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Line-field confocal optical coherence tomography of eyelid margin growths: A case series

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Abstract

Background: The clinical differential diagnosis of lesions arising on the eyelid margin may be challenging and an unneeded surgical approach may have serious functional and aesthetic consequences. Nonetheless, early recognition and treatment of malignant tumors of the eyelid margin is mandatory. Line-field confocal optical coherence tomography (LC-OCT) is a novel tool for the in vivo, real-time skin imaging.

Objectives: The aim of the study was to identify and analyze the LC-OCT features of a series of eyelid margin growths and to correlate these features with the histopathological findings.

Methods: Patients with eyelid margin growths who were scheduled for lesion excision underwent LC-OCT examination. Inclusion criteria were a challenging clinical aspect of the lesions and a clinical history of recent onset (up to 12 months). In all cases, the histopathological examination of the excised lesions was performed for the final diagnosis.

Results: A total of 31 lesions located on the upper (13 cases) or lower (18 cases) eyelid margin from 28 consecutive patients (male = 15, female = 13; mean age: 64.7 years, range: 44–87 years) were evaluated and excised. The histopathologic diagnoses were nodular basal cell carcinoma (BCC) (nine cases), squamous cell carcinoma (SCC) (three cases), compound nevus (four cases), dermal nevus (two cases), seborrheic keratosis (four cases), pyogenic granuloma (one case), trichilemmal cyst (three cases), and hidrocystoma (five cases). LC-OCT allowed the in vivo recognition of the main microscopic features of the examined lesions.

Conclusions: LC-OCT represents a promising tool for the evaluation of eyelid margin lesions. Advantages of non-invasive diagnosis particularly relevant in such a sensitive region include a more correct planning of the treatment and, in case of surgery, the most appropriate surgical approach and, importantly, a correct timing of intervention.

KEYWORDS
basal cell carcinoma, eyelid, imaging, line-field confocal optical coherence tomography, palpebral

1 | INTRODUCTION

Lesions arising on the eyelid margin represent an interdisciplinary issue that may involve different specialties, including ophthalmologists, dermatologists, and plastic surgeons. The clinical differential diagnosis between benign and malignant conditions may be challenging and an unneeded surgical approach may have serious functional and aesthetic consequences. Nonetheless, early recognition and treatment of malignant tumors of the eyelid margin is mandatory.

Previous studies on eyelid margin tumors have reported the usefulness of some non-invasive diagnostic techniques, such as dermoscopy[1,2] and reflectance confocal microscopy.[3] Recently, the use of line-field confocal optical coherence tomography (LC-OCT), a novel tool for the in vivo, real-time skin imaging, is gaining a growing interest, allowing a non-invasive diagnosis of several cutaneous disorders including neoplastic,[4–9] inflammatory[10–13] and infectious[12,14,15] conditions. LC-OCT enables the recognition of different layers of epidermis (EP) and dermis with cellular resolution. Skin images are displayed on the monitor in real time, and, during the examination, the operator can quickly switch between horizontal or vertical vision. In addition, the presence of an integrated dermoscopic camera allows a precise positioning over the examined area.

The aim of the study was to identify and analyze the LC-OCT features of a series of eyelid margin growths.

2 | MATERIALS AND METHODS

Patients with eyelid margin growths who were scheduled for lesion excision at the Department of Ophthalmology of the University of Catania (Italy) between February 2022 and April 2023 underwent LC-OCT examination in the Dermatology Clinic at the same institution. Inclusion criteria were a challenging clinical aspect of the lesions and a clinical history of recent onset (up to 12 months). LC-OCT was carried out with the commercially available DeepLive (DAMAE Medical, Paris, France), which provides images with an axial resolution of 1.1 μm, a lateral resolution of 1.3 μm, and a field of view of 1.2 mm $\times$ 0.5 mm $\times$ 0.5 mm. During the LC-OCT examination, an eye protector sterile metal plate was used, in order to avoid potential eyeballs damage while performing the procedure. In all cases, the histopathological examination of the excised lesions was performed for the final diagnosis.

3 | RESULTS

A total of 31 lesions located on the upper (13 cases) or lower (18 cases) eyelid margin from 28 consecutive patients (male = 15, female = 13; mean age: 64.7 years, range: 44–87 years) were evaluated and excised. The histopathologic diagnoses were nodular basal cell carcinoma (BCC) (nine cases), squamous cell carcinoma (SCC) (three cases), compound nevus (four cases), dermal nevus (two cases), seborrheic keratosis (four cases), pyogenic granuloma (one case), trichilemmal cyst (three cases), and hidrocystoma (five cases). The LC-OCT features and the corresponding histopathological diagnoses are showed in Table 1.

4 | DISCUSSION

In our series of patients, LC-OCT allowed the in vivo recognition of the main microscopic features of the examined lesions.

The LC-OCT features that we observed in BCC, SCC, compound/dermal nevus, seborrheic keratosis, and pyogenic granuloma are in line with those already reported for the same lesions in other cutaneous areas.[6,7,9,16,17] In eyelid BCC (Figure 1), LC-OCT revealed the typical diagnostic findings, including tumor basaloid islands with a laminated, "millefeuilles", structure and dark clefting, altered dermoepidermal junction (DEJ), and prominent vessels. In eyelid SCC, LC-OCT revealed hyperkeratosis with acanthosis, marked atypical epidermal pattern, disrupted DEJ, and tumor budding and dilated vessels in the upper dermis. In eyelid compound/dermal nevus (Figure 2), LC-OCT revealed a regular honeycomb pattern, junctional and/or dermal nests with a typical "wave" pattern and a well-defined DEJ with regular papillae. In eyelid seborrheic keratosis, LC-OCT revealed hyperkeratosis, acanthosis, regular honeycomb pattern, papillomatosis, epidermal invaginations harboring structureless amorphous material (keratin-filled invaginations), elongated bright tubular structures (cords), and roundish hyperreflective, intraepidermal structures (pseudo-horn cysts). In eyelid pyogenic granuloma, LC-OCT revealed a normal EP and, in the dermis, elongated and roundish dark areas, corresponding to vascular lacunae, filled with bright elements, likely related to blood cells and inflammatory cells. Finally, in our cases of eyelid trichilemmal cyst and hidrocystoma (Figure 3) we observed the presence of a thinned EP pushed and compressed from below by a roundish, regular dermal cyst lined by bright thick contour and filled with a hyperreflective amorphous materials or a hyporeflective fluid content, respectively. In both cases, it was not possible to visualize the deeper portion of the lesions. The LC-OCT features of trichilemmal cyst and hidrocystoma have not previously been reported.

Based on our preliminary findings, some considerations can be made. LC-OCT is perfectly suitable for the examination of lesions of this anatomic region, as the handheld probe may be easily positioned and rapidly moved also on eyelid margin for the real-time evaluation and the image acquisition. The integrated dermoscopic camera is very helpful for the precise navigation in the study area. We strongly recommend using an eye protector in order to avoid potential eyeballs

TABLE 1 Results: Histopathological diagnosis and LC-OCT features.

Histopathological diagnosis	Number of cases	LC-OCT features
Nodular basal cell carcinoma	9 cases	In the dermis, hyporeflective ovoid lobules/nests of different shape and size with a laminated ("mille feuilles") structure of the core (tumor basaloid island) and surrounded by a dark rim (clefting) and dilated vessels. The lobules are separated from a normal, thinned epidermis altering the dermoepidermal junction profile
Squamous cell carcinoma	3 cases	Hyperkeratosis with acanthosis, atypical keratinocytes with variable size and shape in the epidermis (atypical, honeycombed pattern), disrupted dermoepidermal junction, tumor budding and dilated vessels in the upper dermis
Compound/dermal nevus	6 cases	Normal epidermis with a regular honeycomb pattern; junctional and/or dermal nests with a typical "wave" aspect and a well-defined dermo-epidermal junction
Seborrheic keratosis	4 cases	Hyperkeratosis, acanthotic epidermis, regular honeycomb pattern normal dermo-epidermal junction, papillomatosis. Epidermal invaginations harboring structureless amorphous material (keratin-filled invaginations), elongated bright tubular structures (cords), and roundish hyperreflective, intraepidermal structures (pseudo-horn cysts)
Pyogenic granuloma	1 case	Normal epidermis with a regular honeycomb pattern and, in the dermis, linear and roundish dark areas filled with bright elements, likely related to blood cells and inflammatory cells
Trichilemmal cyst	3 cases	Normal, though thinned epidermis, pushed and compressed from below by a roundish, regular dermal cyst lined by bright thick contour and containing dense, hyperreflective amorphous materials
Hidrocystoma	5 cases	Normal, though thinned epidermis, pushed and compressed from below by a roundish, regular dermal cyst lined by bright thick contour and filled with a hyporeflective fluid content

Abbreviation: LC-OCT, line-field confocal optical coherence tomography.

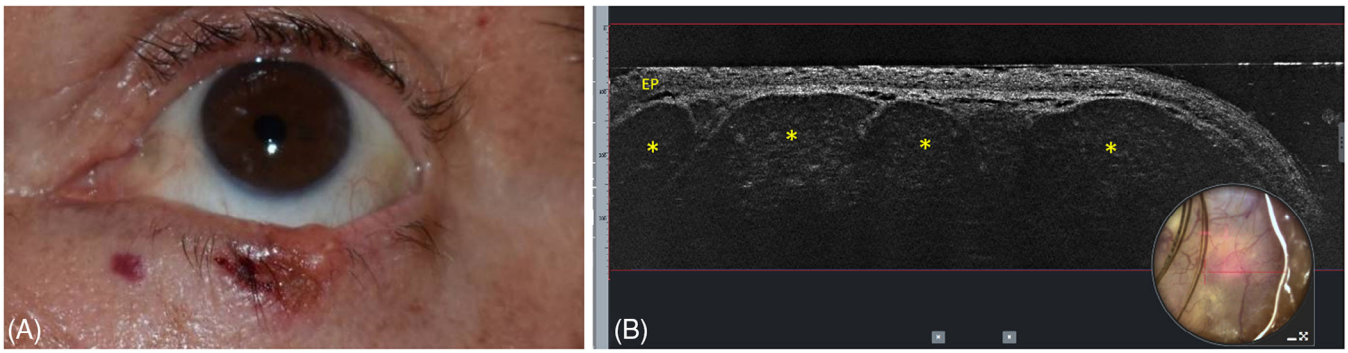

FIGURE 1 Nodular basal cell carcinoma (BCC) of the lower eyelid margin (A). Vertical line-field confocal optical coherence tomography (LC-OCT) shows a thin, normal epidermis (EP) and dermal hyporeflective ovoid lobules/island (asterisks) with a laminated ("millefeuilles") structure (B).

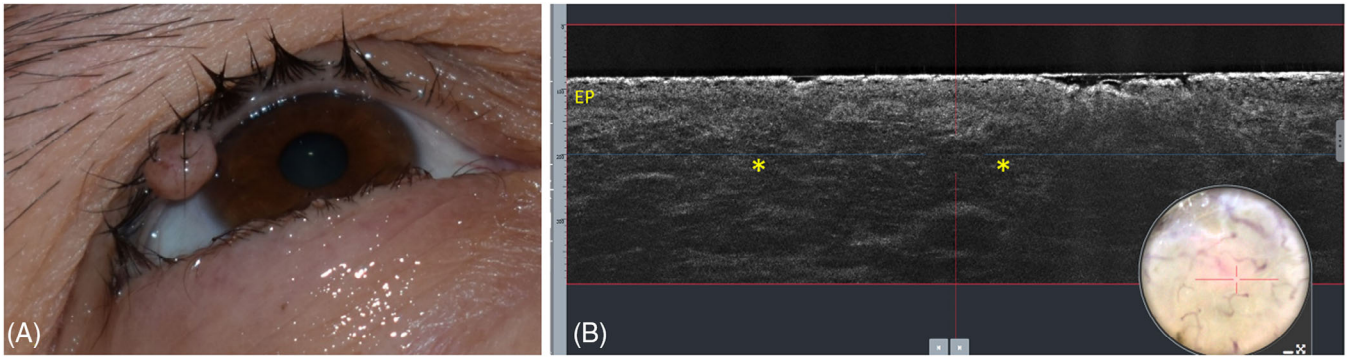

FIGURE 2 Compound nevus of the upper eyelid margin (A). Vertical line-field confocal optical coherence tomography (LC-OCT) shows a regular epidermis (EP) and junctional/dermal nests with a typical "wave" aspect (asterisks) (B).

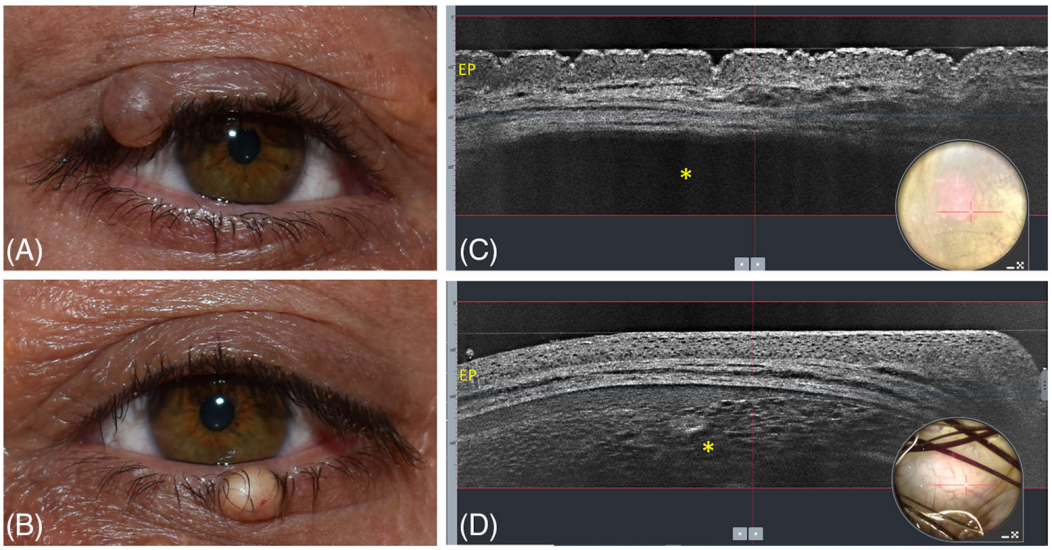

FIGURE 3 Patient presenting a hidrocystoma in the upper eyelid of the right eye (A) and a trichilemmal cyst on the lower eyelid margin of the left eye (B). Vertical line-field confocal optical coherence tomography (LC-OCT) shows in both cases a normal epidermis (EP), pushed and compressed from below by a roundish, regular dermal cyst (asterisks) lined by bright thick contour and containing a hyporeflective fluid content in the hidrocystoma (C), and a dense, hyperreflective amorphous material in the trichilemmal cyst (D).

damage while performing the procedure. Although the limited penetration depth of LC-OCT imaging (500 μm) does not always allow the evaluation of the entire lesion and its deeper limits, the features observed in the EP and in the upper dermis generally provide diagnostic information. Advantages of non-invasive diagnosis particularly relevant in such a sensitive region include a more correct planning of the treatment and, in case of surgery, the most appropriate surgical approach (different in case of benign and malignant lesions especially regarding the margins) and, importantly, a correct timing of interventions. Moreover, in case of large lesions, the use of LC-OCT may avoid the diagnostic biopsy procedure generally performed in the pre-operative stage.

In conclusion, the first study investigating eyelid margin lesions using LC-OCT is reported. Although further studies should be performed to validate our data and to better define the diagnostic ability of LC-OCT in eyelid lesions, this imaging technique represents a promising tool with several potential applications in the evaluation of such a difficult-to-access area.

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The authors have nothing to report.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

ETHICS STATEMENT

The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 1983. The patients in this manuscript have given written informed consent to publication of their case details.

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