THE DIAGNOSIS OF CUTANEOUS LESIONS OF THE HEAD AND NECK USING OPTICAL COHERENCE TOMOGRAPHY

Jerjes W, Hamdoon Z, McKenzie G, Hopper C

Optical coherence tomography

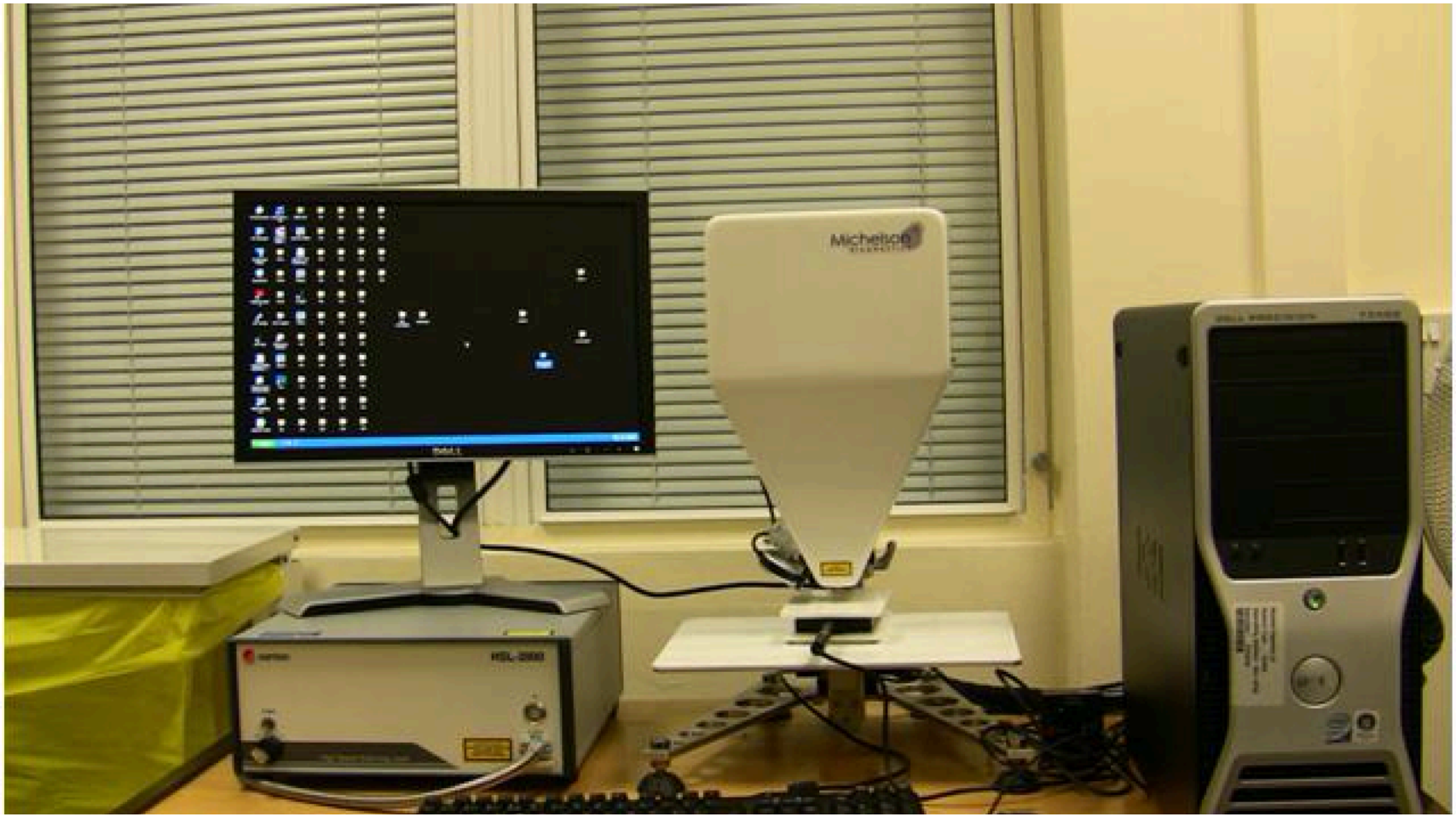
- OCT has been shown to reliably identify tissue changes in skin lesions.

- The objective of this study was to assess the diagnostic value of defined histologic parameters in differentiating skin pathologies.

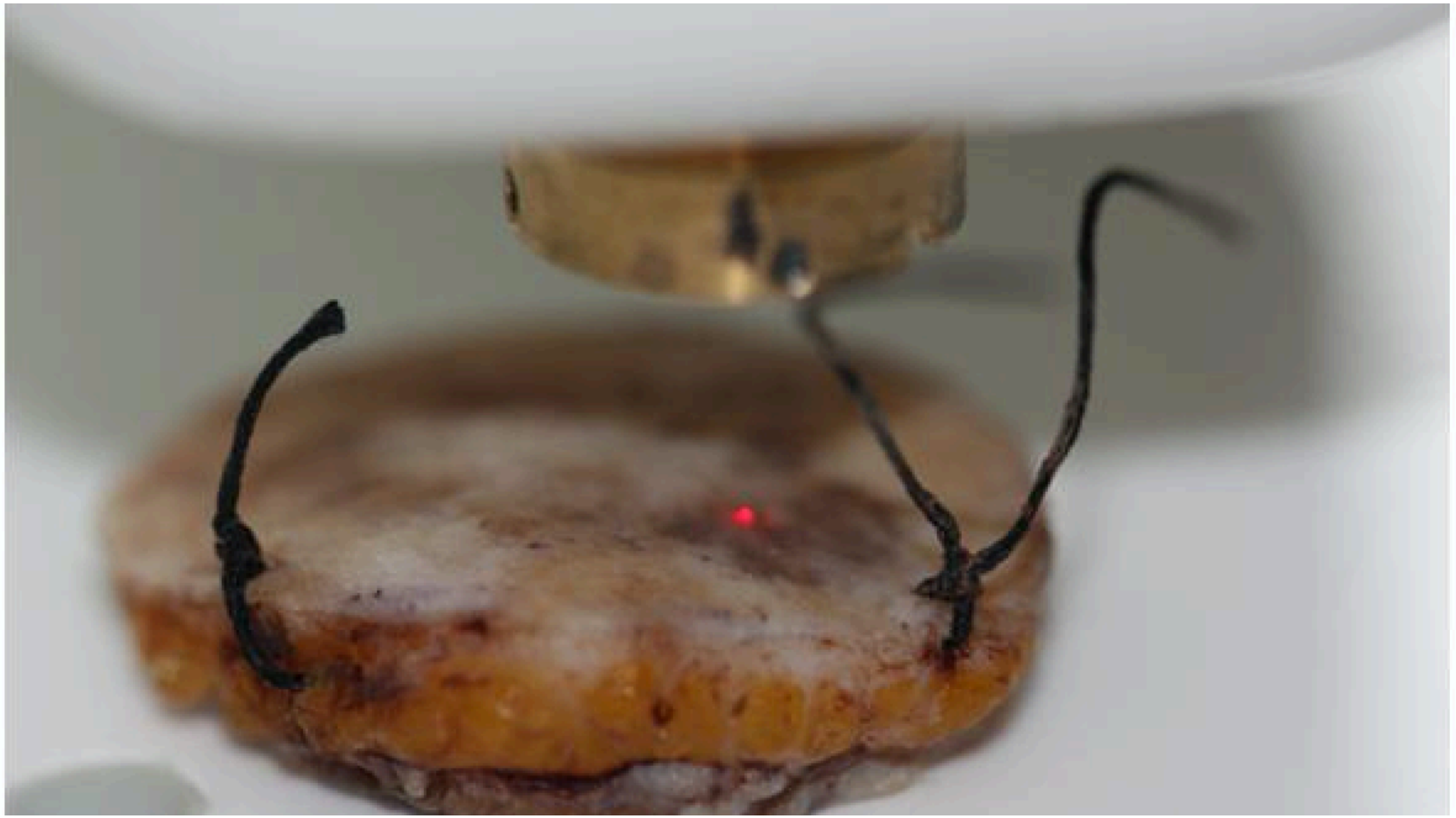
Ex-vivo study

- 103 patients with 110 lesions were included who were suspected of having skin cancer.
- 110 facial lesions were clinically examined and then removed surgically, then scanned with OCT.
- Only excisional biopsies have been included.

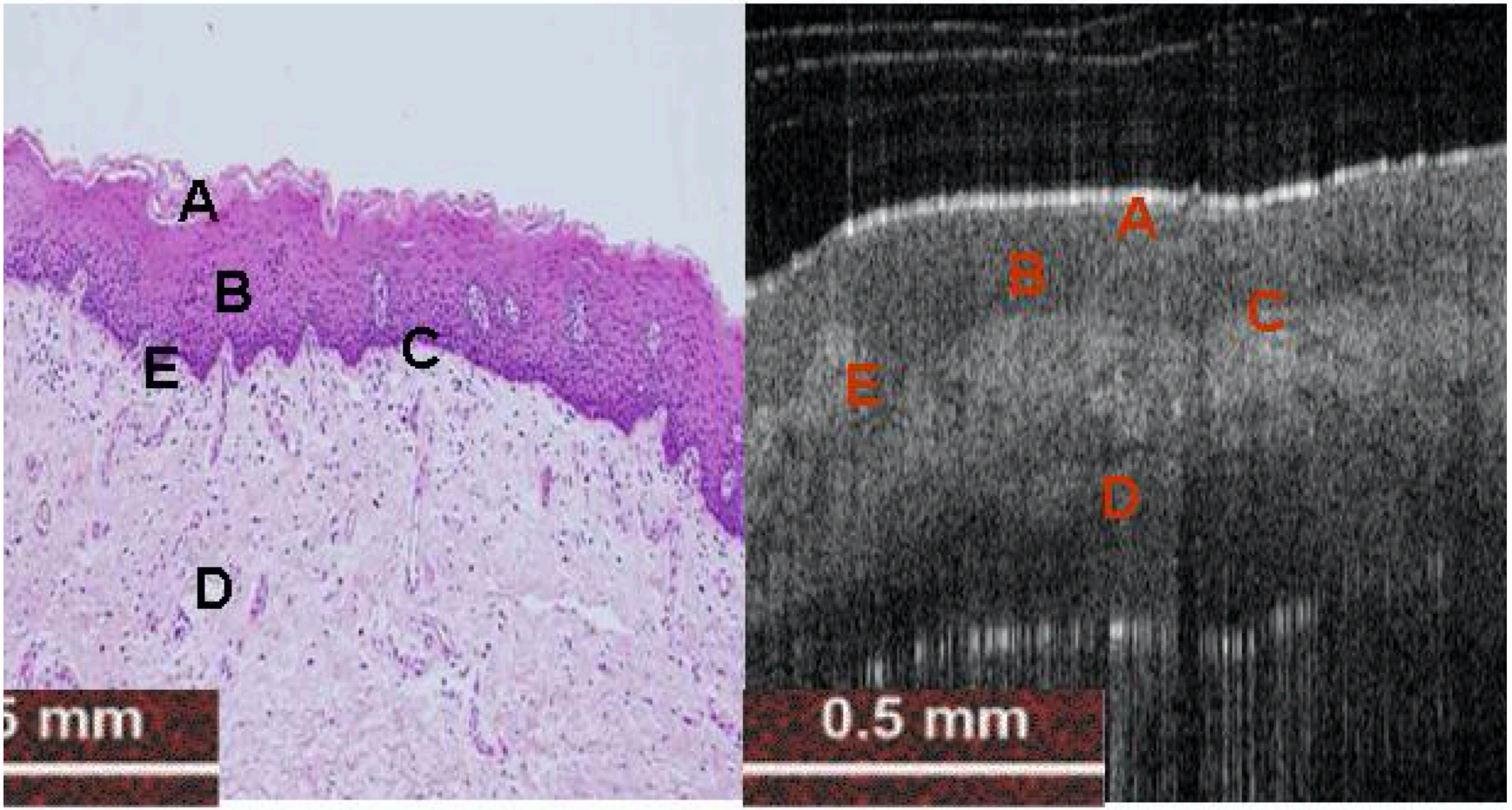
Schematic view of the lab based OCT machine

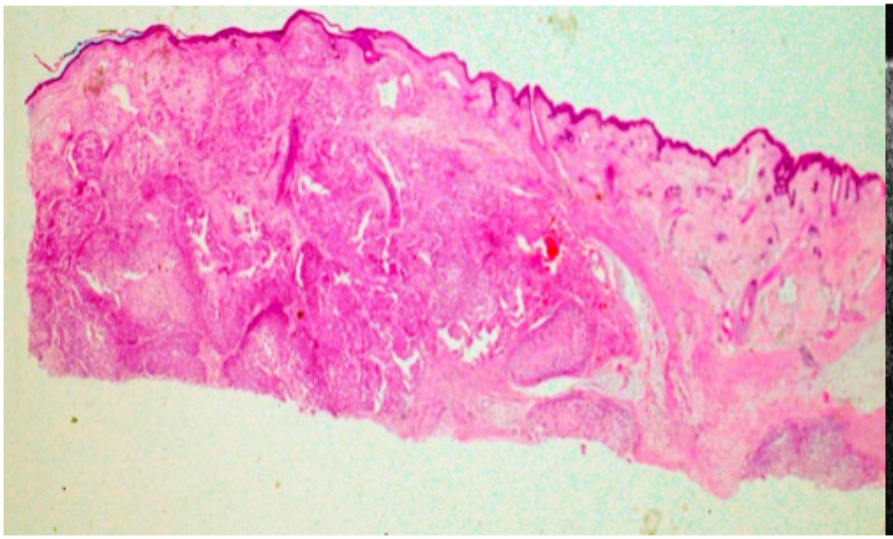


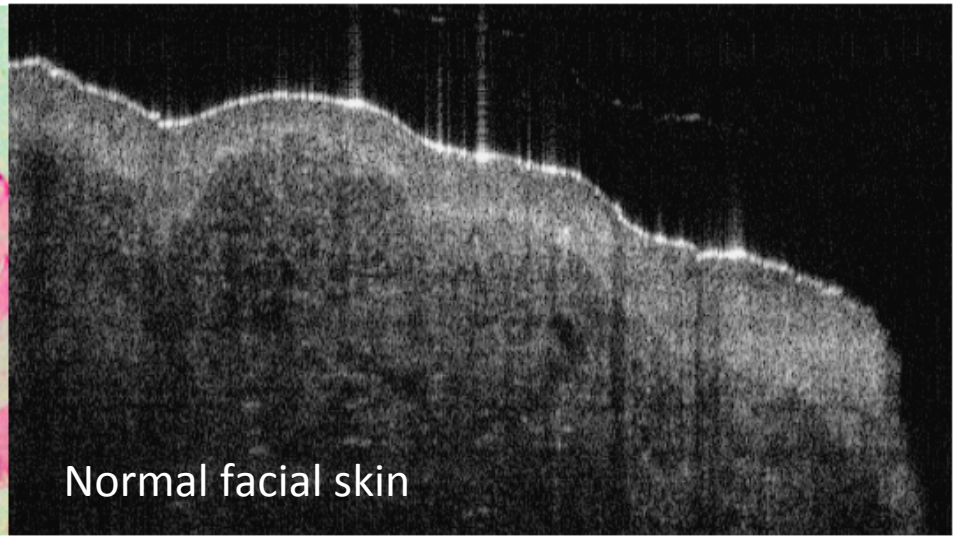
Specimen with orientation suture under OCT scanning arm with laser guiding beam. The scanned area is between the two reference sutures

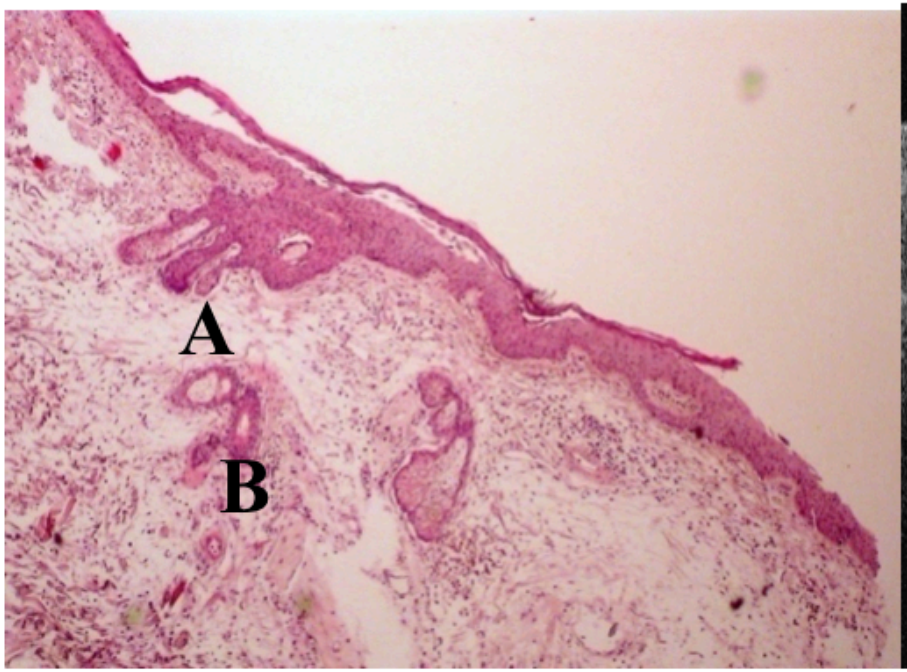


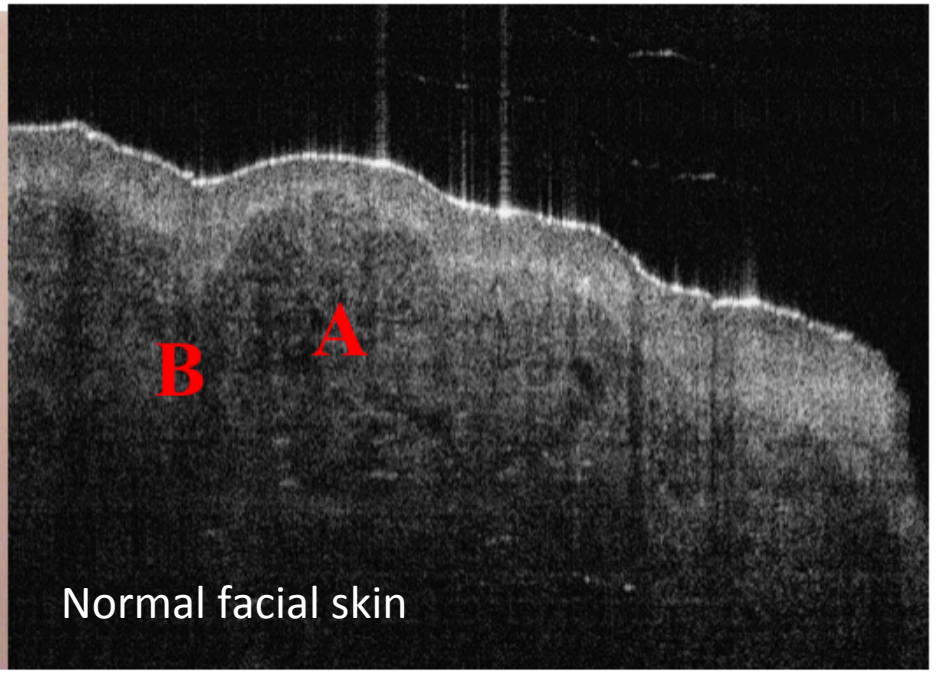
Histology versus OCT scan for normal skin margin of the cheek showing three distinctive layers. A: representing the stratum corneum, B: epidermis, C: DEJ, D: Dermis, E: papilla. Correlation was good for the stratum corneum, epidermis while few large and prominent papilla has been correlated






Normal facial skin


A
B


B
A
Normal facial skin

Part 1 of study

- Identify the normal and abnormal parameters

Part 2 of study

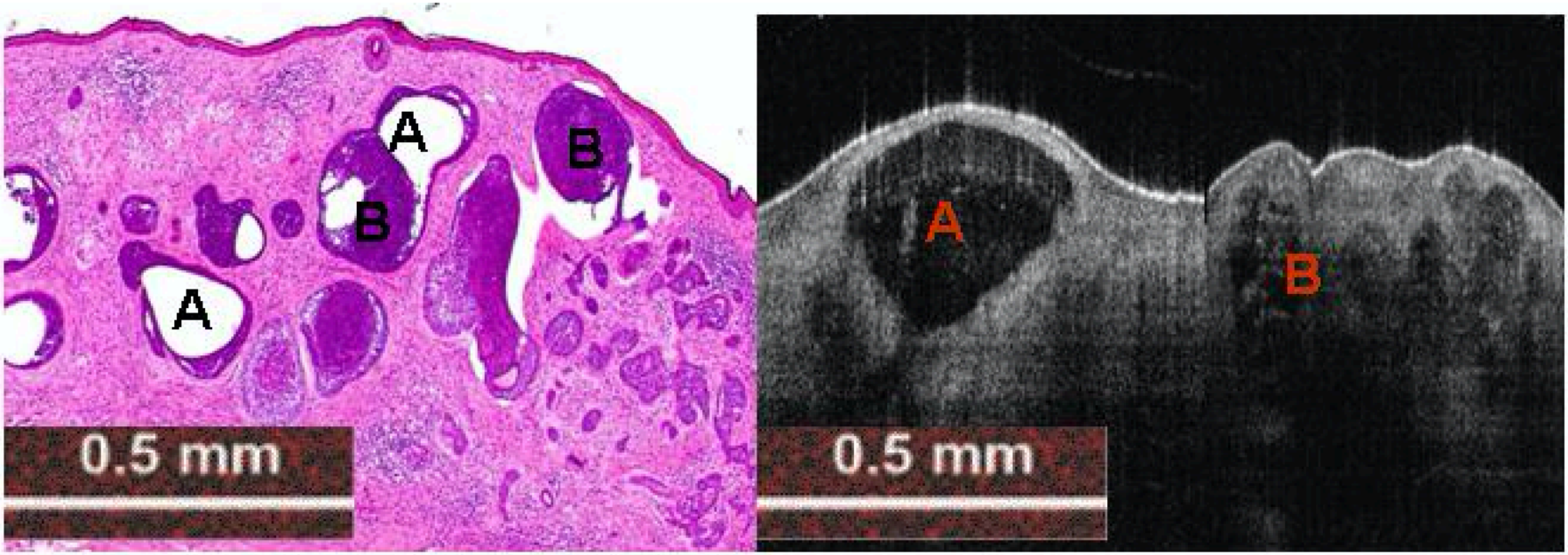
- 2 examiners (blinded to the diagnoses) studied the OCT parameters of skin lesions and looked at the study cohort

Part 1

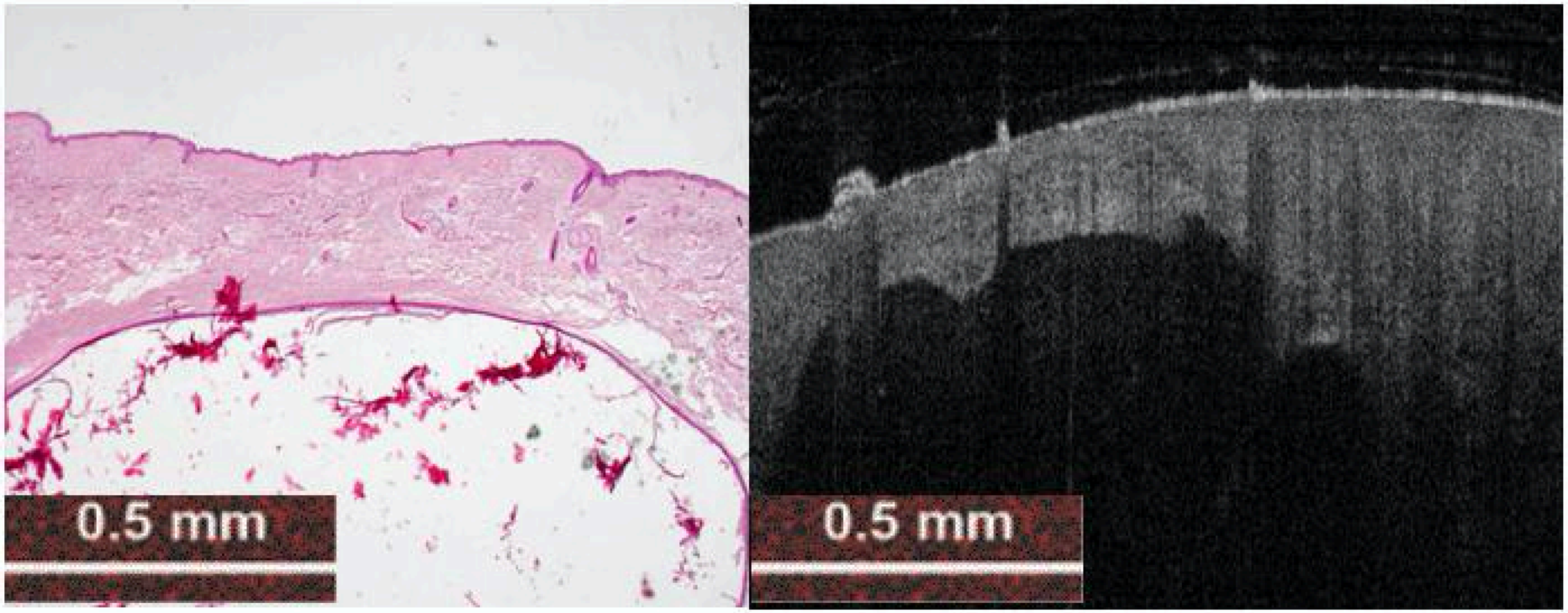
Identified OCT parameters - BCC

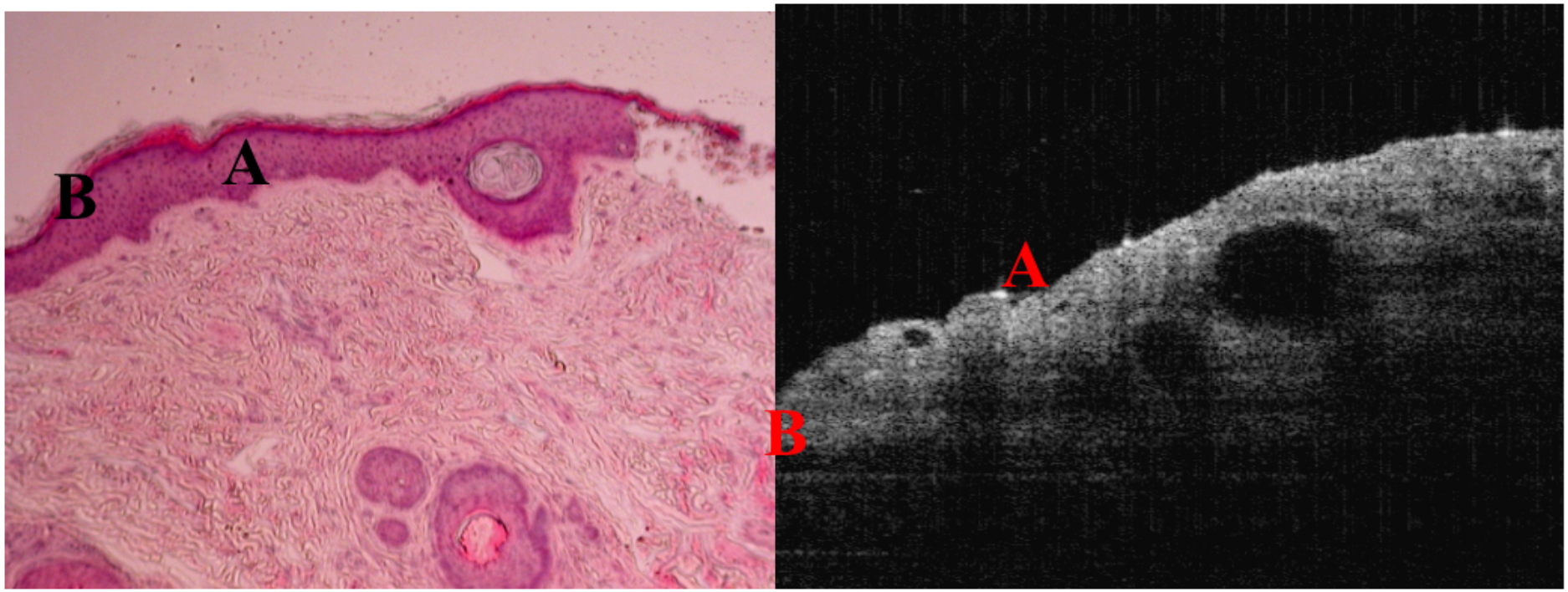
- Single or multiple nodules in the form of a solid or honeycombed compartment (nest) is a typical feature for nodular BCC.
- Empty space below dermo-epidermal junction (DEJ) is a diagnostic feature for cystic BCC.
- Hypoecostic space of 150µm to be the maximum diameter for microcystic BCC.

Mixed cystic (A) and solid (B) BCC



Giant cystic BCC showing lobular hypo-echoic OCT feature occupying large portion of dermis layer





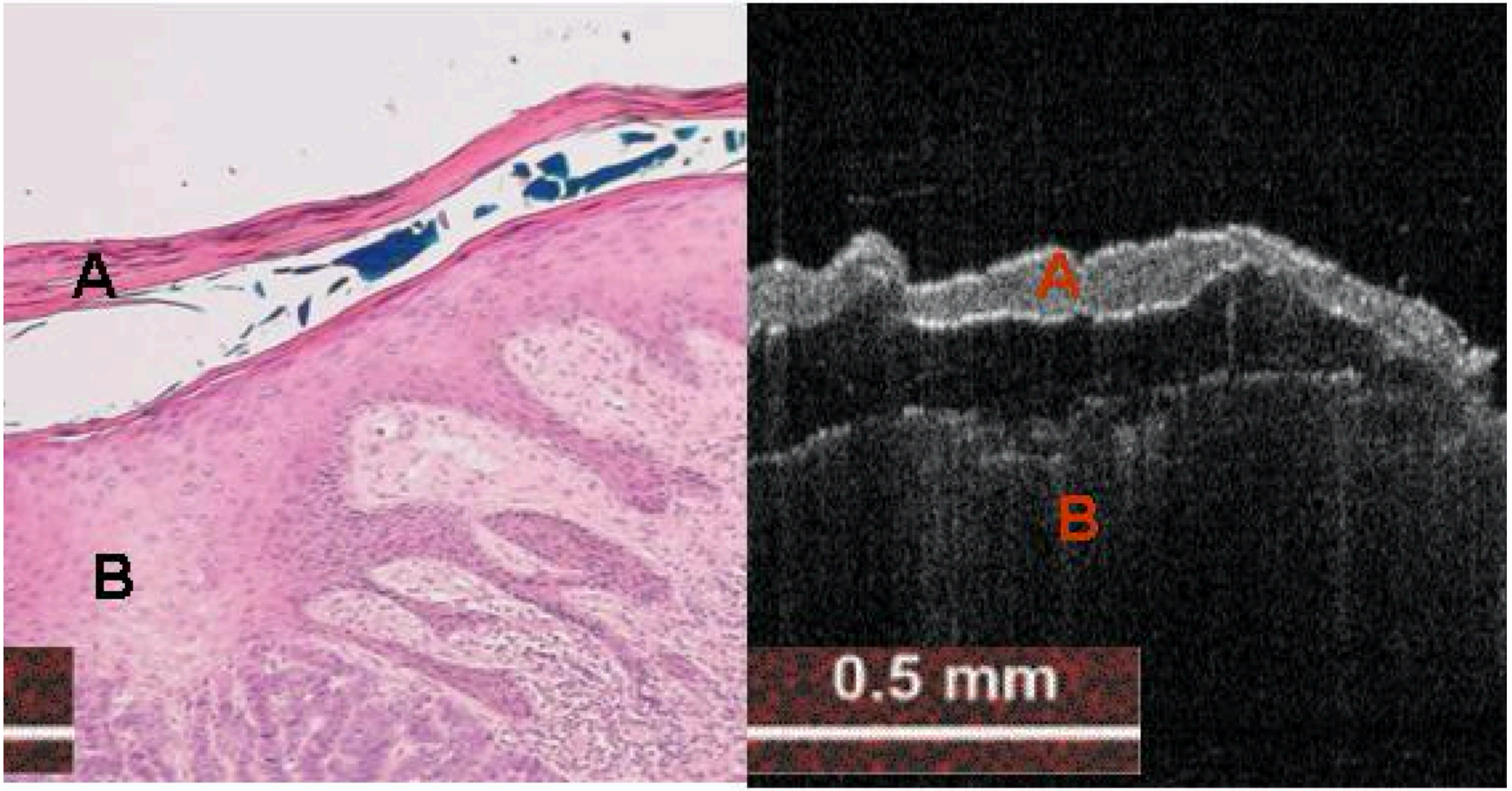
BCC within the epidermis layer (A) without damaged DEJ (B)

Part 1

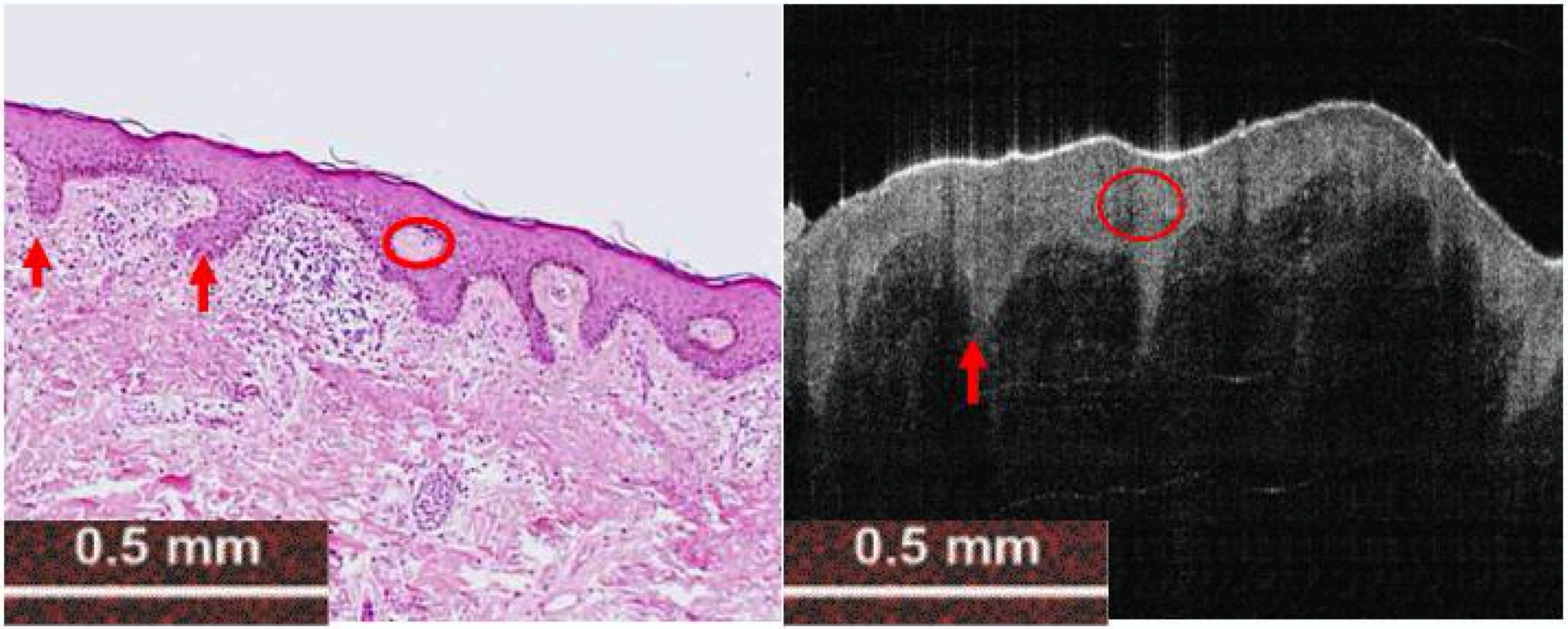
Identified OCT parameters - Lentigo maligna and AK

- Lentigo maligna, characterized by a predominantly uniformly elongated rete ridge. Uniform nests within the epidermis.
- Hyper parakeratosis/hyperkeratosis and/or stratum corneum disruption are diagnosable features for AK.

AK showing damage to stratum corneum layer (A) with thick epidermis (B) but intact dermo-epidermal junction



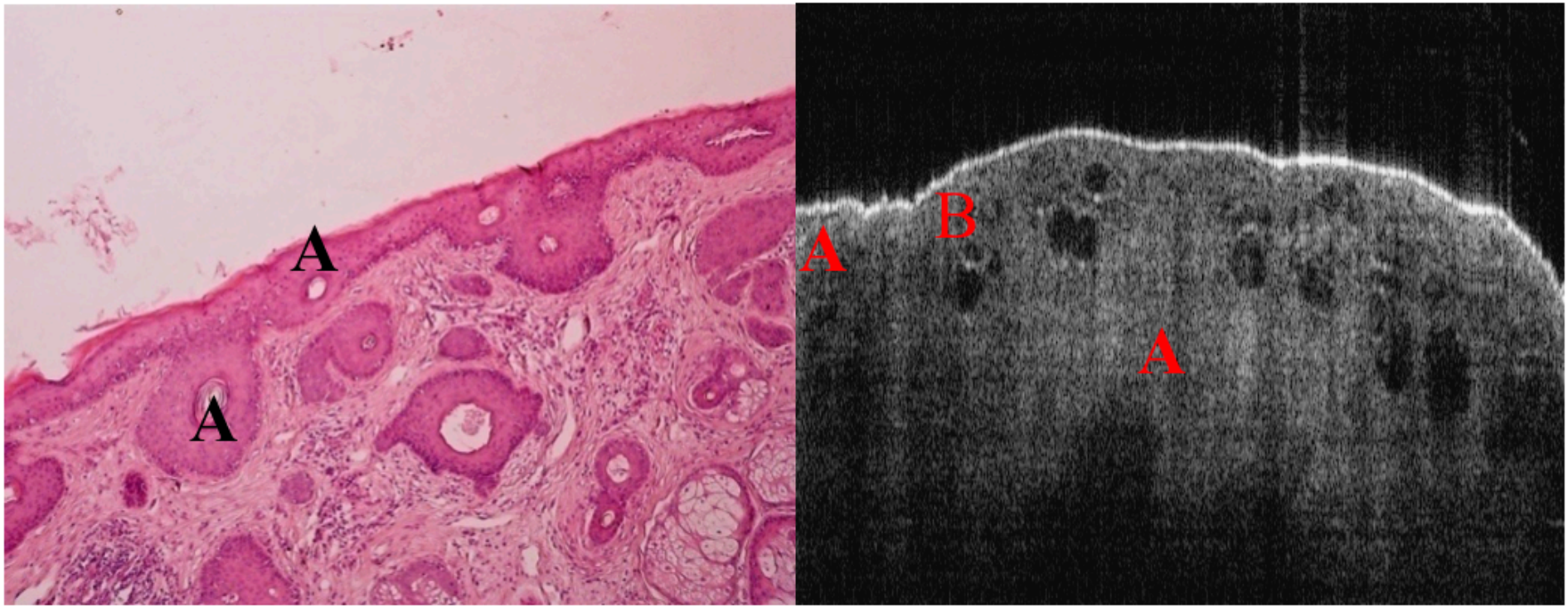
Lentigo maligna, characterized by a predominantly uniformly elongated rete ridges (arrow). Uniform nests within the epidermis (circle).



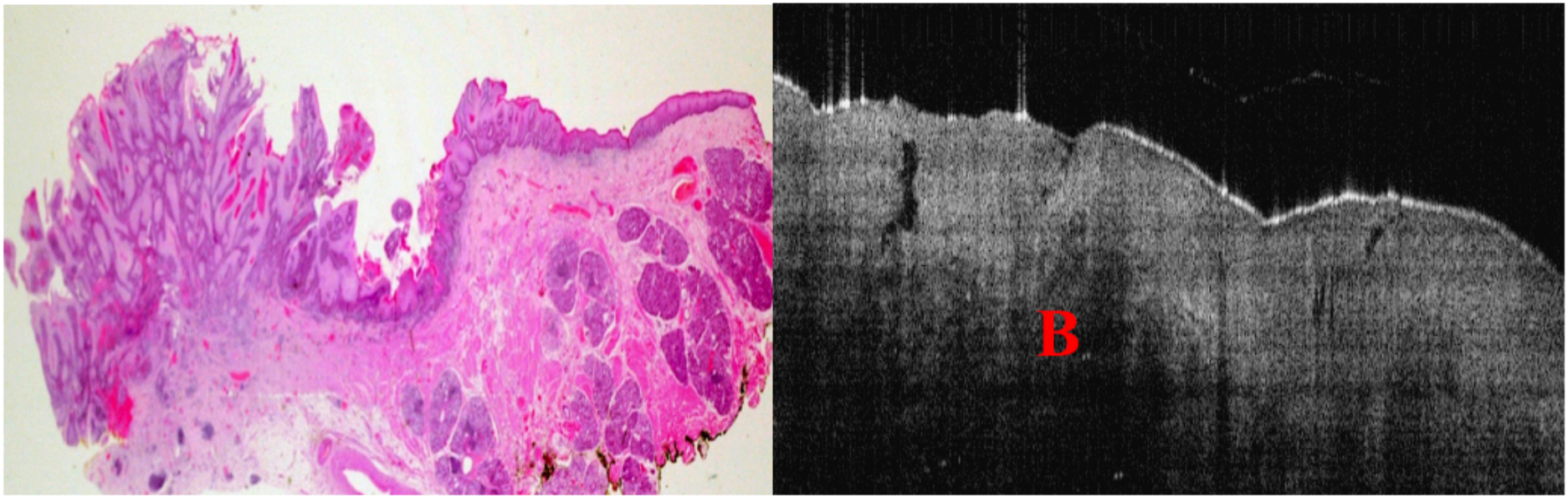
Part 1

Identified OCT parameters - SCC

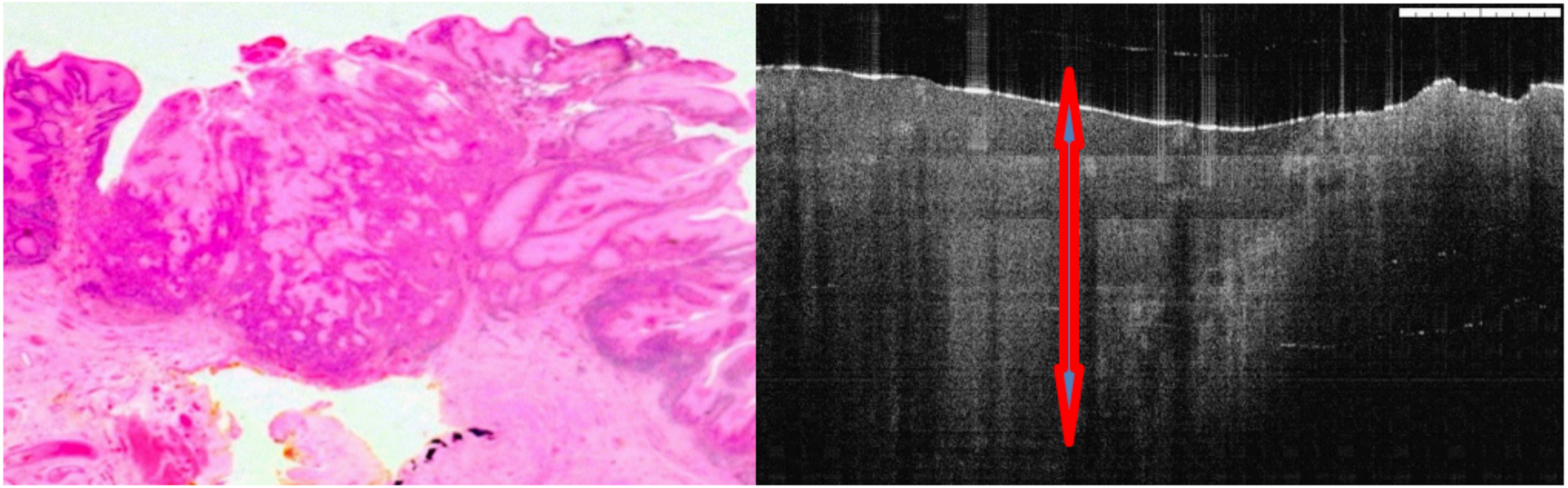
- DEJ that have lost itsintegrity with or without the presence of small bright clusters in the papillary dermis and damage to the superficial epidermal layers (honeycombed, broadened, cobblestone).



Superficial and deep lobular SCC (A) extending beyond the DEJ which is damaged in some areas (B)

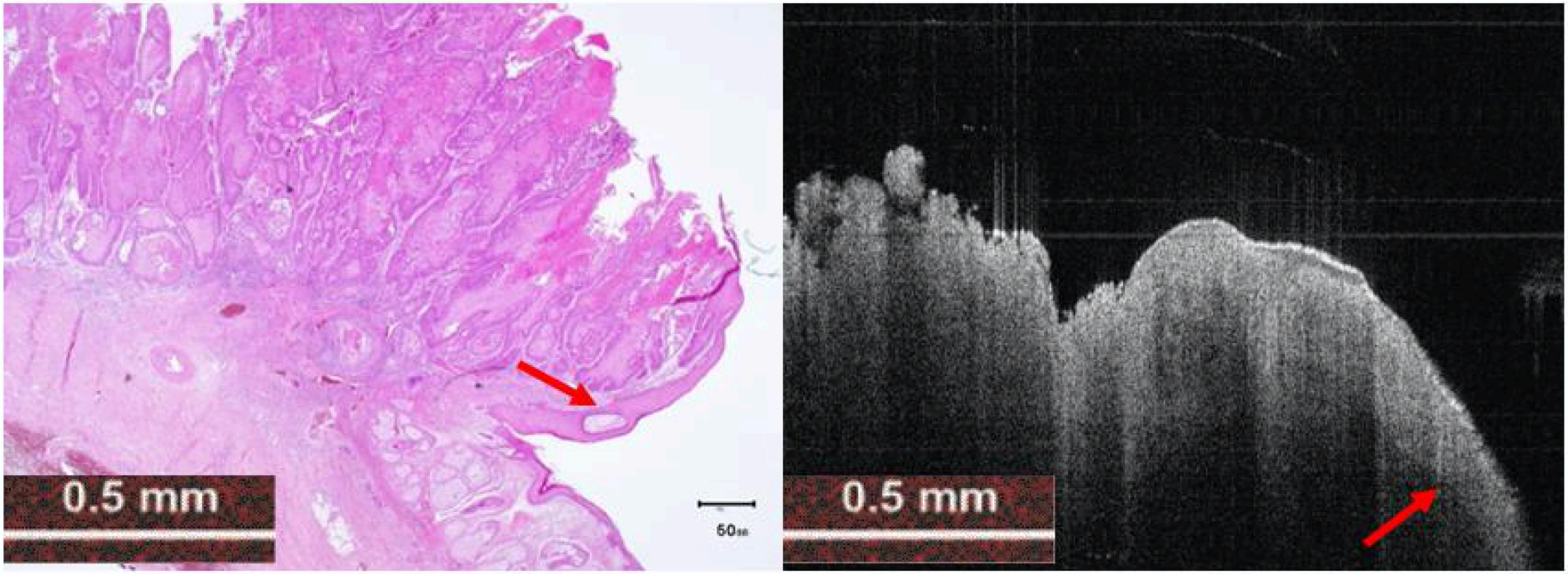


SCC lesion with epidermal hyperplasia and reactive keratosis of stratum corneum layer



SCC tumour thickness exceeding 2 mm. OCT effective depth is 2mm.

SCC showing the transitional area between intact and damaged DEJ (red arrow)

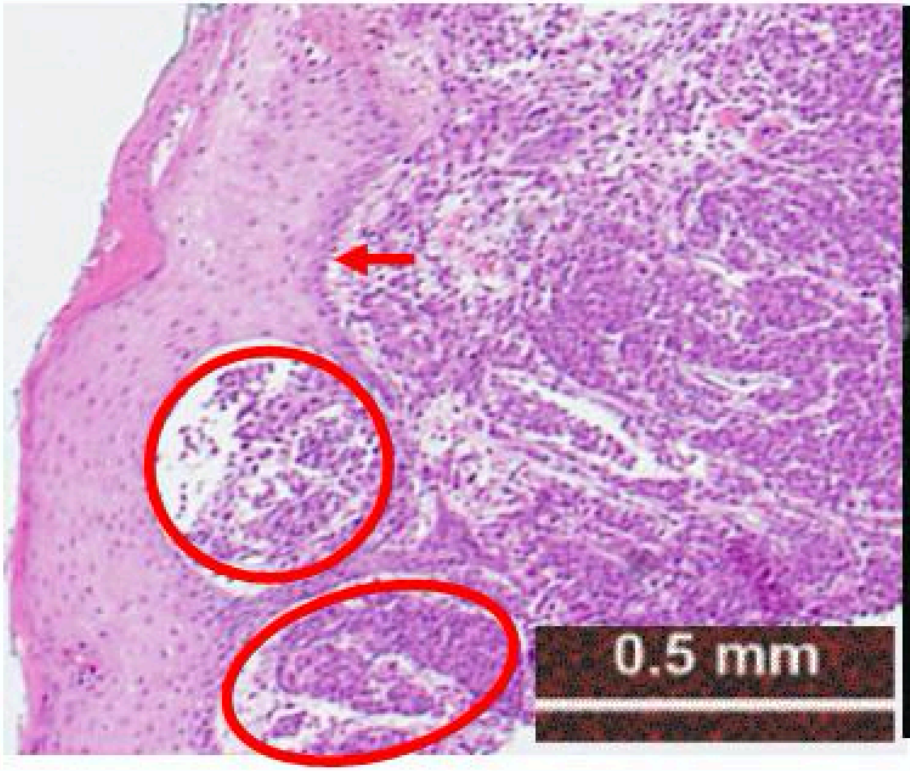


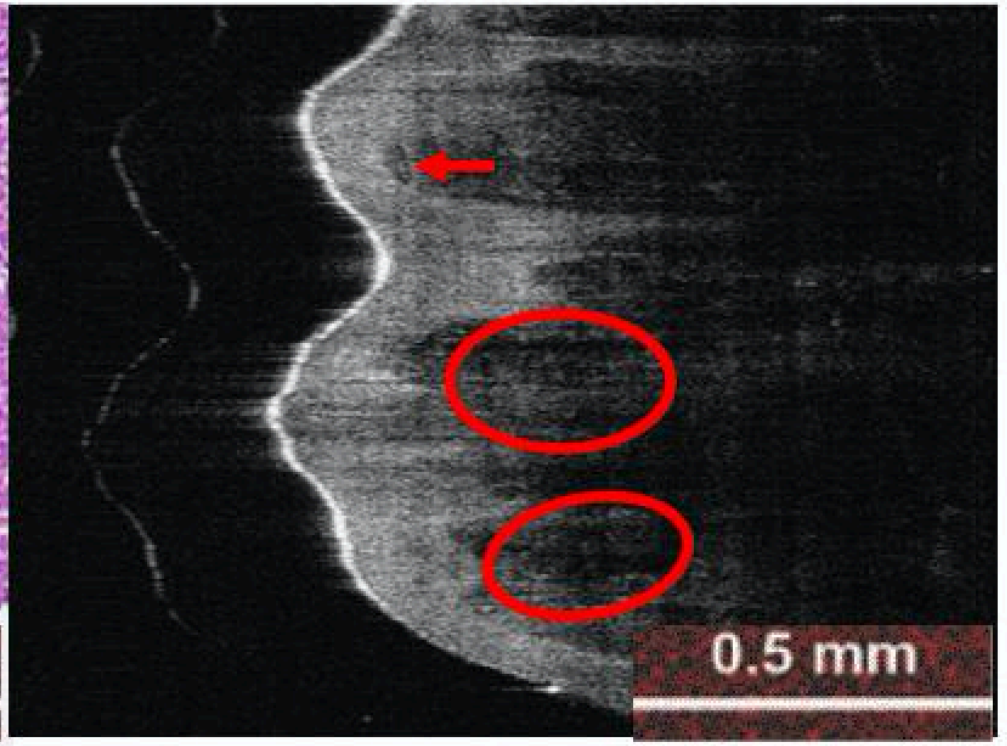
Part 1

Identified OCT parameters - malignant melanoma

- In malignant melanoma, loss of the typical bright horizontal linear structures with architectural disarray and diffuse or patchy reflectivity, non-edged papillae with cerebriform clusters infiltrating dermal papillae and intact DEJ were the main diagnostic features.

Malignant melanoma, non-edged papillae (arrow), cerebriform clusters infiltrating dermal papillae (circle), diffuse or patchy reflectivity, partial loss of the typical bright horizontal linear structures.





Part 2

Assessment of AK

- Examiner 1

Sensitivity 95%

Specificity 100%

PPV 100%

NPV 99%

Accuracy of OCT 99%

- Examiner 2

Sensitivity 100%

Specificity 100%

PPV 100%

NPV 100%

Accuracy of OCT 100%

Part 2

Assessment of LM

- Examiner 1

Sensitivity 60%

Specificity 90%

PPV 73%

NPV 95%

Accuracy of OCT 85%

- Examiner 2

Sensitivity 50%

Specificity 89%

PPV 31%

NPV 94.6%

Accuracy of OCT 85.4%

Part 2

Assessment of BCC

- Examiner 1

Sensitivity 98%

Specificity 96%

PPV 96%

NPV 98%

Accuracy of OCT 97%

- Examiner 2

Sensitivity 98%

Specificity 94.5%

PPV 94.5%

NPV 98%

Accuracy of OCT 96%

Part 2

Assessment of SCC

- Examiner 1

Sensitivity 80%

Specificity 95%

PPV 75%

NPV 96%

Accuracy of OCT 93%

- Examiner 2

Sensitivity 86.6%

Specificity 94.7%

PPV 72%

NPV 97.8 %

Accuracy of OCT 93.6%

Part 2

Assessment of MM

- Examiner 1

Sensitivity 50%

Specificity 75%

PPV 13%

NPV 95%

Accuracy of OCT 73.5%

- Examiner 2

Sensitivity 37.5%

Specificity 77.4%

PPV 11.5%

NPV 94%

Accuracy of OCT 74.5%

High overall levels of intra- and inter-observer agreement were recorded for most of the evaluated features, except for the thickening and the status of the dermo-epidermal junction.

Integrity DEJ	0.89
Solid nest within the epidermis	0.92
Thickening of DEJ with or out protruding clusters	0.60
DEJ status	0.55
Stratum corneum disruption	0.72
Stratum corneum thickening	0.80

Conclusion

- OCT continues to show great promise in classifying premalignant and malignant skin lesions
- Thank you