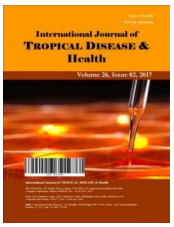

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# Dermoscope-guided Laser Excision of a Pilomatricoma – a Novel Surgical Procedure Performed in Primary Care Settings

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Author AC performed the surgical procedure and supplied the clinical and dermoscopic figures. Author VZ performed the systematic literature search and wrote part of the manuscript. Author RFH interpreted the clinical, dermoscopic images and wrote parts of the discussion section. Author WW performed literature search and wrote substantial parts of the discussion section. All authors read and approved the final manuscript.*

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## ABSTRACT

**Hypothesis:** Dermoscope-guided laser excision is applicable for some cutaneous lesions seen in primary care, particularly those in body flexures or in regions with high blood perfusion.
**Summary:** A male patient presented with an asymptomatic mass behind his left pinna. Polarised

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dermoscopy revealed signs compatible with malignancy. Excision was difficult owing to the location being concave and the region being one with hyper-perfusion.
Dermoscope-guided laser excision was performed. The edge of the lesion and clear margins were marked via dermoscope-guidance. Laser incisions were made following the margins. Dermoscopy confirmed precision of the incision. Upon three laser-dermoscope cycles, the mass separated itself. Laser in coagulation mode achieved haemostasis.
Dermoscope-guided laser excision was performed. The edge of the lesion and clear margins were marked via dermoscope-guidance. Laser incisions were made following such margins. Dermoscopy confirmed precision of the incision. Lesion incisions and dermoscopy were then reapplied. Upon three laser-dermoscope cycles, the mass separated itself. Laser in coagulation mode achieved haemostasis.
**Outcome:** The histopathological diagnosis was a pilomatricoma. Healing was uneventful, with minimal scarring. There was no relapse one year post-operatively.
**Recommendation:** Investigations on dermoscope-guided laser incision and other dermoscope-guided surgical procedures in primary care settings can be conducted to evaluate the outcomes of these procedures.

*Keywords: Cosmetic outcomes; excisional biopsy; laser ablation; office procedures; pyogenic granuloma.*

## 1. INTRODUCTION

We have previously reported dermoscope-guided (DG) punch biopsy [1], DG excisional biopsy [2], DG suturing [3], DG laser ablation [4], and DG cautery [5]. We also reported the first case-control study on the outcomes of DG surgical procedures (DGSP) [6].

We report here the first DG laser excision of a cutaneous mass in an area with high vascular perfusion.

### 1.1 Presentation of the Surgical Procedure

A man aged 63 years attended us with an asymptomatic mass behind his left ear noted two months ago. Contact bleeding occurred on three occasions. Apart from mild allergic rhinosinusitis, his past health was unremarkable. There was no reliable history of trauma to that region. He had not been exposed to cold environments.

Physical examination revealed a non-tender, solitary, firm, semi-peduncular nodule at the posterior crease of the left pinna at the level of the tragus (Fig. 1). The largest diameter was 0.9 cm. Erythema was prominent. A solid black *cap* was present at the most exterior part. The lesion was sticky. However, no erosion and no ulceration were noted macroscopically. The perilesional skin was normal in colour and texture. No abnormality was noted on both pinnae otherwise. There was no cervical lymphadenopathy.

We applied a dermoscope (Dermoscope A) which delivered high-quality images. Dermoscopy under cross-polarisation (Fig. 2) revealed bits of differently coloured garment fibres, substantiating stickiness of the surface of the lesion. The lesion was asymmetrical in patterns and colours.

A big ulcer was seen. Such was due to the flat surface of the receiving probe of Dermoscope A compressing the lesion for focus during examination. The darkened cap was compatible with blood clots and early necrosis. Apart from the cap, the body proper was multi-coloured. Around 20% of the total area of the lesion was in a bluish hue. These regions were also structureless. However, such regions fell short of 25% of the entire area of the lesion. White lines were seen together with polymorphous blood vessels. Whether such vessels were serpentine and whether such crossed the centre of the lesion was difficult to define.

Our provisional clinical diagnosis was pyogenic granuloma. Differential diagnoses including epidermal cyst, haematoma, deformed haemangioma, and hamartomas were highly unlikely. However, cutaneous malignancies could not be excluded by polarised dermoscopy.

We planned for excisional biopsy with 4 mm margins. Several difficulties presented themselves. Firstly, the lesion was on a concave surface, rendering marking of the surgical margins difficult. Secondly, the three-dimensional shape of the lesion might not be

clearly perceived by the clinician. Thirdly, the pinna is a heavily perfused projection. It would be a challenge to achieve haemostasis.

We therefore planned for a novel procedure, which we termed “dermoscope-guided laser excision”. We spent much time discussing the advantages and limitations of this new procedure with the patient, and then attained his informed and written consent.

We elected another type of dermoscope (Dermoscope B) which conferred two advantages. Firstly, the receiving probe of this dermoscope was small, and could be inserted into concave regions. We thus marked the incisional margins precisely. Secondly, this scope could attain focus whether its receiving probe was touching the lesion or not. We thus fixed this dermoscope by clamps to a sturdy steel stand, with the receiver of the scope heading down vertically around 2 cm above the surgical field. We then connected Dermoscope B to a desk-top computer, which outputted the visual signals to a monitor.

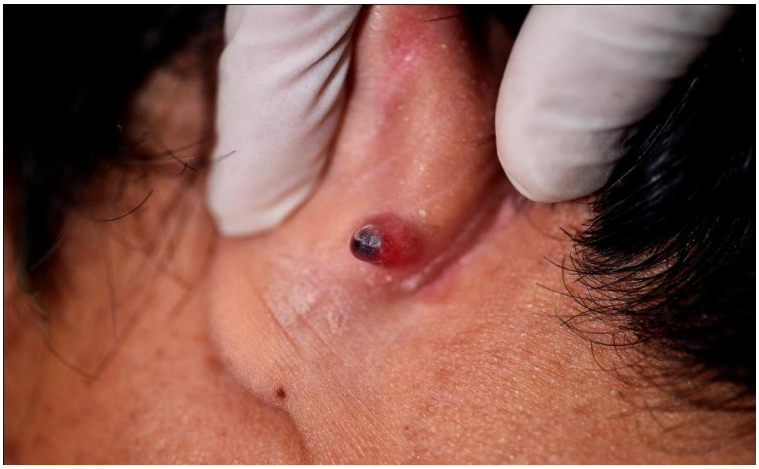

**Fig. 1. A firm semi-peduncular skin mass was seen at the posterior crease of the left pinna, at the level of the tragus. A black cap was present at the most exterior part. No erosion and no ulcer were present**

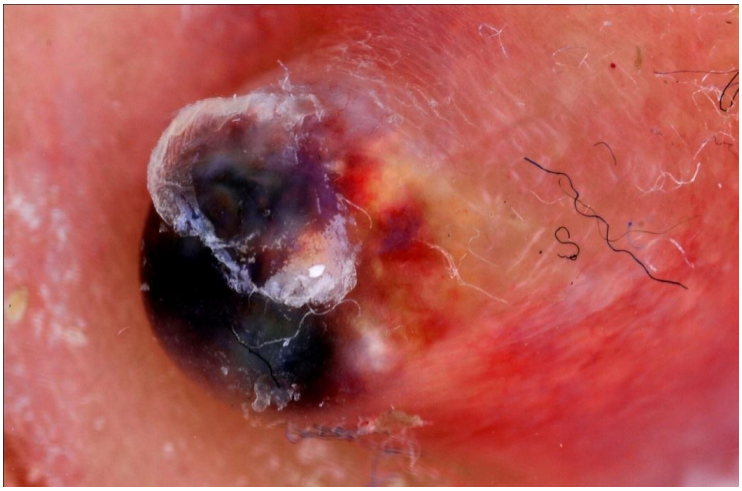

**Fig. 2. Polarised dermoscopic image asymmetries in pattern and in colour. The cloth fibres indicated stickiness. The ulcer was formed when the focusing plain of the dermoscope was applied for compression. The presence of several significant clues – bluish hue, structureless areas (but smaller than 25% of the entire lesion), white lines, and polymorphous blood vessels – indicated that biopsy should be performed**

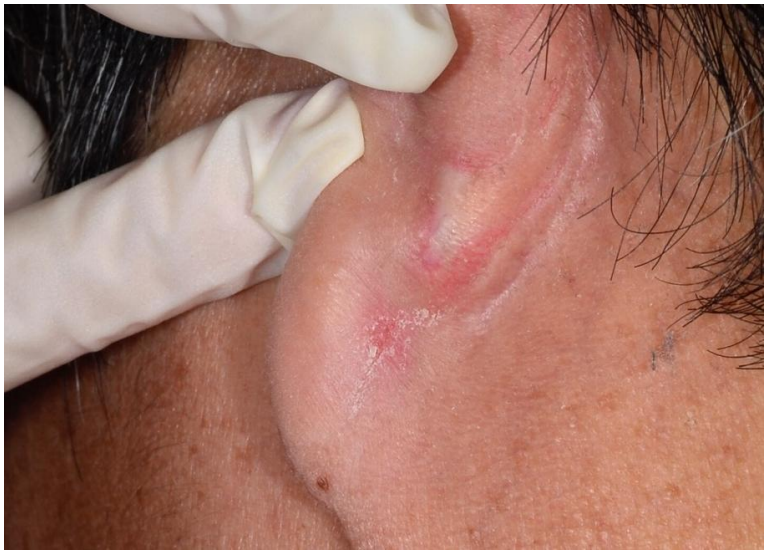

**Fig. 3. Minimal scarring was noted three months after the dermoscope-guided laser excision**

We set the laser to a gentle-cutting mode. We lifted the lesion with a tight pair of forceps, and lased precisely along the incision margins as marked. The cutting edges were made to be perpendicular to the surface. The laser beam allowed for some extent of haemostasis along the incisional route. Once we had completed one circumfluence, the lesion was still attached to the adjacent tissues. We applied Dermoscope B to assure that the incised margins were closely matching the marked margins. Laser was then re-applied. After three "laser-dermoscope cycles", the lesion separated *by itself*, with clear margins. We then set the laser to a coagulating mode, and achieved complete haemostasis. Wound healing was uneventful.

Histopathological examination reported active inflammatory infiltrates and focal areas with proliferation of eosinophilic ghost shadow cells as well as basaloid cells. There were areas with fibrosis, granulation tissue formation, and multinucleated foreign body type giant cells in the background. Some of the multinucleated giant cells contained keratinous material. These features were compatible with a pilomatricoma.

There was minimal scarring three months after the procedure (Fig. 3). There was no relapse one year after the procedure.

## 2. DISCUSSION

Our provisional clinical diagnosis was pyogenic granuloma. This was owing to the lesion being pedunculated to a certain extent. The bright red colour and the rapid growth were also compatible with such in early lesions of pyogenic granuloma. However, the histopathological changes – proliferation of ghost shadow cells and eosinophilic basaloid cells resembling hair matrix cells – validly substantiated the diagnosis being a pilomatricoma [7]. Moreover, the multinucleated giant cells with keratinous material was highly characteristic of pilomatricoma [8]. Pilomatricoma is a slow-growing, firm, dermal or subcutaneous neoplasm, usually measuring fewer than 3 cm in diameters [9].

The advantages of dermoscopes in the early detection and diagnoses of skin cancers are well substantiated. Beyond tumours, dermoscopy has been reported to be applicable in the diagnoses of common inflammatory skin diseases [10,11], vascular diseases [12-14], and infectious diseases [15-17]. The realm of dermoscopy extends to diseases of the skin appendages [18,19] and mucosal surfaces such as the oral mucosa [20].

Our team was fortunate enough to discover several novel applications for dermoscopy [21-25]. In 2015, one of us (AC) performed the first dermoscope-guided surgical procedure (DGSP). He then discussed this new surgical approach with another one of us (VZ) and other esteemed colleagues, and proceeded to report a case-control study on 39 study procedures with DGSP performed and 39 sex-and-age (± five years) paired-matched controls with similar procedures

performed without dermoscope-guidance. Both study and control procedures were retrieved retrospectively to minimise systemic bias and masking [6].

Quantitatively, the advantages of DGSP were lower rate of incomplete removal of the lesions or relapse [(risk ratio (RR): 0.22; 95% confidence interval (CI): 0.05–0.95)] and lower rate of significant scarring (RR: 0.52; 95% CI: 0.32–0.83). For procedures on small lesions (< 4 mm), the rate of scarring was particularly lower for case procedures against control procedures (RR: 0.30; 95% CI: 0.13–0.67) [6].

Qualitatively, the setup for DGSP is relatively easy, as reported by us [3-6,26]. Magnification and epiluminescence enhanced precisions of each surgical manoeuvre. DGSP is highly versatile. The current types are covered in the Introduction [1-5]. DG laser excision as reported here is the sixth novel type of DGSP. Lastly, the softwares necessary to support DGSP are available at almost no cost.

The limitations of DGSP include costs in purchasing and maintenance of dermoscopes, computers, stands, and other hardwares. The durations of each DGSP were obviously longer than a procedure not guided by dermoscopy, although we have not investigated this aspect specifically. As relatively novel procedures, DGSP might harbour limitations yet unknown to us. Lastly, the likelihood of pain affecting activities of daily living in the first week for patients after DGSP was insignificantly different from patients with control procedures performed [6].

Our current report is the first reported DG laser excision. Whether the advantages and limitations of other DGSP can be applicable to DG laser excision is yet to be evaluated.

Different models of dermoscopes contributed in differing roles in this procedure. While Dermoscope A together with a single-lens reflex camera body provided clear images with high resolutions with and without cross-polarisation, Dermoscope B demonstrated its versatility all through the operation. Firstly, it allowed us to mark incisional lines for a lesion in the skin crease owing to its small receiving probe. Secondly, we could adjust the magnification by altering the height of the probe above the surgical field. Thirdly, we could adjust the depth of the lesion and the surrounding tissues to be visualised via changing the extent of cross-polarisation. Fourthly, we applied it to assure that the incisions were where such should be in dermoscopy-laser cycles. Lastly, it minimised the extent of bleeding through fast and precise surgical manoeuvres planned pre-operatively.

As we previously presented, for clinicians with experience in dermoscopy and with structured training in skin surgery, performing DGSP should not be difficult [1-3]. It takes some time to operate with your hands while watching the monitor. For superficial lesions, the scope could just focus on the surface of the lesions, that is, with no cross-polarisation. For thick lesions or those with complicated patterns, the extent of cross-polarisation could be adjusted during different surgical manoeuvres. As we had previously depicted, the clinician can even set focus on the mucosal surfaces during DG suturing adjacent to the eye and the nasolacrimal duct [3].

For clinicians contemplating DGSP, we suggest that such should be performed on adults in the early phases. Once having the procedures performed with virtuosity, operation on younger patients and for elderlies should be considered patient by patient. One of us (AC) has performed DGSP for a boy aged seven years (DG excisional biopsy for a CD68+ and S100- juvenile xanthogranuloma) [2] and for a lady aged 89 years (DG suturing for accidental wound) [3].

We thus urge other investigators to perform DGSP, provided that the hardwares, softwares, and the clinicians are up to the needs for this new genre of surgical procedures on the largest organ of the human body.

## 3. CONCLUSION

DG laser excision delivered good clinical and cosmetic outcomes for our patient. This procedure is feasible to be performed in a primary care setting.

## CONSENT

We spent much time discussing the advantages and limitations of this new procedure with the patient, and then attained his informed and written consent.

## ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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