Optical coherence tomography-guided photodynamic therapy for skin cancer

Zaid Hamdoon
UCLH Head and Neck Centre
Photodynamic therapy (PDT) has been scientifically used as a novel modality for the treatment of non-melanoma cutaneous malignancies for more than two decades.

This treatment method has an advantage in term of tissue conservation over surgery, which excises esthetical and functionally important tissue.

PDT has shown a 75%-100% cure rate for basal cell carcinoma, actinic keratosis, Bowen’s disease, and initial squamous cell carcinoma.
Principles of PDT:

PDT therapy requires the simultaneous presence of light, photosensitizer (PS) and oxygen.

Optimal treatment outcome can not only achieved by these three parameters.
Tumour margins assessment

How accurate is the visual assessment of skin margins?

More than 30% error in the assessment.

High resolution Ultrasound

1-poor resolution to define early cancer.
2-poor contrast.
Fluorescence-guided surgery


No-melanoma skin cancer study.
This open, non-comparative case series study

- Ethical approval acquired
- Informed consent
- Exclusion criteria included:
  1-previous, surgery, cryotherapy used within 2 months of the study.
  2-history of photodermatoses.
  3-pregnancy or lactation.

- Carried out at UCLH
- 12 patients with consecutive 18 skin lesions
Demographics

- Age 37-78
- Gender: 5 (42%) M; 7 (58%) F
- Clinical features: papule 5(42%), Nodule 4(33%), ulcer 3 (25%)
- Site: Cheek 4 (22%), Forehead 4 (22%), Nose 4 (22%), Nasolabial fold 2(11%), Lower eyelid 1(5.5%), Lower lip 1(5.5%), Upper lip 1(5.5%)
- Fitzpatrick skin types: Type II 3(25%), Type III 4 (33%), Type IV 5(42%)
Aims of study

- to demonstrate the technical feasibility of OCT to map real tumor margins
- to monitor skin changes that occurred after PDT
- Final clinical and aesthetic outcome
Study setting

- Foscan (mTHPC) 0.05 mg/kg, was slowly administered intravenously into an antecubital vein.

- 48 h later laser illumination of the lesion surface by 200 J/cm² red light 630 ± 15 nm. Anesthesia may or not need.

- patients were advised to avoid bright ambient light for 4 weeks.
Conventional way
In-vivo Optical coherence tomography image guiding
Outcome measures

Results 1, 3, 6 and 12 months after last treatment were obtained.

The primary outcomes were the clinical lesion response at 6 months:
1-CR: complete clearance of the lesion
2-Non-CR: (non-complete clearance of the lesion)
3-partial response (PR).

The secondary outcomes were as follows: lesion recurrence at 12 months.

The cosmetic outcome assessed by the investigator at 12 months on a 4-point scale.

(0: poor, 1: fair, 2: good, 3: excellent).
Baseline Evaluation of the OCT images

Morphometric and architectural features of OCT images obtained before and after PDT

Our previous study on skin cancer set diagnostic Criteria:

Normal
Transition from the normal area toward diseased area
Early stage AC with strong signal reflection at the stratum corneum layer which is already separated from the epidermis.
Advanced squamous cell carcinoma of check with area of transition from normal toward thickened epidermis with dermis invasive. The area of advance invasion show hypoechoic feature as a sign of tumor cells necrosis.
Single nodular basal cell carcinoma lesion showing a single hyporeintensive tumour nest

Multinodular basal cell carcinoma presenting as multiple, closely arranged, distinct cancer lobule
Mixed cystic and nodular basal cell carcinoma lesion showing two distinctive hyporeflective areas.
AK

Baseline

1 month

Six month
Nodular BCC

Baseline

1 month

Six month
Final outcome

Primary outcome: complete clearance of the lesion
Secondary outcome: no recurrence
Aesthetic outcome: excellent
Primary outcome: complete clearance of the lesion
Secondary outcome: no recurrence
Aesthetic outcome: good
Primary outcome: complete clearance of the lesion
Secondary outcome: no recurrence
Aesthetic outcome: fair
Primary outcome: partial clearance of the lesion
Aesthetic outcome: fair
Cosmetic camouflaging
Clinical response

Clinical CR in full list time was observed in seventeen (94.5%) lesions and PR in one (5.5%), the total response rate was 100%. Among there were 17 cases of CR, 10 cases completely disappeared after the third month, 5 after the sixth, 3 after 12 months.

For 1 PR case, even though the tumours did not disappear completely, their margins cleared distinctly (100%) at the end of pdt.

Cosmesis
Conclusion

1-This study demonstrates the feasibility of OCT to detect, monitor, and quantify changes after PDT.

2-OCT imaging system provided a unique opportunity to assess the effects of PDT on normal skin.

3-OCT does indeed aid in the planning of PDT.

4-OCT-guided PDT has been shown to be an inexpensive and valuable guide in the treatment of nonmelanotic cutaneous malignancies.
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