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Illuminating LiDAR Use in Dermatologic Surgery: A Pilot Survey Exploring New Dimensions in Procedural Care

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INTRODUCTION

Photography is essential in dermatology for longitudinal comparisons and referrals. While advancements in cameras and mobile phones/tablets have increased technology accessibility, these modalities are limited to two-dimensional (2D) imaging.[1] Current advanced imaging technologies are often costly/impractical for most dermatology practices.[2-4] Light/laser-imaging detection and ranging (LiDAR) measures the time taken for emitted infrared light to return to a sensor to create virtual, high-resolution, proportional three-dimensional (3D) models.[5] Studies suggest LiDAR could be a cost-effective clinical tool.[5] This study assesses the perceptions and feasibility of LiDAR compared to conventional photography for pre-operative dermatology assessments.

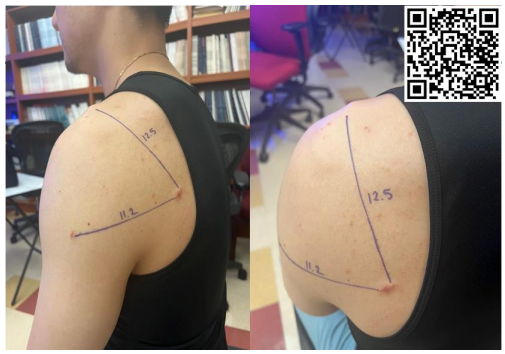
MATERIALS AND METHODS

The IRB-approved survey was distributed electronically via the American College of Mohs Surgeons (ACMS) to US-based Mohs surgeons, fellows, and residents. The 18-item survey gathered information on practice setting, experience, pre-operative assessment protocols, and photography device usage. Participants evaluated a vignette using both a still photo (Figure 1A) and a LiDAR model (Figure 1B), rating the ease of use and likelihood of incorporating LiDAR in practice on a 5-point Likert scale (1=very difficult to 5=very easy). Data were analyzed via chi-square or Mann-Whitney U-test with post-hoc Holm-Bonferroni test, with $P<.05$ denoting significance.

RESULTS

Final analysis included 37 participants (Table 1) with 59.4% having over 10 years of independent practice, and 45.9% in group dermatology private practice settings. Tablets were the most used photo capture device (n=25; 67.5%; Table 1) with the Apple iPad being the most used tablet (n=24; 96%; Table 1). Whether referrals were accompanied by documentation was significantly associated with referral source (e.g., dermatologists vs non-dermatologists vs non-physician clinician, $P<.001$; Figure 2). If

FIGURE 1. Hypertrophic scar. Pre-operative still photographs and a QR code to an interactive three-dimensional LiDAR of our mock patient were provided to survey participants.



referrals included documentation, they most commonly were clinical photographs without triangulations/markings among dermatologists (n=18; 48.5%) and non-physician clinicians (n=13; 35.1%; Figure 2). For non-dermatologist physicians, anatomical diagrams or patient charts with written descriptions or triangulations were more commonly provided (n=12; 32.4%, Figure 2).

Although majority (69.4%) of participants were unfamiliar with LiDAR and its availability on smart devices (91.9%; Table 1), participants reported similar interpretation ease between photographs ($\bar{x}$=4.75) and LiDAR ($\bar{x}$=4.63; Table 2). While LiDAR was rated easy to use among those unfamiliar with the technology ($\bar{x}$=4.63; Table 1), participants were generally less inclined to adopt it into clinical workflow ($\bar{x}$=2.00-2.71; Table 2). Dermatologists in academic/government/ university settings were more likely to consider using LiDAR for pre-operative planning ($\bar{x}$=3.67) and patient and resident education ($\bar{x}$=3.67) and in their surgical practice as a whole ($\bar{x}$=3.67) compared to their colleagues, which were both significant with Bonferroni's Correction (P=0.04; Table 2).

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TABLE 1.

Demographics Of Survey Respondents, Types of Smart Devices Used, Knowledge of LiDAR	
Demographics of survey respondents	**Count (%) N=37**
Gender	
Male	18 (48.6)
Female	18 (48.6)
No answer	1 (2.7)
Years in Practice	
Current Resident/ Fellow	2 (5.4)
1-10 years	13 (35.1)
11-20 years	11 (29.7)
21-30 years	7 (18.9)
≥31 years	4 (10.8)
Practice Setting	
Solo private practice	5 (21.6)
Dermatology group private practice	17 (45.9)
Multi-specialty group private practice	6 (16.2)
Academic / Government/ University	8 (21.6)
Hospital Based	1 (2.7)
Approximate # of Mohs/dermatologic surgery cases performed per year	
1-500	10 (27)
500-1000	12 (32.4)
1000-1500	9 (24.3)
>1500	10 (27.0)
None	1 (2.7)
Prior to day-of-surgery, do you have a separate visit for preoperative evaluation?	
Yes	8 (21.6)
No	29 (78.4)
Type of smart devices	
Type of device primarily used for still photography in practice:	
Tablet	25 (67.5)
Camera (i.e. point-and-shoot)	7 (18.9)
Smartphone	5 (13.5)
Brand of device used	
Smartphone (n=5)	
Apple iPhone	5 (100%)
Tablet (n=25)	
Apple tablet	24 (96%)
Microsoft Surface Pro	1 (4%)
Knowledge of LIDAR	
Prior to taking this survey, were you aware of…	
LiDAR technology?	
Yes	13 (35.1)
No	24 (64.9)
LiDAR technology being available on smart devices?	
Yes	3 (8.1)
No	34 (91.9)

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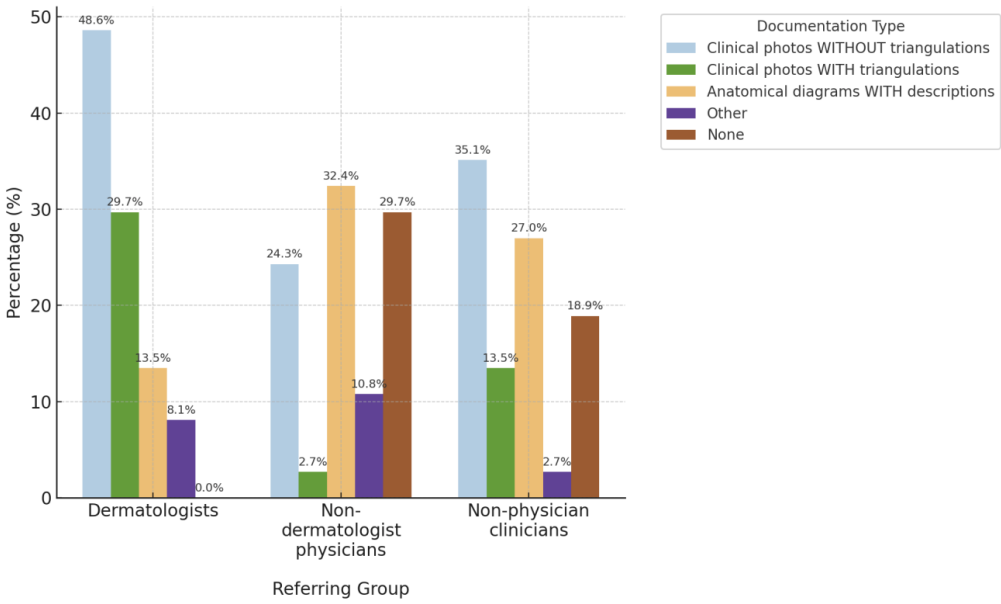
TABLE 2.

Crosstabulation of LiDAR Awareness and Average Likert Rating for Ease of Use of Photography vs LiDAR and Likelihood to Integrate LiDAR.

		Mean Rating for Ease of Use of …		Mean Rating of Likelihood to Incorporate LIDAR for:					
		Photography	LIDAR	Preoperative Planning	Biopsy Site Identification	Wound Checks	Patient/ Resident Education	Surgical Approach Planning	Surgical Practice as a whole
Aware of LiDAR before?	No	4.75	4.63	2.42	2.71	2.00	2.29	2.00	2.46
	Yes	4.69	4.77	3.15	3.38	2.54	3.23	2.54	3.31
	MW	1	1	0.51	0.40	1	0.22	1	0.19
Practice Setting	Academic/ Hospital	4.67	4.78	3.67	3.67	3.11	3.67	3.11	3.67
	Private§	4.75	4.63	2.36	2.71	1.89	2.29	1.89	2.46
	MW	1	1	0.04*	0.12	0.17	0.04*	0.21	0.04*
Years of Experience	<10 years	4.53	4.47	2.40	2.80	1.93	2.60	1.87	2.53
	>10 years	4.86	4.81	2.86	3.05	2.36	2.64	2.41	2.91
	MW	1	1	1	1	1	1	1	1

Likert scale rating of 1=very difficult to 5=very easy. MW – Mann-Whitney U with Bonferroni correction (*= P<0.05). § = multispecialty, solo, or group.

FIGURE 2. Type of documentation received with referral.



CONCLUSION

Our study found significant gaps in referral documentation, especially from non-dermatology sources. Although most surveyed dermatologists were unfamiliar with LiDAR technology, many recognized its potential in pre-operative assessments. This survey suggests that LiDAR could enhance dermatologic care by democratizing access to 3D imaging. Although participants unfamiliar with LiDAR reported being less likely to utilize it, increased awareness and familiarity with LiDAR may address knowledge gaps regarding practical dermatologic applications. Limitations include a small sample size and response bias; however, the sample was diverse in practice experience/setting. Additionally, the study assessed LiDAR's user-friendliness with only one item, so further research is needed to thoroughly evaluate its ease of use.

LiDAR offers an accessible way to integrate 3D imaging into dermatology. LIDAR may provide an affordable alternative to costly commercially available 3D-imaging devices, especially given the near ubiquitous (clinical-)adoption of handheld devices. Future studies should explore LiDAR's utility across diverse dermatological domains and clinical settings to lower costs, improve patient outcomes, and increase healthcare access.

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DISCLOSURES

JWM serves as a Digital Health Fellow for Doximity, Inc. JWM and DMS serve as Clinical Advisors for Berman Medical, Inc. YN, MDM, and RMC have no disclosures.

IRB approval status: Reviewed and exempt (approved) by SUNY Downstate IRB & Privacy Board; approval FWA#:00003624 · IORG#:0000064

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