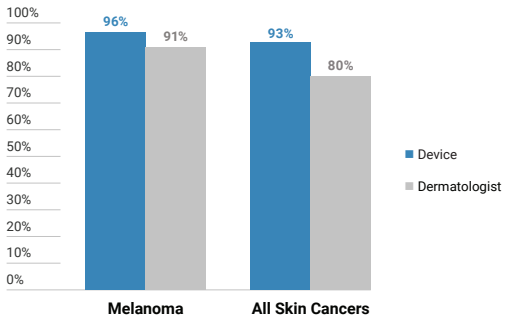
DermaSensor™ Optical Spectroscopy Technology

DermaSensor™

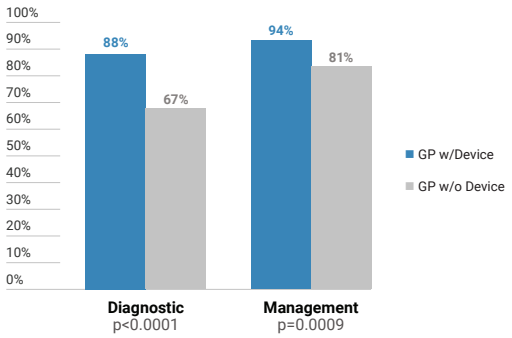
Safety and Effectiveness Results Across Multiple Clinical Studies:

DERM-ASSESS II Prospective Skin Cancer Validation Study[1]
DERM-ASSESS II Prospective Clinical Utility Study[2]
DERM-ASSESS III Prospective Melanoma Validation Study[3]
PATIENT-SELECT Prospective Specificity Validation Study[9]

DermaSensor and Dermatologist Sensitivity for Melanoma and All Skin Cancers[3]



DermaSensor and GP Sensitivity for Skin Cancer[2]



Overall study performance summary: All clinical validation studies reported no adverse events, and studies showed DermaSensor sensitivity superior to GPs and similar to Dermatologists.[1,3,4]

DermaSensor's sensitivity for melanoma ranged from 88-97% based on dermatopathology.[1,3,4,10]

For non-melanoma skin cancer (NMSC), i.e. BCC and SCC, DermaSensor's performance was 88-98% based on dermatopathology.[1,3,4]

- There were no adverse events among over 2,000 enrolled lesions from DERM-ASSESS II, DERM-ASSESS III, and STUDY 005[1,3,4]
- In DERM-ASSESS II, there was no statistical difference between the sensitivity of DermaSensor (97%) and dermatologists' (96%) across skin cancer types.[1]
- In a blinded, prospective study with 10 dermatology study centers in the U.S. and Australia, DermaSensor was found to have melanoma sensitivity comparable to the dermatologists' in diagnosing melanoma (DermaSensor: 96%; Investigators: 91%).[3]
- Across 1,500+ lesions in a blinded, prospective study with 22 GP study sites in the U.S. and Australia, DermaSensor's sensitivity results for melanoma, SCC and BCC were 88%, 98%, and 98%, respectively.[4]
- Depending on the clinician type and lesion selection criteria, specificity of the device ranged from 27-67% for benign nevi, 19-70% for SKs, and 7-57% for AKs.[1,3,4,9]
- An Independent Investigator-Initiated Study conducted in NZ found a 98% sensitivity of the device across all skin cancers.[5]
- DermaSensor's specificity was 61% for lesions of concern to patients, 36-37% for unbiopsied lesions of concern for non-specialist HCPs, and 21-33% for physician biopsied lesions.[1,4,7,8,9]
- As reported in Nature in 2019, "... most skin lesions are diagnosed by primary care doctors, and problems with inaccuracy have been underscored; if AI can be reliably shown to simulate experienced dermatologists, that would represent a significant advance."[6]
- In a randomized, prospective study of DermaSensor utility with 57 GPs, these physicians made over 5,000 assessments of skin lesions. DermaSensor increased physicians' cancer detection sensitivity from 81% to 94%, and this improvement was statistically significant (p = .0009).[2] There was no statistically significant change in the GP's specificity, or false positive rate, for benign lesions (p = .3558).[2]

DERM-ASSESS II Summary Table[2,7,8]

DERM-ASSESS II	Device	Dermatologist
All skin cancers	**97%**	**96%**
Melanoma	100%*	90%
SCC	97%	96%
BCC	97%	100%

***Note:** There were only 20 melanomas included in the sample and the study was not powered for melanoma detection.

DERM-ASSESS III Summary Table[3]

DERM-ASSESS III	Device	Dermatologist
All skin cancers	**93%**	**80%**
Melanoma	96%	91%
Melanoma and Highly Atypical Nevi	91%	72%

PATIENT-SELECT Summary Table[9]

PATIENT-SELECT	Device	GP Assessment
All skin cancers	**90%**	**40%**

Note: Device and PCPs performance assessed on biopsy diagnosis when available, and dermatologist-panel diagnosis when pathology was unavailable.

88-97%[10]

DermaSensor's spectroscopy technology showed a 88-97% sensitivity for melanoma (including highly atypical nevi) in three multi-year, multi-site prospective studies.[1,3,4]

94%

Skin cancer detection results improved from 81% to 94% with use of the DermaSensor device.[2]

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DermaSensor™ Number Needed to Biopsy, NPV/PPV Performance Across Spectral Score Ranges 1-10

DermaSensor Number Needed To Biopsy & PPV

Lesion Type and Study	NPV	PPV	Device NNB
GPs for All Skin Cancers	**97%**[4]	**17%**[4]	**6.7**[4]
Specialists for Melanoma	98%[3]	16%[3]	6.3[3]
Specialists for All High Risk Lesions	96%[3]	23%[3]	4.4[3]

Indications for Use

The DermaSensor device is indicated for use as an objective tool to assist qualified healthcare professionals in evaluating skin lesions suggestive of melanoma, basal cell carcinoma, and/or squamous cell carcinoma. The DermaSensor device is intended to assist the user in deciding whether skin lesions require further clinical care and is not intended to be used for direct diagnosis of skin cancer. DermaSensor is only for use by qualified healthcare professionals appropriately trained in the assessment of skin lesions for cancer.

Risks

False-positive and false-negative results may lead to unnecessary care or to a malignant skin lesion not being optimally managed, respectively. However, it is important to note that biopsy is used to confirm pathology and that elastic scattering spectroscopy is to be used as an adjunctive tool to visual inspection and history-taking. The DermaSensor device is not a screening tool—lesions that clearly warrant a biopsy should be biopsied per normal clinical practice. Clearly benign lesions do not require the use of the DermaSensor device.

Publications

Validation of a Handheld Elastic Scattering Spectroscopic Device in the Evaluation of Lesions Suggestive of Melanoma
Hartman, R. Tepedino, K., Fung, MA., McNiff, JM., Grant-Kels, J. Clinical, Presentation at the American Academy of Dermatologists Annual Meeting, Mar 24-28th, 2022

Clinical Utility of a Handheld Elastic Scattering Spectroscopy Tool and Machine Learning on the Diagnosis and Management of Skin Cancer by Primary Care Physicians
Tepedino K, Tablada A, Barnes E, Da Silva, T. (2021)

Use of Elastic-scattering Spectroscopy and Machine Learning When Assessing Skin Lesions Suggestive of Skin Cancer
Salmon P and Bonning M. (2021)

Safety and Effectiveness of Elastic Scattering Spectroscopy and Machine Learning in the Evaluation of Skin Lesions for Cancer
Benvenuto-Andrade, C., Manolakos, D., Cognetta, A.B. (2020)

Optical Spectroscopy as a Method for Skin Cancer Risk Assessment
Eladio Rodriguez-Diaz, Danielle Manolakos, Holly Christman, Michael A Bonning, John K Geisse, Ousama M A'Amar, David J Leffell, Irving J Bigio (2019)

Elastic Scattering Spectroscopy in Assessing Skin Lesions: An "In Vivo" Study
Tahwinder Upile, Waseem Jerjes, Hani Radhi, Jaspal Mahil, Anuja Rao, Colin Hopper (2011)

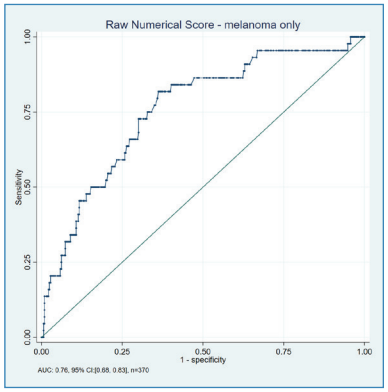
A New Tool to Inform Intra-Operative Decision Making in Skin Cancer Treatment: The Non-Invasive Assessment of Basal Cell Carcinoma of the Skin Using Elastic Scattering Spectroscopy
T Upile, Waseem Jerjes, O Johal, Simione Lew-Gor, J Mahil, Holger H Sudhoff (2012)

Elastic Scattering Spectroscopy in the Diagnosis of Pigmented Lesions: Comparison with Clinical and Histopathological Diagnosis
J. J. Scarisbrick, C. D. O. Pickard, Andrew C. Lee, Gavin M. Briggs, Kristie Johnson, Stephen G. Bown, Marco Novelli, M. R. S. Keshtgar, Irving J. Bigio, R. Yu (2003)

Preoperative Discrimination of Benign From Malignant Disease in Thyroid Nodules With Indeterminate Cytology Using Elastic LightScattering Spectroscopy
Jennifer E Rosen, Hyunsuk Suh, Nicholas J Giordano, Ousama M Aamar, Eladio Rodriguez-Diaz, Irving I Bigio, Stephanie L Lee (2014)

Comparison Between Ultraviolet-Visible and Near-Infrared Elastic Scattering Spectroscopy of Chemically Induced Melanomas in an Animal Model
Ousama M. A'amar, Ronald D. Ley, Irving J. Bigio (2004)

ROC Curve for the DermaSensor Device for Melanoma



The Receiver Operating Characteristic (ROC) curve for the DermaSensor device demonstrates the diagnostic capabilities (sensitivity and specificity) of the device based on a model taking into account differences between users. The associated area under the curve (AUC) is a calculated measure of diagnostic capabilities and can be used to assess potential for improvement in detection capabilities with use of a diagnostic tool. The AUC of the DermaSensor device for melanoma was 0.76 compared to 0.75 for dermatologists.

Spectral Score Groupings 1-5 and 6-10[3]

Spectral Scores Groupings	Melanoma PPV (NNB)	Frequency of 'Investigate Further' Lesions
1-5	13% (8)	84%
6-10	32% (3)	16%

Spectral Score Groupings 1-3, 4-7, and 8-10[3]

Spectral Scores Groupings	Melanoma PPV (NNB)	Frequency of 'Investigate Further' Lesions
1-3	6% (17)	46%
4-7	18% (6)	35%
8-10	40% (2)	19%

Note: Number neeeded to Biopsy (NNB) assumes all positive device results were biopsied by the HCP. It is calculated by dividing 100 by the PPV.

Spectroscopic Sensing of Cancer and Cancer Therapy: Current Status of Translational Research
Irving J Bigio, Stephen G Bown (2004)

Real-Time Pathology to Guide Breast Surgery: Seeing Alone is Not Believing
Irving J Bigio (2012)

The Color of Cancer: Margin Guidance for Oral Cancer Resection Using Elastic Scattering Spectroscopy
Gregory A Grillone, Zimmern Wang, Gintas P Krisciunas, Angela C Tsai, Vishnu R Kannabiran, obert W Pistey, Qing Zhao, Eladio Rodriguez-Diaz, Ousama M A'Amar, Irving J Bigio (2017)

Endoscopic Histological Assessment of Colonic Polyps by Using Elastic Scattering Spectroscopy
Eladio Rodriguez-Diaz, Qin Huang, Sandra R Cerda, Michael J O'Brien, Irving J Bigio, Satish K Singh (2014)

Skin Cancer: Precancers
Paul Bruner, Benjamin Bashline (2019)

References:
1) Manolakos D, Rabinovitz H, Geisse J, Bonning M, Rodriguez-Diaz E, Bigio I, Cognetta A. Clinical Validation of a Handheld Elastic Scattering Spectroscopy-Artificial Intelligence Device. Presentation, AAD Innovations Academy, July 21-24, 2022. **2)** Tepedino K, Tablada A, Barnes E, Da Silva, T. Clinical Utility of a Handheld Elastic Scattering Spectroscopy Tool and Machine Learning on the Diagnosis and Management of Skin Cancer by Primary Care Physicians. Poster Presentation, SDPA Fall Conference, Nov 4-7, 2021. **3)** Hartman, R. Tepedino, K., Fung, MA., McNiff, JM., Grant-Kels, J. Clinical Validation of a Handheld Elastic Scattering Spectroscopic Device in the Evaluation of Lesions Suggestive of Melanoma, Presentation at the American Academy of Dermatologists Annual Meeting, Mar 24-28th, 2022. **4)** Data on file, DermaSensor, Inc. **5)** Salmon P and Bonning M. Use of Elastic-scattering Spectroscopy and Machine Learning When Assessing Skin Lesions Suggestive of Skin Cancer, Poster Presentation, SDPA Fall Conference, Nov 4-7, 2021 **6)** Topol E. High-performance medicine: the convergence of human and artificial intelligence. Nature Medicine. 2019;25:44-66. **7)** For lesions biopsied in DERM- ASSESS II, dermatologist performance (i.e. dermatologist sensitivity and specificity) is based on the study dermatologists' in-person binary assessment of biopsied lesions as being malignant or benign, prior to receiving pathology results. **8)** For unbiopsied lesions the dermatologists' clinical determination of the lesion as benign was used as the reference standard; however, for the dermatologists' clinical assessment there was no reference standard since no biopsies were performed and accordingly no specificity is reported for their evaluations. **9)** Tepedino M, Balthazar D, Hucks C, Zeitouni N. Use of Elastic Scattering Spectroscopy on Patient-Selected Lesions That are Concerning for Skin Cancer, Poster Presentation, American Dermoscopy Meeting, Jun 29-Jul 2, 2022. **10)** Includes melanoma plus severely atypical nevi.

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