Project Title

Visualising Cancer In 3D: 3-Dimensional Tissue Imaging for Management Of Cutaneous Basal Cell Carcinoma

Project Lead and Members

Project lead: A/Prof Tey Hong Liang

Project members: Yingrou Tan; Yuning Zhang; Li Liang Yao Jackson, Hui Yi Chia, Melissa Wee Ping Tan; Lee Teck Kwong Bernett; Lai Guan Ng.

Organisation(s) Involved

National Skin Centre; Singapore Immunology Network, A*STAR

Healthcare Family Group(s) Involved in this Project

Allied Health/Research

Applicable Specialty or Discipline

Dermatology, Laboratory Medicine

Project Period

Start date: 2018

Completed date: 2022

Aims

To develop a method to examine cancer margins in 3D

Background

See poster appended/ below

Methods

See poster appended/ below

Results

See poster appended/ below

Lessons Learnt

Adjusting the method to best fit the clinical workflow and timeline; optimizing and tweaking the method to deal with variability of human samples

Conclusion

Cancer margins are better visualized in 3D to provide more complete sampling of unexcised tumour.

Additional Information

SHBC 2022 Basic Science/ Translational Research Poster Category (Gold Award)

Project Category

Applied/ Translational Research

Qualitative Research

Keywords

Research And Development; Cancer Margin Management; 3D Imaging; Whole-Tissue Imaging

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BP-BSTR-04

Visualising cancer in 3D: 3-Dimensional Tissue Imaging for management of cutaneous basal cell carcinoma

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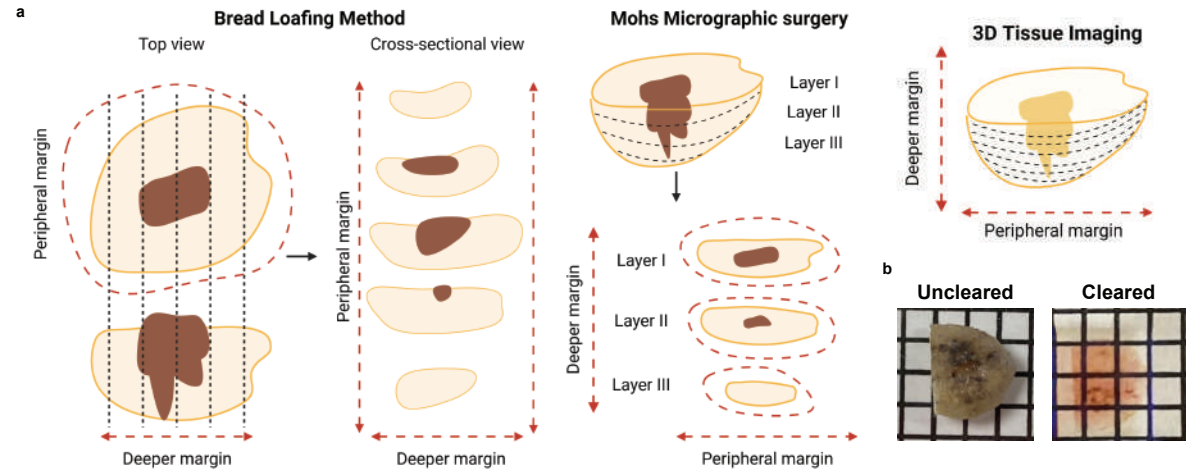
Resolving limitations of existing BCC management tools with 3D Tissue Imaging

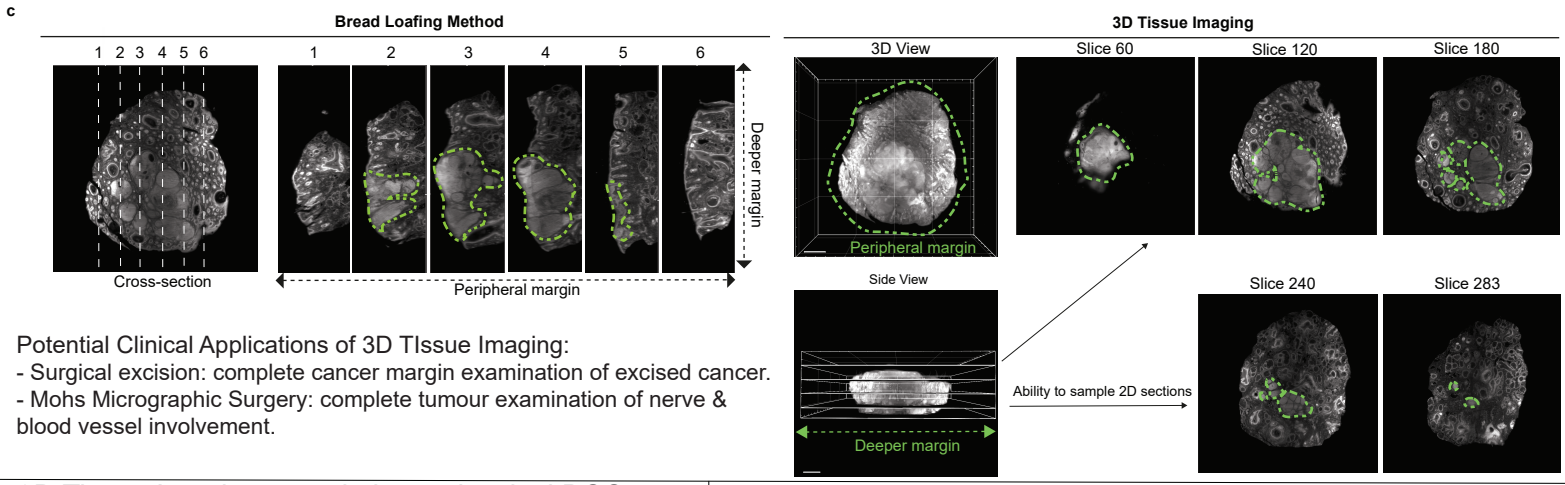


Problem statement:

- Bread-loafing method
: Low cost, fast technique
: Limited sampling of resection margins
: 0.09% to 0.42% of resection margins sampled at 2-3mm intervals
: 12.2% chance of recurrence

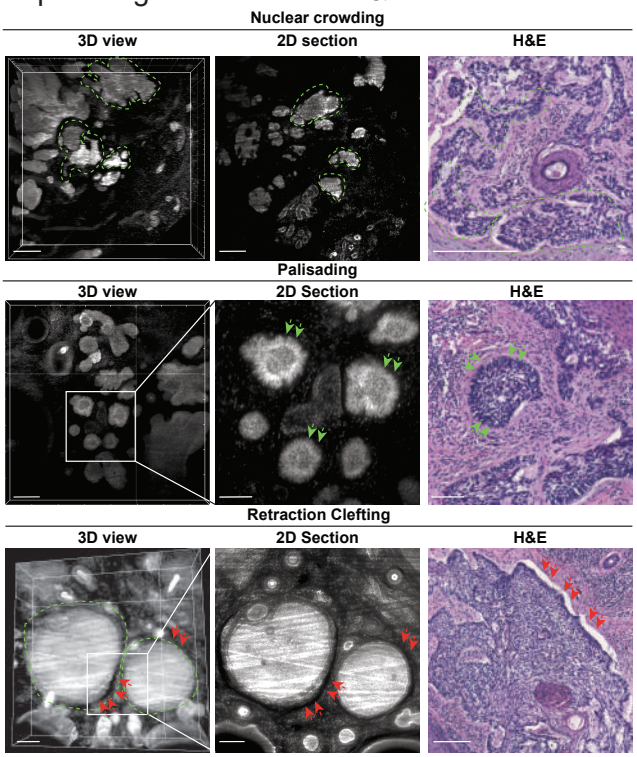
- Mohs Micrographic surgery
: More thorough procedure
: Resource-intensive, time-consuming & costly
: 4.4% chance of recurrence

- 3D Tissue Imaging
: Complete examination of resection margins
: Low cost, fast technique



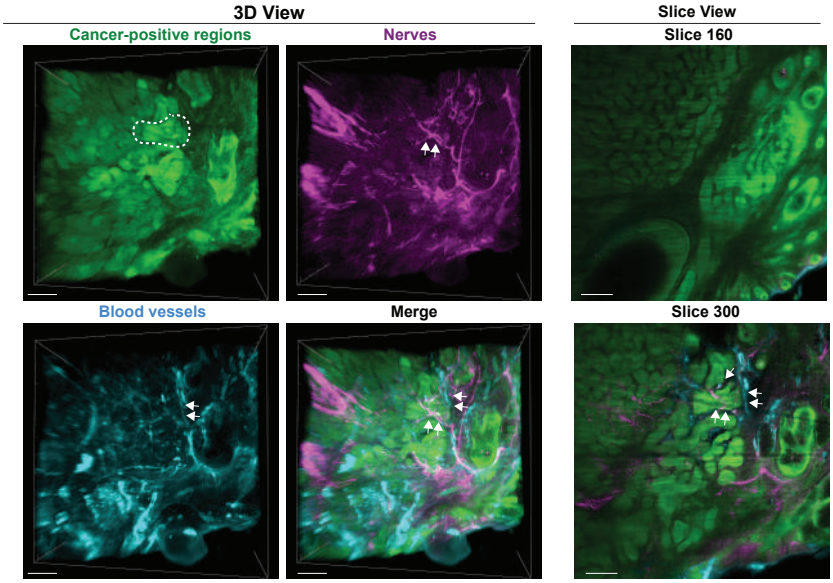
Potential Clinical Applications of 3D TIssue Imaging:
- Surgical excision: complete cancer margin examination of excised cancer.
- Mohs Micrographic Surgery: complete tumour examination of nerve & blood vessel involvement.

3D Tissue Imaging recapitulates classical BCC histopathological features in H&E



a. Nuclear crowding. Cancer-positive regions typically consist of dense tumour nests (arrows) which are well demarcated from the surrounding stroma.
b. Palisading. A key feature of BCC is the arrangement of cells at the edge of the tumour nest in columnar fashion.
c. Retraction clefting. Retraction clefting refers to the empty space (arrows) associated with tumour nests (asterix) which form due to contraction of mucin deposited around the tumour nest during fixation.

3D Tissue Imaging allows for detection of nerve & blood vessel abutment in tumour



Fluorescence microscopy images in 3D fluorescence views of cancer-positive regions (green), nerves (magenta) and blood vessels (cyan) within a cancer sample at 2.5x magnification.
Nerves (arrows) traversing the tumour nodule (dotted region) with blood vessels lining the side of the tumour (arrows) are visible in the 3D rendering and slice view. Scale bar, 400 µm.

Conclusion

3D Tissue Imaging provides additional information to the clinician for patient management through:
(1) complete examination of surgical margins
(2) detection of cancer progression by visualising nerve & blood vessel abutment