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### **The value of dermoscopy of the nail plate free edge and hyponychium**

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**ABSTRACT**

The non-invasive examination of the nail unit using a dermoscope is known as onychoscopy. This technique has become increasingly appreciated to facilitate the clinical diagnosis of nail disorders, opening up a valuable second front with a potential to avoid invasive diagnostic procedures. During a nail consultation, the nail unit should always be examined with

the aid of a dermatoscope in all its components. The aim of this paper ~~review~~ is to provide practical information about onychoscopy of the nail plate free edge and hyponychium, two components of the nail unit difficult to evaluate at naked eye and often forgotten, but of paramount importance.

## **INTRODUCTION**

The free edge, the thickest part of the nail plate, grows beyond the fingertip, protecting it. Frontally, it appears as a slightly curve and flexible transverse band, approximately 0.5 - 1 mm thick, of a white yellowish color and made up of three layers corresponding to the dorsal nail plate (produced by the proximal portion of the nail matrix), the intermediate nail plate (produced by the distal matrix) and the ventral nail plate (produced by the nail bed)<sup>1</sup>.

Under the free edge lies the hyponychium, a 0.1 - 0.2 mm cutaneous margin that continues the nail bed and corresponds to the site where the nail plate detaches from the bed. The hyponychium is proximally margined by the onychodermal band and distally by the distal groove, a cutaneous ridge demarcating the border between subungual structures and the finger pulp<sup>2-4</sup>. Together with the free edge, the hyponychium forms a crevice, well known reservoir for different microbes often responsible for nail plate secondary changes<sup>5</sup>. Both the hyponychium and the free edge can be however hit by different primary dermatological conditions, often overlooked because this anatomic area is difficult to evaluate by naked eye. Things may change with the use of a dermoscope.

Onychoscopy has become increasingly appreciated in the last years to facilitate the clinical diagnosis of nail disorders, opening up a valuable second front with a potential to avoid invasive diagnostic methods<sup>6-8</sup>. Enabling easier and closer observation of nail features not visible to naked eye, onychoscopy is a valuable aid not only in revealing cryptic details of diagnostic value, but also in monitoring the evolution of a disease and response to treatment through stored images<sup>9</sup>. The aim of this paper is then to provide practical information about onychoscopy of the nail plate free edge and hyponychium, two components of the nail unit often forgotten, but of paramount importance. A practical table with the most common findings will also be provided according to authors' experience, supported and confirmed by the existing literature listed as references of this paper.

## **METODOLOGY**

The unique anatomy of the nail apparatus makes onychoscopy a difficult technique to be performed, in every site. The nail plate, in fact, is a convex structure that doesn't allow to a flat and rigid lens to adhere perfectly. When observing the free edge of the nail plate and hyponychium, the lens should be placed on the nail plate free edge, pushing back the fingertip. The dermoscope should then be moved up and down and from side to side. An initial dry observation (dry dermoscopy technique) can be followed by the application of an interface medium (wet dermoscopy technique). Given the nail plate small size, convexity and hardness, which prevent a complete adherence of the lens to the surface, the dermoscope needs to be tilted and an interface medium with high viscosity should be used, in order not to roll off/slide off the plate. Water-based gels (e.g., ultrasound gel), antiseptic gels or oils serve this purpose very well. However, ultrasound gel is probably the best option because it doesn't flow<sup>10</sup>.

The lowest magnifications, i.e. 10X to 30X, are the ones to start with: the nail plate free edge, subungual contents and digital creases are easily seen. Higher magnifications (50X-200X) detect instead the detailed capillary architecture of the hyponychium.

The patient undergoing the exam must initially be seated comfortably with the hand or foot to be examined placed on a flat surface, since the whole procedure may take 15-20 minutes. A grey or black backdrop is always preferable because the colour absorbs the excess of light without reflecting it<sup>4</sup>. Lighter backdrop is instead better for darker phototypes.

Regarding the choice of the device, videodermoscopes are versatile devices capable of providing high magnifications, though resolution may be suboptimal. On the other hand, handheld dermoscopes provide much lower magnification, but more clarity. Non-contact (polarized) handheld dermoscopes may also be used, proving very useful in visualizing deep structures and capillary architecture without pressing or blanching vessels<sup>11,12</sup>. Both devices, non-polarized and polarized, should however be used when examining the nail plate free edge and hyponychium to perform a complete evaluation of the disease.

## **INTERPRETATION**

As stated, specific disorders affecting these areas require the use of the dermatoscope as mandatory.

Considering that these nail structures are able to respond only with a limited number of reaction patterns to the number of disorders affecting them, collecting diagnostic clues can be extremely challenging. Knowledge of nail anatomy and the most common nail disorders are mandatory

before starting onychoscopy because it is very important to know where and what to look at. Being the plate a product of the matrix, for example, the free edge can also reveal alterations coming from the matrix.

Lower dermoscopy magnifications are usually enough to visualize the nail plate free edge that, in normal conditions, appears as a white - yellowish upside-down “U”, more or less curved, with a thickness regular in all its length. The hyponychium is instead not always visible, as frequently covered by the free edge, but it is seen as a “cul de sac” below the free edge when the nail plate is cut too short or in nail biters. Higher magnifications are needed to visualize the capillary network of this area that appears as a regular pool of red dots: the appearance as dots is due to the perpendicular arrangement of the dermal capillaries to the skin (each dot represents the top of one loop)<sup>13</sup>.

Different conditions may alter the aspect of these areas and dermoscopic observation can often give diagnostic hints to clinical examination that might avoid biopsy or tell us which is the right place to biopsy. Table I reports the most common findings seen at dermoscopy when examining the nail plate free edge and hyponychium affected by a nail disorder. Figure 1 reports the most common disorders affecting these areas.

The free edge may be locally or diffusely thickened or thinned, it may be splitted, fissured or detached and the color may vary. The curvature may also be affected totally or in small areas. When onycholysis is present, the hyponychium becomes more evident. Scales of different thickness and colors may be present under the nail plate and the capillary network might be changed and more visible. A subungual mass of different shape, size and consistency may also be present.

### **CLINICAL RELEVANCE**

Dermoscopic features of the nail unit should always be observed in all its parts, including the distal nail plate free edge and the hyponychium, because they can reveal important clues for the correct diagnosis. The most important data that the nail plate free edge is able to provide are probably those collected during the evaluation of a longitudinal melanonychia. The color of the nail plate free edge permits first to distinguish between a melanic and a non-melanic pigmentation: the first one is located within the nail plate that is then grey to brown to black, the second is located below or above the nail plate leaving it free from pigment<sup>14</sup>. Once we are dealing with melanonychia, the origin of the pigment is very important because biopsy the distal matrix will

result in a limited risk of scarring, and this is a useful information we can provide to patients to further encourage them before surgery. If the pigment is located in the upper portion of the free edge, the source is likely to be the proximal portion of the matrix; if the pigment is found in the lower portion, it favors a more distal matrix location. Moreover, a dermoscopic evaluation of the hyponychium can reveal a micro-Hutchinson sign, the periungual melanic pigmentation due to tumor spread into adjacent tissues, not visible at naked eye<sup>15-17</sup>. Detecting the micro Hutchinson sign is particularly useful in presence of an ulcerated mass of the nail bed and hyponychium because it might be a sign of amelanotic melanoma. Hyponychial pigmentation can be however observed also in congenital nevi, where it just suggests presence of nest of melanocytes in the periungual skin.

The distal nail edge evaluation is also important in case of single white longitudinal bands of the nail plate. Presence of multiple sharply demarcated honeycomb holes within a locally thickened nail plate is diagnostic for onychomatricoma<sup>18</sup>. The holes correspond to the longitudinal digitations of the tumor excavated within the nail plate.

Enhancing vision of a subungual mass is also important to define the diagnosis and avoid unnecessary procedures. Onychopapilloma is, for instance, almost always diagnosed through dermoscopy and clearly differentiated from a wart or a longitudinal melanonychia in case of pigmentation. Onychopapilloma grows as a focal gray filiform keratotic plug underneath the free edge of the nail plate, and it is never surrounded by a collarette<sup>19</sup>. A collarette characterizes subungual warts, which also present dotted dilated and intermingled thrombosed vessels (dark red-blackish hemorrhagic dots), some of which surrounded by a white halo<sup>20</sup>.

Fibroma and Fibrokeratomas appears as skin-colored papules with a central pale yellowish area more or less hyperkeratotic<sup>21</sup>. Exostosis are hard nodules with possible vascular ectasia or ulceration<sup>22</sup>.

The presence of subungual hyperkeratosis and scales can instead suggest an inflammatory disorder like psoriasis or eczema, but if the scales are yellow-orange or multicolored, with a ruin-like appearance, a diagnosis of onychomycosis should be always taken into account<sup>23,24</sup>. The rare form of onychomycosis called endonyx, not characterized by subungual scales, can instead be easily identified observing the nail plate free edge that shows shiny white areas confined to the nail plate<sup>25</sup>. Usually, subungual hyperkeratosis and scales are associated with onycholysis, but when this presents alone a traumatic etiology can be suspected.

The presence of pustules in the hyponychial area can also be detected, facilitating the diagnosis of pustular psoriasis (Hallopeau's acrodermatitis), but differential diagnosis should include herpes infection, which can be ruled out by clinical observation, history and Tzanck smear test.

Evaluation of the vascular architecture is finally very important. The presence of irregularly distributed, dilated, tortuous, and elongated capillaries can be a clue for the definitive diagnosis of nail psoriasis when the nail plate signs are unspecific<sup>26</sup>. Abnormal capillaries are absent in allergic contact dermatitis even when it presents with psoriasiform nail changes<sup>27</sup>. Capillary density is also correlated with nail psoriasis severity and can be a marker of response to treatment.

## CONCLUSIONS

Performing onychoscopy is not easy like skin dermoscopy or trichoscopy, but due to the small and often hidden nail components this technique is always advisable in any patient during a nail consultation and should become a routine to reinforce presumptive clinical diagnoses.

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#### FIGURE LEGENDS

**Figure 1:** Dermoscopy of the nail plate free edge and hyponychium: (A) Hutchinson's sign in nail melanoma; (B) onychomatricoma; (C) allergic contact dermatitis; (D) subungual exostosis; (E) longitudinal melanonychia - proliferation – with the pigment coming from the distal matrix; (F) pincer nail; (G) traumatic onycholysis; (H) psoriasis; (I) psoriasis; (L) onychomycosis; (M) onychopapilloma; (N) wart.

**Table 1:** Most common dermoscopic findings observed in nail plate free edge and hyponychium.

Table 1

	<b>NAIL PLATE FREE EDGE</b>	<b>HYPONYCHIUM</b>
<b>Longitudinal Melanonychia (proliferation)</b>	<p><b>Thickness:</b> normal</p> <p><b>Shape:</b> normal</p> <p><b>Color:</b> pigmentation of the upper portion (PM involvement) pigmentation of the lower portion (DM involvement) pigmentation of the full thickness (PM+DM inv.)</p> <p><b>Margin:</b> possible splitting/dystrophy in case of Melanoma frequent splitting in case of pediatric nevi</p> <p><b>Subungual scales/mass:</b> absent</p>	<p><b>Scales:</b> absent</p> <p><b>Color:</b> possible presence of Hutchinson sign (also micro) and/or vascular nodule with irregular vascular pattern (dots &amp; irregular lines) in case of Melanoma</p> <p><b>Capillaries:</b> normal</p>
<b>Longitudinal Melanonychia (activation)</b>	<p><b>Thickness:</b> normal</p> <p><b>Shape:</b> normal</p> <p><b>Color:</b> normal to light gray</p> <p><b>Margin:</b> normal</p> <p><b>Subungual scales/mass:</b> absent</p>	<p><b>Scales:</b> absent</p> <p><b>Color:</b> normal</p> <p><b>Capillaries:</b> normal</p>

<b>Onychomatricoma</b>	<p><b>Thickness:</b> partial or full-length thickening</p> <p><b>Shape:</b> transverse overcurvature</p> <p><b>Color:</b> yellowish</p> <p><b>Margin:</b> honeycomb cavities (sharply demarcated holes)</p> <p><b>Subungual scales/mass:</b> absent</p>	<p><b>Scales:</b> absent</p> <p><b>Color:</b> normal</p> <p><b>Capillaries:</b> normal</p>
<b>Pincer Nails</b>	<p><b>Thickness:</b> Whole length thickening</p> <p><b>Shape:</b> overcurvature</p> <p><b>Color:</b> yellowish</p> <p><b>Margin:</b> normal</p> <p><b>Subungual scales/mass:</b> absent</p>	<p><b>Scales:</b> absent</p> <p><b>Color:</b> normal</p> <p><b>Capillaries:</b> normal</p>
<b>Koilonychia</b>	<p><b>Thickness:</b> Whole length thinning</p> <p><b>Shape:</b> concave shape</p> <p><b>Color:</b> normal</p> <p><b>Margin:</b> normal</p> <p><b>Subungual scales/mass:</b> absent</p>	<p><b>Scales:</b> absent</p> <p><b>Color:</b> normal</p> <p><b>Capillaries:</b> normal</p>
<b>Traumatic Onycholysis</b>	<p><b>Thickness:</b> normal</p> <p><b>Shape:</b> normal</p>	<p><b>Scales:</b> absent</p> <p><b>Color:</b> normal</p>

<b>(acute / chronic)</b>	<b>Color:</b> normal <b>Margin:</b> normal <b>Subungual scales/mass:</b> absent	<b>Capillaries:</b> normal
<b>Psoriasis</b>	<b>Thickness:</b> may be diffusely thickened <b>Shape:</b> normal <b>Color:</b> normal or yellowish <b>Margin:</b> normal <b>Subungual scales/mass:</b> absent	<b>Scales:</b> may be present <b>Color:</b> normal <b>Capillaries:</b> irregularly distributed, dilated, tortuous, and elongated capillaries (best seen at 50x)
<b>Allergic Contact Dermatitis</b>	<b>Thickness:</b> normal <b>Shape:</b> normal <b>Color:</b> normal or yellowish <b>Margin:</b> normal <b>Subungual scales/mass:</b> absent	<b>Scales:</b> present with skin fissures <b>Color:</b> erythema, hemorrhages <b>Capillaries:</b> normal
<b>Onychomycosis</b>	<b>Thickness:</b> slightly increased (especially in DLSO) <b>Shape:</b> normal <b>Color:</b> normal, but shiny white in case of endonyx onychomycosis <b>Margin:</b> may be irregular	<b>Scales:</b> irregularly distributed hyperkeratosis with yellow-orange scales, <b>Color:</b> possible black/multicolored pigment and indentations (“ruin appearance”) <b>Capillaries:</b> normal

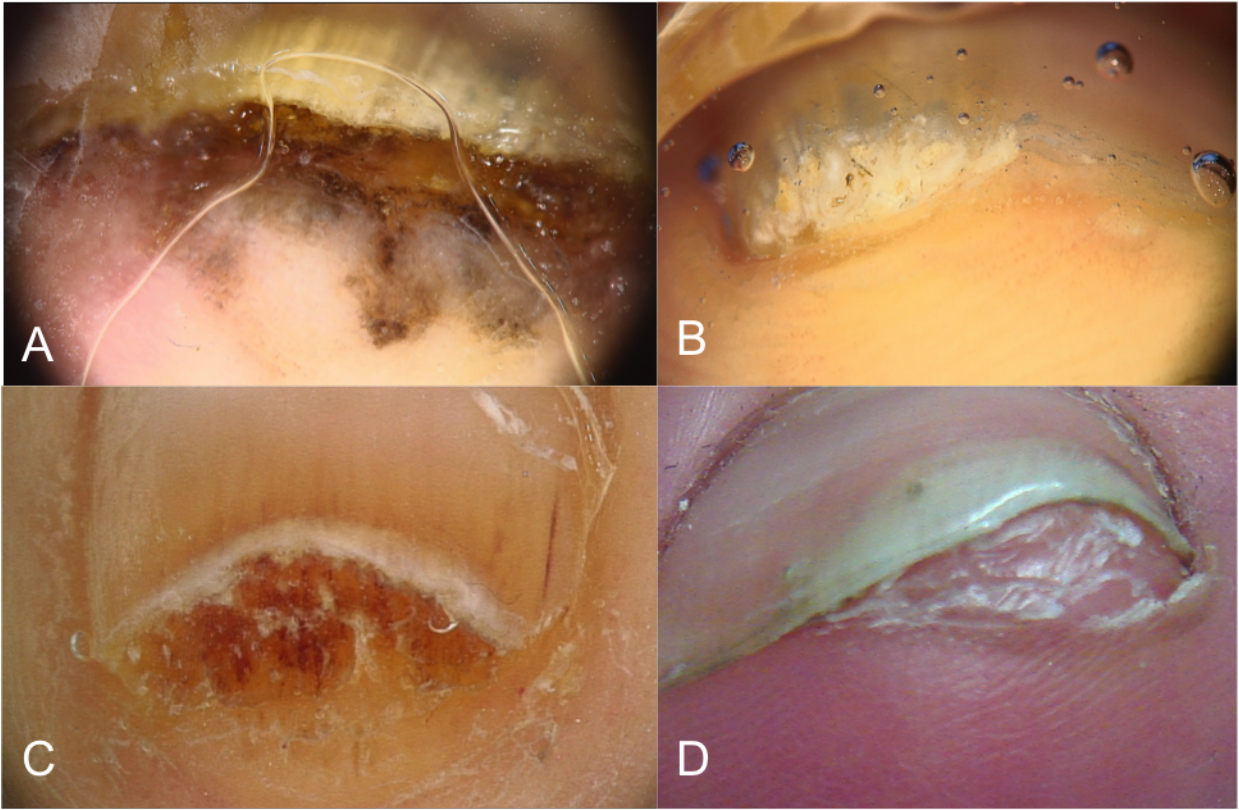
	<b>Subungual scales/mass:</b> ruin-shaped yellow-white orange scales	
<b>Warts</b>	<b>Thickness:</b> normal <b>Shape:</b> normal <b>Color:</b> normal <b>Margin:</b> normal <b>Subungual scales/mass:</b> keratotic mass in a mosaic pattern with dotted vessels; presence of a collarette limiting the lesion	<b>Scales:</b> may be present <b>Color:</b> normal <b>Capillaries:</b> normal
<b>Onychopapilloma</b>	<b>Thickness:</b> normal <b>Shape:</b> normal <b>Color:</b> normal <b>Margin:</b> fissured <b>Subungual scales/mass:</b> absent localized pink-brownish filiform keratotic plug	<b>Scales:</b> absent <b>Color:</b> normal <b>Capillaries:</b> normal
	<i>Of the proximal nail fold:</i>	<b>Scales:</b> absent

<p><b>Fibroma / Fibrokeratoma</b></p>	<p><b>Thickness:</b> localized thinning  <b>Shape:</b> localized concave shape  <b>Color:</b> normal  <b>Margin:</b> fissured  <b>Subungual scales/mass:</b> skin colored papule with a central pale yellowish area (<math>\pm</math> hyperkeratotic), surrounded by a scaly collarette</p> <p><i>Subungual localization:</i></p> <p><b>Thickness:</b> normal  <b>Shape:</b> normal  <b>Color:</b> normal  <b>Margin:</b> normal  <b>Subungual scales/mass:</b> skin colored papule with a central pale yellowish area (<math>\pm</math> hyperkeratotic), surrounded by a scaly collarette</p>	<p><b>Color:</b> normal  <b>Capillaries:</b> normal</p>
<p><b>Exostosis</b></p>	<p><b>Thickness:</b> normal  <b>Shape:</b> normal  <b>Color:</b> normal</p>	<p><b>Scales:</b> absent  <b>Color:</b> normal  <b>Capillaries:</b> normal</p>

	<p><b>Margin:</b> normal</p> <p><b>Subungual scales/mass:</b> hard nodule together with hyperkeratosis and ulceration, possible vascular ectasia</p>	
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PM: proximal matrix; DM: distal matrix; NB: nail bed; NP: nail plate; DLSO: distal lateral subungual onychomycosis





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