J. Appl. Cosmetol. **14**, 9-14 (January - March 1996)

EXAMINATION OF FINGERNAIL PLATES BY MEANS OF POLARIZED LIGHT VIDEOMICROSCOPY

R. Strumia
Clinica Dermatologica, Università di Ferrara. Direttore: Prof. A. Califano

Received: *July 21, 1995*

Key words: *nail, videomicroscopy, polarized light.*

Synopsis

Examination of fingernail ridges or plates by means of polarized light has been performed using metallographic microscopes, stereomicroscopes and microscopes specifically designed for firearm and toolmark studies. All of these tecniques require the drawing of nail specimens and their adequate preparation. To the best of our knowledge a polarized light videomicroscope has never been employed.

Material and methods.

The apparatus (Moritex Video Microscope System Scopeman, MS-S04, Meisei Bldg., Japan) is composed of a processing unit and a color monitor (14"TTL CVS); light from the light source (a 100W mercury vapour lamp) of the processing unit is guided with the optic fiber to the probe end. Objectives are equipped with non contact lens (from lx to up 400x) and with contact lens (from 50x to up 1000x). The application of a light polarized objective x50 allows us to obtain perfect images of the surfaces. Fragile and brittle nails were evaluated. Furthermore some pathologies such as psoriasis, lichen planus, and rheumatoid arthritis were included in the study. Observations were made by polarized light and, for comparison, by videomicroscope with a normal objective

Results.

This tecnique has allowed early detection some of changes in nail plates such as onycoschizia, longitudinal and transverse lines, pits, nail beading when they were scarcely evident to the naked eye and to a normal objective. We believe that also in the field of cosmetic dermatology this tecnique will be very useful for example in the study and tberapy of brittle and fragile nails and in the evaluation of new hair cosmetics.

Riassunto

Una delle tecniche impiegate per lo studio delle lamine ungueali e dei capelli è rappresentata dall' osservazione a luce polarizzata che sfrutta la birifrangenza della cheratina. All' uopo sono stati impiegati stereomicroscopi e microscopi metallografici. A quanto ci consta, non è mai stato utilizzato un videomicroscopio a sonda ottica dotato di obiettivo a luce polarizzata.

Materiali e metodi.

L' apparecchio è un Video-microscopio a sonda ottica, (Moritex Video Microscope System Scopeman, MS-504, Meisei Bldg., Japan); si tratta di un sistema di "Video-imaging" microscopico costituito da una telecamera, da una sonda ottica e da un monitor a colori ad alta definizione (14"TTL CVS). É dotato di obiettivi intercambiabili, con lenti a contatto (da 50x a lOOOx) e non a contatto

(da 1x a 400x). É collegabile ad un videoregistratore, a una stampante e a un computer. L'obiettivo a luce polarizzata utilizzato consente ingrandimenti di 50x. Sono stati studiati soggetti con unghie fragili e friabili e individui affetti da psoriasi, lichen e artrite reumatoide. Per confronto, le lamine sono state osservate anche con un obiettivo a luce non polarizzata.

Risultati

A luce non polarizzata la superficie delle lamine appare virtualmente trasparente. L'obiettivo a luce polarizzata ha consentito di ben evidenziare:

- la presenza di solchi verticali e trasversali;
- il "pitting" psoriasico, anche quando le lesioni non erano evidenti clinicamente,
- le alterazioni "a goccia di pioggia" (nail beading) in corso di artrite reumatoide

Questa tecnica, non invasiva e di facile esecuzione, può rivelarsi utile nella dimostrazione di alterazioni ungueali ancora clinicamente poco evidenti e, in campo cosmetologico, nella valutazione dell' effetto di cosmetici per unghie e per capelli.

Introduction

Diagnostic tecniques to evaluate nail disorders include KOH examination for fungal hyphae, cultures for bacteria and fungi and nail unit biopsy. Onychology research has also resulted in technological advances such as x-ray microanalysis to determine nail plate composition and ultrasonography to evaluate thickness (1). More recently, optical profilometry after nail shadowing has been introduced as a new tecnique to quantify nail surface alterations (2). Examination of fingernail ridges or plates by means of polarized light has also been performed using metallographic microscopes, stereomicroscopes and microscopes specifically designed for firearm and toolmark studies (3). All of these tecniques require the drawing of nail specimens and their adequate preparation. We have employed a non invasive method to investigate fingernail plates: the polarized light videomicroscopy (PLVM) (4).

Material and methods

Material

Video-microscopy is an extension of traditional epiluminescence microscopy. Using a fiber optic camera, magnifications from 1 up to 1000x may be obtained so that the possibilities of study are greatly enhanced. In our Clinic we employ a video-imaging system, "Hand-Held Video Microscope Imaging System" by which both cutaneous pigmented lesions and superficial microvasculature may be investigated. The apparatus (Moritex Video Microscope System Scopeman, MS-504, Meisei Bldg., Japan) is composed of a processing unit and a color monitor (1 4"TTL CVS~, light from the light source (a 100W mercury vapour lamp) of the processing unit is guided with the optic fiber to the probe end. Objectives are equipped with non contact lens (from lx to up 400x) and with contact lens (from 50x to up 1000x). A still video recorder and a colour printer may be attached. The quality of the recorded images is, however, lower than those seen on the screen. The instrument is usually employed in the metal industry for the evaluation of corrosion and in the artistic field for the study of the deterioration of works of art. It is also used in mechanics, electronics and aviation. The application of a light polarized objective x50 allows us to obtain perfect images of the surfaces with an optical effect very similar to scanning electron microscopy (SEM). Furthermore, crossed pola~izing filters of the objective display bands of interference colors as a consequence of the birifringence of keratin.

Methods

Fingernail plates of housewives and aged people were evaluated. Furthermore some pathologies such as psoriasis, lichen planus, and rheumatoid arthritis were included in the study (Table I). Observations were made by PLVM and, for comparison, by videomicroscope with a normal objective.

Table 1:

CLINICAL FEATURES OF THE PATIENTS

PZ.	AGE	PATHOLOGY
	75	vertical lines
2	50	onycoschizia
3	48	fragile and brittle nails
4	29	psoriasis
5	25	psoriasis
6	64	psoriasis
7	59	artropatic psoriasis
8	47	lichen
9	59	rheumatoid arthritis
10	60	rheumatoid arthritis

Results

PLVM has allowed early detection some of changes of nail plates such as onycoschizia, longitudinal and transverse lines, pits, nail beading when they were scarcely evident to the naked eye and to a normal objective (Figg. 1a,1b; 2a,2b; 3a,3b). We have obtained "tridimensional" images very similar to those of SEM. In colour photographies, the birifrangence of keratin is also evident. The bands of different colours indicate regions of different thickness in the nail.

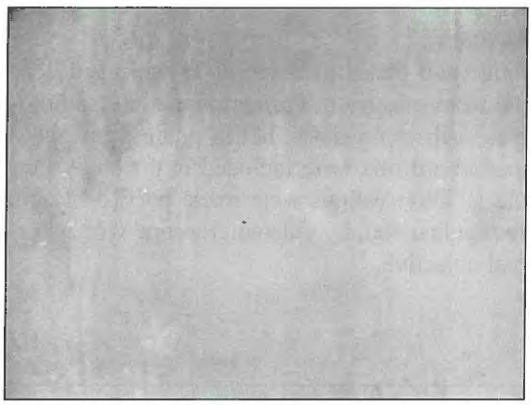

Fig. 1a - Pitting in psoriasis (Videomicroscopy, normal light, x50)

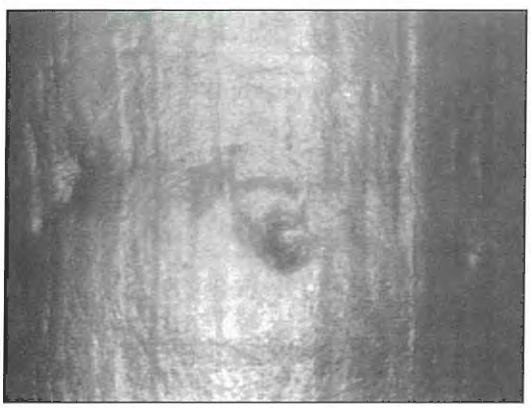

Fig. 1b - Pitting in psoriasis (Videomicroscopy, polarized light, x50)

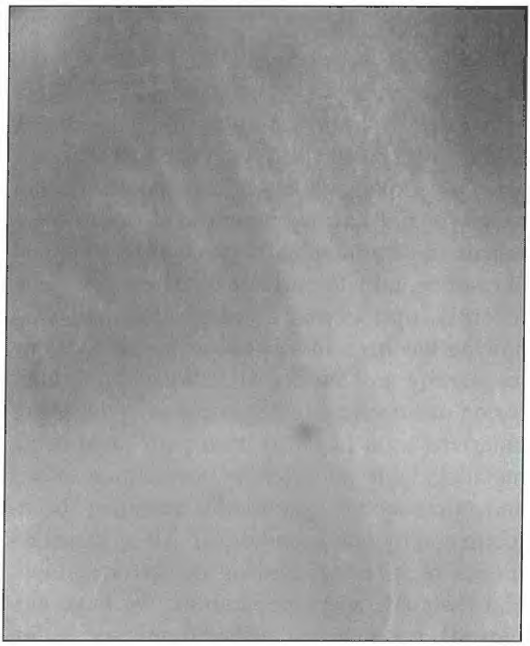

Fig. 2a - Nail beading in rheumatoid arthritis (Videomicroscopy, normal light, x50)

Fig. 2b - Pitting in psoriasis (Videomicroscopy, polarized light, x50)

Fig. 3a - Vertical lines (Videomicroscopy, normal light, x50)

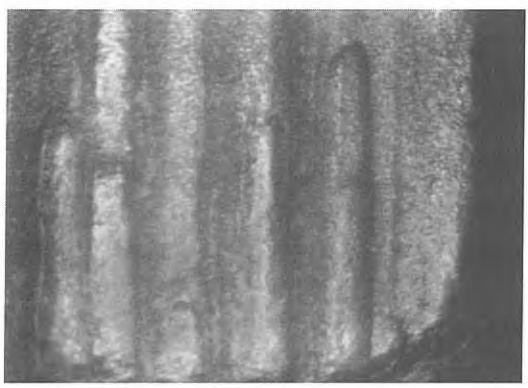

Fig. 3b - Vertical lines (Videomicroscopy, polarized light, x50)

Discussion

PLVM is a non invasive tecnique which allows us to investigate, in vivo, nail plates and hairs without drawing of specimens. This may be very useful when the effects of a prolonged therapy must be evaluated. The numerous magnifications are usefull in detecting very small lesions not yet visible to the naked eye. We believe that also in the field of cosmetic dermatology this tecnique will be very helpful, for example, in the study and therapy of brittle and fragile nails and in the evaluation of new hair cosmetics.

References

1. **Cohen PR, Scher RK. (1989)** Nail disease and dermatology. *J Am Acad Dermatol* **21:**1020-2.
2. **Nikkels-Tassoudji N, Piérard-Franchimont C, De Doncker P, Piérard GE. (1995)** Optical profilometry of nail distrophies. **190**:301-4.
3. **Apolinar E, Rowe WF. (1980)** Examination of human fingernail ridges by means of polari~ed light. *J Forensic Sciences* **25**:154-61.
4. **Strumìa, C. Roveggio, S. Trimurti.** Impiego della video-microscopia a sonda ottica con obiettivo a luce polarizzata nello studio delle onicopatie. Atti: III Congresso dell' Associazione Italiana di Diagnostica Non Invasiva in Dermatologia. Siena, 2-3 dicembre 1994.