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Funding sources: None.

Conflicts of interest: None disclosed.

Parts of this work were presented as a poster at the Medical Women's International Association Centennial Congress in Brooklyn, New York, July 25-28, 2019.

IRB approval status: Partners IRB Approved Protocol #: 2018P001954.

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https://doi.org/10.1016/j.jaad.2020.03.035

Facial lesion triangulation using anatomic landmarks and augmented reality

To the Editor: It is common for dermatologists to use photography for the purpose of biopsy-site identification. However, lack of standardization of photographs, absence of anatomic landmarks, scars from previous procedures, inadequate documentation, and poor image quality can make biopsy-site triangulation challenging.[1] Physicians and patients incorrectly identify 5.9% and 16.6% of surgical sites, respectively.[2] Proper photography can be helpful in accurate biopsy-site identification.[3] Here, we describe the use of facial recognition and augmented reality to provide lesion triangulation.

This study was granted approval by the Columbia University Irving Medical Center institutional review board. Residents and medical assistants from the Department of Dermatology at Columbia University were recruited to participate (n = 5; 27 to 58 years). A circular green 1.27-cm-diameter sticker was placed at 2 different locations on the participant's left and right cheeks, resulting in a total of 4 simulated lesions per participant. At each sticker location, the distance from the center of the green sticker to the lateral canthus, nasal ala, and oral commissure was measured by 2 authors (D.T. and N.K.A.) using a ruler. A series of images of each participant's face was captured with a handheld rear-facing smartphone camera, which recorded 1080 pixels at 30 frames per second for 10 seconds. The distance between the camera and the participant was varied between approximately 1 and 5 feet to simulate photography during a clinical encounter. Computer code was written in Python[4] with the OpenCV computer vision library. A 68-landmark facial detector[5] was used to recognize facial landmarks. Measurements from the center of the sticker to the lateral canthus, nasal ala, and oral commissure were generated by the algorithm and displayed virtually in the image. The first 200 frames that fulfilled computer screening parameters (which included a minimal sticker radius of at least 5 pixels, less than a 15% ratio between the left and right eye width to limit the effect of axial plane rotation, and less than a 30% ratio between the vertical location of the lateral canthus of each eye to limit the effect of sagittal plane rotation) were used for analysis. The algorithm is demonstrated on a female mannequin in Fig 1 and on one of the participants in Fig 2.

A total of 20 simulated lesions, 4000 images, and 12,000 computer-generated measurements were analyzed. The largest absolute error between the average of the 2 human measurements and the computer-generated measurements for all simulated lesions on the cheek was 1.55 cm. Of the computer-generated measurements, 95.25% were within 1 cm of the average of the human measurements. This study suggests that the use of facial recognition and augmented reality in the outpatient setting has the potential to reduce medical errors and wrong-site surgery by allowing dermatologists to accurately triangulate biopsy sites.

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Funding sources: None.

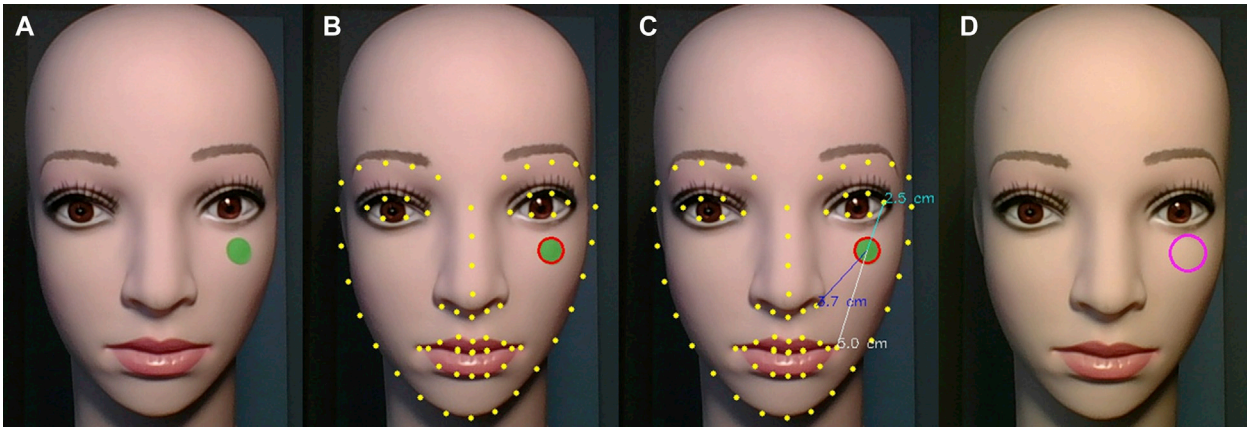

Fig 1. Computer triangulation of facial lesions, using augmented reality. **A**, A frontal-facing photograph of a mannequin with a green sticker attached was obtained. **B**, A facial detection algorithm recognized a face and identified 68 landmarks (yellow circles), whereas a masking and color detection algorithm identified the green sticker (red outline) and its size. **C**, Distances triangulating the sticker were determined and displayed (ie, 2.5 cm to the lateral canthus, 3.7 cm to the nasal ala, and 5.0 cm to the oral commissure). **D**, An estimate of the original sticker location (purple circle) on a new photograph was computer generated.

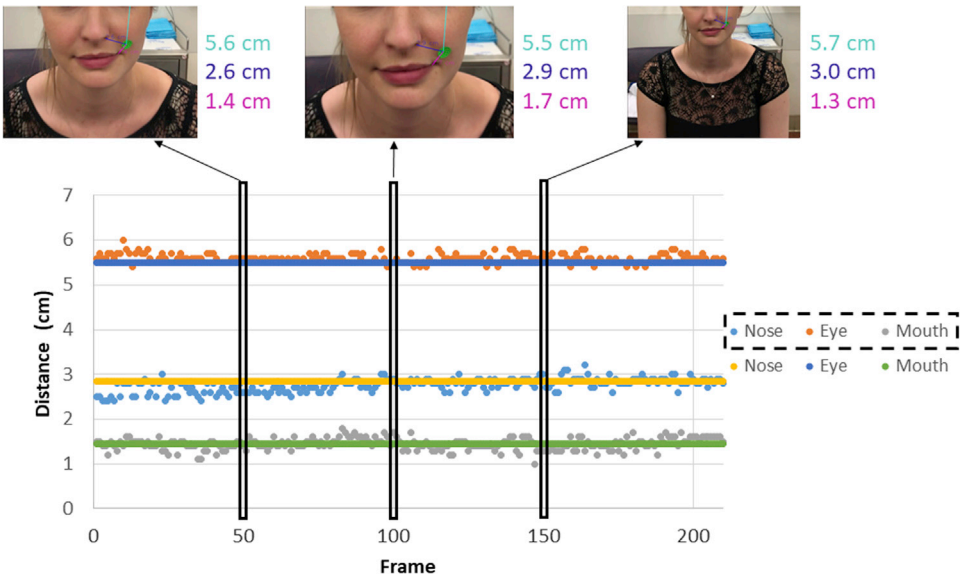

Fig 2. Triangulation accuracy at various distances. Comparison of measurements obtained from greater than 200 images of a sample lesion at various distances from the camera. The labels within the dashed box indicate computer-generated measurements for the 3 distances (in which "nose," "eye," and "mouth" correspond to the nasal ala, lateral canthus, and oral commissure, respectively). The human distance measurements are graphed as a constant and are indicated by the 3 horizontal lines. Sample images at frames 50, 100, and 150 with the associated computer-generated measurements are shown to demonstrate the measurement consistency at various distances.

Conflicts of interest: None disclosed.

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https://doi.org/10.1016/j.jaad.2020.03.040

Cutaneous absorption of tretinoin in 0.05% cream and 5% chemical peel formulas

To the Editor: Tretinoin chemical peels have been used for over 2 decades as an adjuvant therapy for melasma, photoaging, and acne.[1] The available literature does not elucidate to what degree a chemical peel at 5% may concentrate tretinoin in the epidermis and dermis to target nuclear retinoic acid receptors compared with the conventional 0.05% cream. This study aimed to quantify the cutaneous absorption of tretinoin in 0.05% (cream) and 5% (chemical peel) formulas.

A side-randomized, evaluator-blinded trial was conducted on 24 postmenopausal female volunteers older than 60 years, with Fitzpatrick skin types II to III, who were treated for photoaging. Tretinoin 0.05% and 5% emulsions were compounded 1 day before with the same vehicle, containing water, glycerin, polyacrylamide, $C_{13\text{-}14}$ isoparaffin and laureth-7, caprylic/capric triglyceride, phenoxyethanol, caprylyl glycol, ethylenediaminetetraacetic acid tetrasodium salt, butylhydroxy toluene, butylhydroxy anisole, and pentaerythrityl tetra-di-t-butyl hydroxyhydrocinnamate (School of Pharmacy, Federal University of Sao Paulo). Sealed 0.5-g sachets were kept refrigerated and photoprotected until topical application over a 250-cm^2 rectangle in each dorsal aspect of the forearm after gentle degreasing with acetone/ethanol 1:1, and left unoccluded for 6 hours before washing.[2] A delimited area had the corneal layer stripped by tape technique,[3] followed by a 3-mm punch biopsy for the quantification by liquid chromatography with tandem mass spectrometry of tretinoin extracted from the corneal layer and the epidermis or dermis.

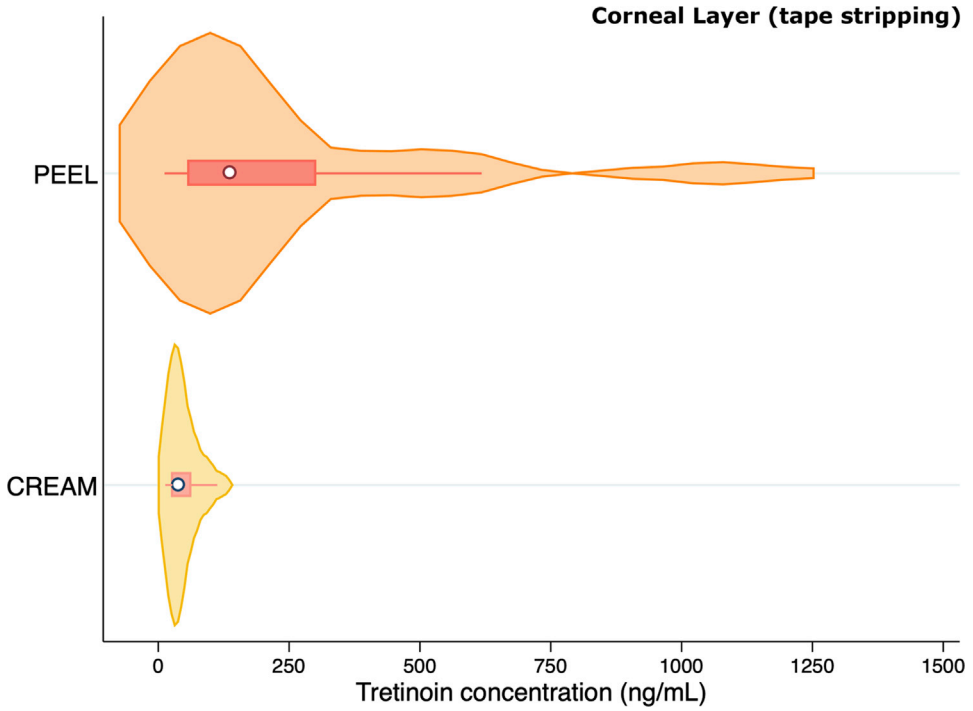

Fig 1. Corneal layer concentration. Violin plots of the distributions of tretinoin concentration extracted from the corneal layer of 24 side-randomized volunteers, after a treatment time of 6 hours, in cream formulas containing 0.05% tretinoin ("cream" on the *y* axis) and 5% tretinoin ("peel" on the *y* axis), followed by washing with soap and tape stripping (10 times) for the removal of the corneal layer. Tretinoin was extracted from the tapes and quantified by liquid chromatography with tandem mass spectrometry.