Evaluation of diode laser-assisted treatment for benign eyelid margin lesions

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Abstract

PURPOSE: To report the treatment response of benign eyelid margin tumors with a laser ablation as an alternative to shaving biopsy

METHODS: Fifty-eight patients with 61 benign tumors of the eyelid margin were included in this study retrospectively (2019–2022). In all patients, the tumor was eliminated by laser ablation or shaving biopsy. Twenty-nine cases were eliminated by laser ablation and 28 cases were removed by shaving excision biopsy. Comparative analysis was done between the laser-assisted ablation patients group: Group 1 and shaving excision surgery patients group: Group 2. Postoperatively, histologic confirmation was obtained in 11 patients of the 28 shaving excision removal cases.

RESULTS: There was no functional or cosmetic complication in group 1. The wound margin was clear after laser-assisted ablation in all cases. There was one notching of the eyelid, loss of cilia, and two pigmentations in group 2. No infections of the wounds occurred. The average wound epithelialization duration was 3.3 weeks in group 1, significantly faster than 4.2 weeks in group 2. No recurrences occurred during the follow-up period.

CONCLUSIONS: Laser ablation of benign eyelid margin tumors may good alternative option regarding shaving excision biopsy surgery. All patients were satisfied with the cosmetic result. There was no definitive postoperative or intraoperative complication during or after laser application.

Introduction

Benign eyelid lesions are common concerns of many physicians in ophthalmology and dermatology daily clinical practice in South Korea. Although surgical excision is a standard primary therapy in managing eyelid lesions, laser ablation has also been reported as an alternative treatment, including argon lasers, erbium YAG lasers, diode lasers, and carbon dioxide lasers [1–4]. Both green (495–570 nm) and yellow (570–590 nm) lasers have a widely used for the treatment of various ocular diseases, including diabetic retinopathy, glaucoma, and central serous chorioretinopathy [5–7]. Since various lasers, including argon, diode has been successfully used for dermatological disorders, ophthalmologists are considering their utilities in many anterior segment diseases and ocular adnexa such as conjunctival nevus, conjunctivochalasis, xanthelasma, eyelid benign tumors, and trichiasis [1, 4, 8–10].

Laser ablation of benign eyelid lesions has several advantages because retinal laser equipment is easily available and accessible to most ophthalmologists. In addition, outpatient-based laser procedures are well accepted by patients who are reluctant to undergo an excision operation. Laser ablation have been suggested to be an effective and well tolerated alternative therapy to standard surgical excision of benign eyelid tumors by several researchers [1, 3, 11]. In this study, we investigated the surgical outcomes of diode laser-assisted ablation of benign eye.

Methods
Patient selection

The charts of patients who underwent diode laser-assisted eyelid tumor ablation or surgical shave excision at Dongtan Sacred Heart Hospital and Dasan Samsung Bright Eye Clinic from January 2019 to December 2021 were reviewed retrospectively. We selected lesions that were not darkly pigmented or ulcerated. Suspected premalignant lesions such as actinic keratosis or keratoacanthoma, lesions with a history of rapid growth, and lesions causing lid notching and lash loss were excluded from our analysis. The patients were followed up for at least 12 months. This study adhered to the ethical standards in the Declaration of Helsinki. It was approved by Hallym University Dongtan Sacred Heart Hospital Institutional Review Board. Informed consent was obtained from each patient. Each patient received an ophthalmologic examination, including best-corrected visual acuity, intraocular pressure, anterior segment, and fundus examination before removing the lesion. Preoperative data collected included age, gender, follow-up time, laterality, location, size of lesions. Intraoperative and postoperative complications and recurrence were recorded. Patients have been classified into two groups; group 1: lesion ablated by laser, and group 2: lesion removed by shaving excision. A comparative analysis between the two groups was performed for treatment response and surgical complication.

Laser ablation technique

The patients were placed at the slit lamp of a diode laser (Easy Ret 577, Quantel Medical, Coumon d’Auvergne, France) after applying a topical lidocaine cream on the lesion. For all cases in which the eyelid margin was involved, a corneal protection plate was used. Laser photoablation (emitting a yellow laser at 577 nm with a spot size of 50–200 µm, a power between 300 and 700 mW, and an exposure time between 0.1 and 0.2 s) was applied until the epithelial layer of the lesion was completely burned. Set values were gradually increased depending on the depth of the lesion or if tissue reaction was not satisfactory. After the procedure, local ophthalmic ointments (Forus ophthalmic ointment®; Samil, Seoul, Korea) were applied twice a day until wound healing (Fig. 1).

Surgical technique Each shave excision was performed under local anesthesia (0.2–0.5 cc Lidocaine 1% for each lesion) [12]. The excision margin was then demarcated with a marking pen, and the tumor was excised with Westcott scissors or blade [12]. Bleeding was controlled with cauterization. After tumor excision, the defect was allowed to heal by second intention. The defect was dressed with an ointment containing neomycin sulfate, polymyxin B sulfate, and dexamethasone (Forus ophthalmic ointment®, Samil, Seoul, Korea) for proper wound care (Fig. 2).

Statistical analysis

The statistical analysis was carried out using SPSS (Statistical Package for Social Sciences), version 21 (SPSS Inc. Chicago, IL, USA). The data were expressed as mean (SD) or frequency (percentage), in general. Clinical data of patients of two groups were evaluated with the Chi-square test and the Mann-Whitney U test; a p value < 0.05 was considered significant.
Results

We studied 56 patients (21 men and 35 women) (Table 1) were included in the study. The mean age of the patients was 41.1 years (range, 24~75 years). There was a significant difference in laterality, location, follow-up period between groups (Table 1). The upper lids were involved in 18 cases, the lower lids were involved in 38 cases, and both upper and lower lids were involved in one patient. Mean tumor size was 3.0x2.9 mm in group 1 and 3.5x3.4 mm in group 2. The tumor size was significantly larger in group 2 than group 1. The histological results of 11 cases in group 2, intradermal nevus was the most common with 6 (Table 2). We observed mild pigmentation in 2 patients, cilia loss in 1, and mild lid notching in 1, among group 2. In both groups, no patient had significant functional complications, such as ectropion, corneal erosion, trichiasis, hypertrophic scar, lid notching, or wound infection. The subjective cosmetic results were satisfactory in all patients, without significant deformities in both groups (Table 3). The mean epithelialization period was 3.7 ± 0.6 weeks in both groups. The average epithelialization period of group 1 was 3.3 ± 0.4 weeks, significantly shorter than the 4.2 ± 0.7 weeks of group 2 (Table 3). All wounds became covered with normal-appearing epithelium (Fig. 2). We observed no tumor recurrence after shave excision or ablation during the follow-up period for each patient.

Table 1
Demographic and preoperative characteristics of two groups.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group 1 (n = 29)</th>
<th>Group 2 (n = 27)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>41 ± 12</td>
<td>41 ± 14</td>
<td>0.860</td>
</tr>
<tr>
<td>Sex, n (Male/Female)</td>
<td>12/17</td>
<td>9/18</td>
<td>0.403</td>
</tr>
<tr>
<td>Laterality (Right/Left/Bilateral)</td>
<td>17/12/0</td>
<td>13/15/0</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Eyelid, n (Upper/Lower/Both)</td>
<td>8/21/0</td>
<td>10/17/1</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Location, n (Palpebral/Marginal)</td>
<td>0/29</td>
<td>0/28</td>
<td></td>
</tr>
<tr>
<td>Size of the lesion (mm), (mean)</td>
<td>3.0 x 2.9</td>
<td>3.5 x 3.4</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Table 2
Histologic classification of group 2

<table>
<thead>
<tr>
<th>Classification</th>
<th>Group 2 (11/28)</th>
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<tbody>
<tr>
<td>Intradermal nevus</td>
<td>6</td>
</tr>
<tr>
<td>Compound nevus</td>
<td>3</td>
</tr>
<tr>
<td>Squamous papilloma</td>
<td>1</td>
</tr>
<tr>
<td>Epidermal cyst</td>
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</tr>
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Table 3
Treatment response and postoperative complication

<table>
<thead>
<tr>
<th>Results</th>
<th>Group 1</th>
<th>Group 2</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notching, n</td>
<td>0/29</td>
<td>1/28</td>
<td>0.491</td>
</tr>
<tr>
<td>Loss of cilia, n</td>
<td>0/29</td>
<td>1/28</td>
<td>0.491</td>
</tr>
<tr>
<td>Pigmentation, n</td>
<td>0/29</td>
<td>2/28</td>
<td>0.237</td>
</tr>
<tr>
<td>Cosmetic unsatisfaction, n</td>
<td>0/29</td>
<td>0/28</td>
<td></td>
</tr>
<tr>
<td>Functional complication, n</td>
<td>0/29</td>
<td>0/28</td>
<td></td>
</tr>
<tr>
<td>Recurrence, n</td>
<td>0/29</td>
<td>0/28</td>
<td></td>
</tr>
<tr>
<td>Epithelization period (weeks)</td>
<td>3.3 ± 0.4</td>
<td>4.2 ± 0.7</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

Discussion

There are many research presentations on removing or treating many skin diseases using lasers [8]. However, the eyelids, especially benign tumors or illnesses in the margin of the eyelid (the boundary between the eyeball and the skin), are unfamiliar areas to dermatologists. On the other hand, most ophthalmologists are easily accessible to ocular lasers as pan-retinal photocoagulation (PRP) or refractive surgery, but most are not familiar with eyelid laser irradiation. Therefore, many oculoplastic surgeons primarily perform excision biopsies [12, 13].

In this study, we demonstrated that laser ablation is an effective and well-tolerated alternative therapeutic modality in the treatment of benign eyelid lesions. The 577 nm wavelength yellow laser has peak absorption in oxyhemoglobin and is minimally absorbed by xanthophyll, melanin and H2O [14]. With this characteristic of 577 nm wavelength, many advantages have been reported in the treatment of vascular diseases (Port wine stain, telangiectasia, etc.) in dermatology [15, 16] and various other diseases (Demodex, inflammatory acne, etc.) [17, 18] as being applied. When irradiating the retina, the lower absorption and increased transmission of 577 nm through the non-uniform melanin granules of the RPE are more than compensated by the higher absorption of 577 nm in the underlying more uniformly distributed hemoglobin-rich choriocapillaris. It allows treatment closer to the fovea. Therefore, there are many research results on diseases such as diabetic macular edema and CSC [19, 20] When applied to the skin, the selective photothermolysis system targets the lesion specifically without causing thermal damage to surrounding tissue, which helps to avoid scarring and dyspigmentation [16].

There are several preparations for laser treatment. Even if lidocaine cream is sufficiently applied, some pain remains, so that most patients can feel pain. If the pain is very severe and it is difficult to use laser treatment, a local lidocaine anesthetic injection can be performed. It is also recommended to wear a plastic cornea protector to prevent laser exposure to the eyes.
The fact that epithelialization progressed slightly faster in the laser group is likely due to the smaller average lesion size. Laser ablation itself cannot explain that epithelialization is faster than surgical excision. This part is one of the limitations of the study. Another limitation is that the lesion size affected the treatment method when the physician chose the initial treatment option, so there may be selection bias for this result.

In conclusion, it can be an effective alternative to the surgical approach in treating tumors of small eyelid margins using a laser. In addition, it provides an opportunity to choose a suitable treatment option for patients who are reluctant to surgical removal of lesions on the eyelid margin. In particular, for lesions that are small in size and not deep, rapid treatment effects and cosmetic satisfaction may be high.

**Declarations**

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**The Authors declare that there is no conflict of interest**

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**Author Contributions**

Study design and concept (JGS); database search (HIH), data extracting (LTY), data analysis (LTY), manuscript writing (JGS, HIH), manuscript revising (JGS, HIH, LTY, STG, HJR).

All authors approved the final version of the manuscript.

**Statement of Ethics**

This study was conducted in accordance with the tenets of the Declaration of Helsinki and approved Institutional Review Board/ Ethics Committee Dongtan Sacred Heart Hospital (IRB no. 2022-12-017-001). Informed consent was obtained in writing from all parent of participants after explain the nature course.

**State of data availability**

All data generated or analysed during this study are included in this published article [and its supplementary information files].

**Disclosure Statement**

The authors have no conflicts of interest to declare
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Financial Disclosures: The authors have no financial disclosures to report

References


**Figures**

(A) Tumor on the right lower lid margin (hollow arrow). (B) Lesion immediately after laser ablation of the tumor (hollow arrow). (C) Lesion completely epithelialization after 3 weeks (hollow arrow).
Figure 2

(A) Tumor on the right lower lid margin (hollow arrow). (B) Lesion immediately after shaving excision of the tumor (hollow arrow). (C) Lesion completely epithelialization after 4 weeks (hollow arrow).