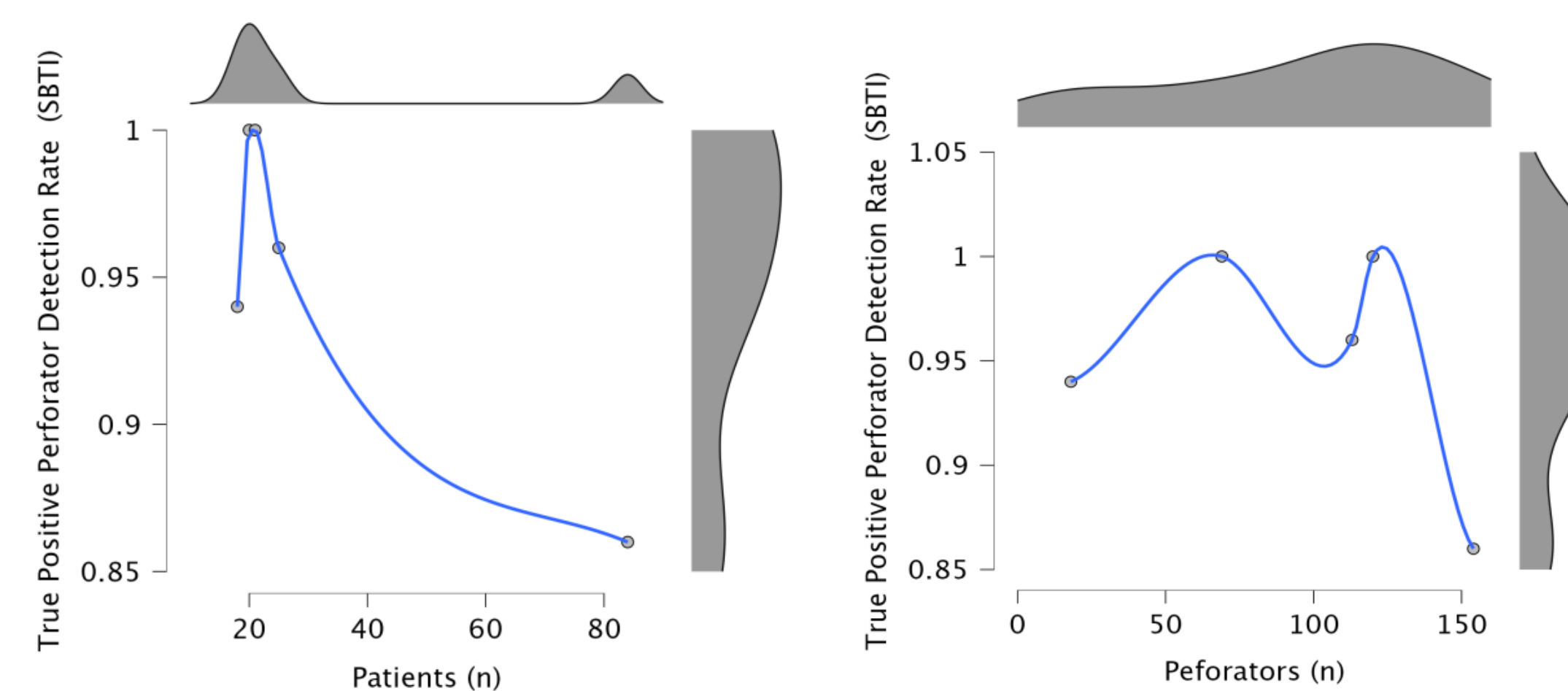
Results

Systematic Review

- Initial search yielded 153 articles.
- SBTI device assessed in all included studies was FLIR ONE®.
- 11 applicable studies
 - 416 patients
 - 430 flaps included.

Primary outcome:

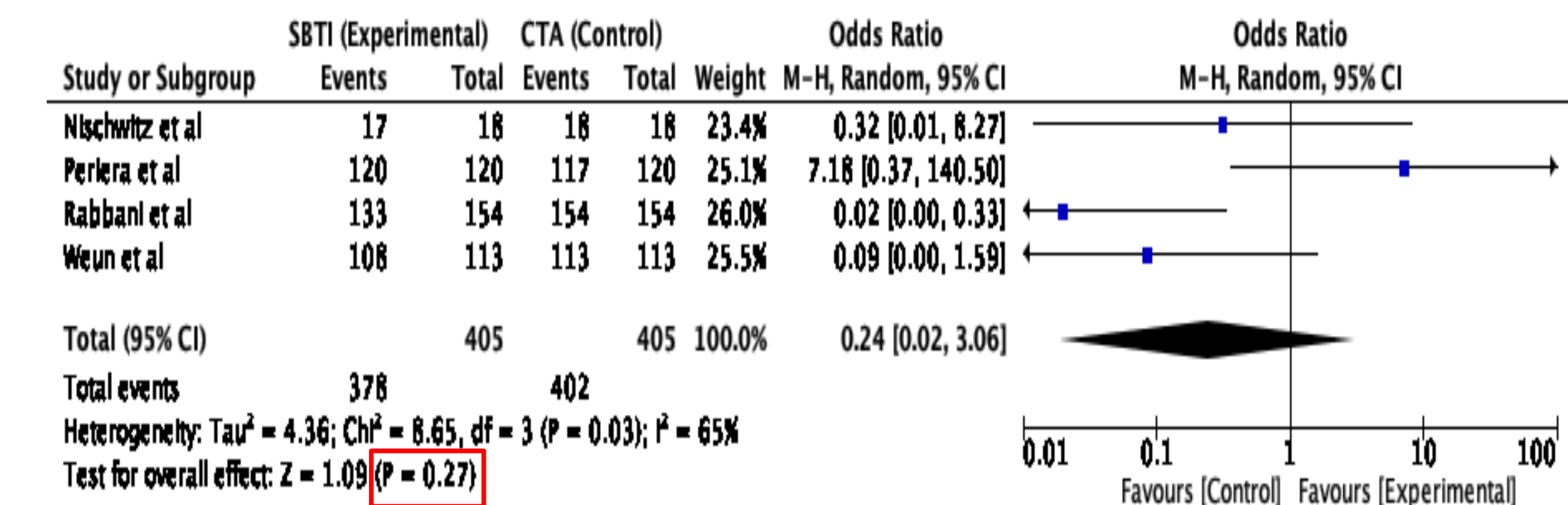
- Perforator identification accuracy compared to gold standard CTA (assessed via meta-analysis)



Secondary outcomes:

- Pooled flap survival rate= 95.1%
- Pooled flap failure rate= 4.9%

Meta-Analysis



- Pooled total of 405 perforators
- CTA correctly identified perforators at a true positive rate of 99.2 % (402 of 405)
- SBTI correctly identified perforators at a true positive rate of 93.3% (378 of 405).
- A random effects model was used (I² =65%) and **no significant difference in perforator detection ability was found between SBTI and CTA (p=0.27).**

Conclusions

- These preliminary findings support SBTI as user and cost friendly, contactless imaging modality with perforator detection ability comparable to current gold-standard CTA.
- Post-operatively, SBTI allows early detection of microvascular changes causing flap compromise, allowing for prompt tissue salvage. This could allow for more frequent flap monitoring, without the extensive training or expense associated with Doppler Ultrasound.
- SBTI could therefore lower complication rates and improve patient outcomes following complex flap reconstructions, though further study is warranted.

References

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- Rabbani, M. J., Ilyas, A., Rabbani, A., Abidin, Z. U., & Tarar, M. N. (2020). Accuracy of Thermal Imaging Camera in Identification of Perforators. *Journal of the College of Physicians and Surgeons--Pakistan : JCPSP*, 30(5), 512–515.
- Pereira, N., Valenzuela, D., Mangelsdorff, G., Kufeke, M., & Roa, R. (2018). Detection of Perforators for Free Flap Planning Using Smartphone Thermal Imaging: A Concordance Study with Computed Tomographic Angiography in 120 Perforators. *Plastic and reconstructive surgery*, 141(3), 787–792.