Comparison of Photographic Methods for Evaluation of Skin Lesions
Kristin Kucera Marcum, M.D., Neal Goldman, M.D.
Department of Otolaryngology Head and Neck Surgery, Wake Forest Baptist Medical Center

Abstract

Objectives: To observe and document the different skin characteristics that can be better evaluated by examining skin under various types of photographic methods including parallel polarizing, cross polarizing and UV passing photography.

Introduction: Since the beginning of time there has been interest in capturing one’s own image. Therefore when the first photograph, a method to permanently capture an image, was created, there was almost a state of hysteria in the masses interested in this unimaginable phenomenon. Modern photography has advanced to include not only standard and digital photography, but there has been increasing research into the different skin characterizations that can be determined using photography. The standard initial consultation for facial plastics involves accurate flash photography for photo documentation. Newer techniques however exploring the use of polarized light, cross and ultraviolet photography can give detailed information on subtle skin lesions including skin pigmentation and skin surface characteristics. These multiple photography methods will provide a basis for objective, non-invasive data collection, which is much superior to the standard subjective evaluation of skin.

Setting: Tertiary Academic Medical Center

Methods: A prospective analysis of advanced photographic techniques used to evaluate skin texture, pigment, and/or vascularity, on patients that present themselves to the Department of Otolaryngology clinics. Subjects meeting the inclusion criteria and who have given written informed consent to participate have their photo taken under standard photography, polarized light photography, cross-polarized light photography and ultraviolet passing light. The photos are then evaluated by two photographers (otolaryngology resident and facial plastic surgeon) and a blinded observer (non-physician) to characterize the differences visualized in each type of photography.

Results: Each method of photography shows a significant difference in its ability to evaluate and document elements such as skin texture, vascularity, and pigmentation when used by the study team photographers. This is verified by the blinded observer.

Conclusions: Cross polarized photography is effective at revealing underlying vascular and subsurface features as well as skin pigment changes but poor at documenting surface features and texture. Parallel polarizing light is useful to examine and document skin surface features and texture but poor at documenting skin pigment and vasculature. UV passing light photography can reveal underlying sun damaged skin and worrisome premalignancy lesions but is poor at documenting vascular lesions.

Parallel Polarizing Light

Sunlight and almost every other form of natural and artificial illumination produces light waves whose electric field vectors vibrate in all planes that are perpendicular with respect to the direction of propagation. If the electric field vectors are restricted to a single plane by filtration of the beam with specialized materials, then the light is referred to as plane or linearly polarized with respect to the direction of propagation, and all waves vibrating in a single plane are termed plane or linearly polarized. Polarized light photography relies on the fact that light reflected from the skin has two components, namely, regular reflectance (glare) and light “back-scattered” from within the tissue. The regular reflectance contains the visual information relating to the skin surface texture including structure and contours of the stratum corneum, whereas the back-scattered light contains the information relating to intracutaneous. While the back-scattered light is depolarized, the reflected light preserves the plane of polarization of the incident light. This characteristic can be exploited to separate surface and intracutaneous detail by using polarizing filters that are parallel or perpendicular in orientation to each other. If the second filter covering the camera lens is parallel to that of the filter covering the flash, only the reflected polarized light passes through the lens filter and consequently surface details of the skin (texture, elevation, scaling) are enhanced.

Cross Polarizing Light

Conversely, if the lens filter is perpendicular to the flash passing filter, the regular reflectance is blocked and only the back-scattered light from the tissues reaches the lens. In this way, all surface detail is lost, but telangiectasia, tattoos, and inflammatory lesions are enhanced and pigmented lesions are more easily seen.

A number of applications, most notably polarized optical microscopy, rely on crossed polarizers to examine birefringent or doubly refracting specimens. When two polarizers are crossed, their transmission axes are oriented perpendicular to each other and light passing through the first polarizer is completely extinguished.

UV Passing Filter

Ultraviolet (UV)-emitting lamps emit light at wavelengths of 300 to 400 nm. As UV light penetrates the epidermis, it is absorbed by the epidermal melanin. As UV light is absorbed by melanin, skin areas with high epidermal concentrations of this pigment, such as solar lentigines, show up as darker areas compared with normal skin. Conversely, depigmented areas such as vitiligo lesions do not absorb UV light and appear as lighter areas.

Polarizing filters

UV passing filter

Polarizing filter

Photography Setup

Methods

Skin characteristics are examined for example various types of lesions such as basal cell lesions, vitiligo, melasma, or photoaging, under various methods of photography including black and white flash photography, standard color photography, parallel polarized light photography, cross polarized photography, and ultraviolet passing photography.

A Nikon N70 camera with a UV passing filter with black and white Tmax400 film was used for the black and white, ‘control’ as well as UV passing, ‘experimental’ photographs. Two white lightening flash with the UV protectant film removed were used to obtain adequate amount of light. A Nikon digital camera with setting of F11, was used behind a parallel polarizing filter for the parallel polarized light and a second filter rotated 90 degrees for a cross polarized light photograph.

Conclusions

By implementing various types of advanced photographic techniques such as parallel and cross polarized light as well as ultraviolet passing photography, skin characteristics are more readily demonstrated and documented.

Cross polarized photography is effective at revealing underlying vascular and subsurface features as well as skin pigment changes but poor at documenting surface features and texture. Parallel polarizing light is useful to examine and document skin surface features and texture but poor at documenting skin pigmentation and vasculature. UV passing light photography can reveal underlying sun damaged skin and worrisome premalignancy lesions but is poor at documenting vascular lesions.

Appropriate choice of advanced photographic techniques will more effectively document and diagnose and monitor cutaneous disease and dermatologic characteristics and thus improve our ability to provide patient care.

References
