

## ORIGINAL ARTICLE

## A scientometric analysis of dermoscopy literature over the past 25 years

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### Abstract

**Background** Dermoscopy is a useful method allowing the non-invasive visualization of dermal and epidermal structures.

**Objective** To determine the scientific output in dermoscopy between 1985 and 2009 using ISI Web of Knowledge.

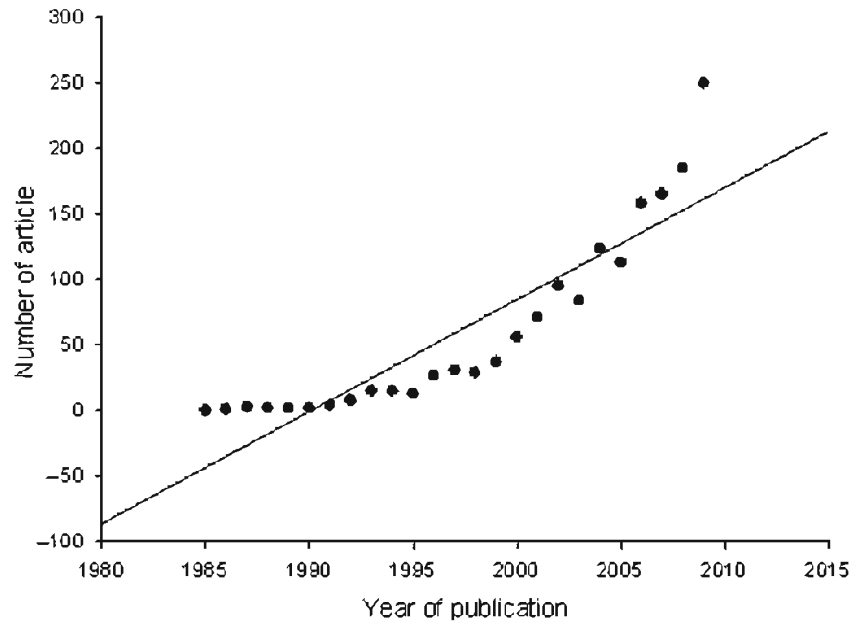
**Methods** The ISI Web of Knowledge was searched for articles on dermoscopy published between 1985 and 2009 using appropriate terms. Articles were characterized each year by publication type and journal type.

**Results** The search yielded 1490 dermoscopy publications, of which 1198 (80%) appeared in dermatology journals. A cubic increase in the number of publications over time was observed ( $R^2 = 95.3\%$ ,  $P < 0.0001$ ). Most of these publications were published in high-impact dermatologic journals, including *Archives of Dermatology* (209, 14%), *Journal of the American Academy of Dermatology* (161, 10.8%) and *British Journal of Dermatology* (113, 7.6%). Italy produced 29% of all articles followed by the United States with 22% and Austria with 15%. The number of dermoscopy publications associated with a given country correlated with melanoma incidence and Growth Domestic Product (GDP) per capita of that country ( $r = 0.517$   $P = 0.02$ , and  $r = 0.486$   $P = 0.03$  respectively).

**Conclusion** The number of scientific publications in the field of dermoscopy has increased significantly over the past 25 years. Italy, the United States and Austria have dominated the field of dermoscopy.

**Table 1** Number of publications on dermoscopy per year per publication type

	Total n	Article n	Letter n	Proceeding N	Abstract N	Review n	Other N	Derm journals n (%)	Non-derm journals n (%)
1985	0	0	0	0	0	0	0	0 (NA)	0 (NA)
1986	1	0	0	0	1	0	0	1 (100)	0 (NA)
1987	3	2	1	0	0	0	0	2 (100)	1 (NA)
1988	2	0	0	0	2	0	0	2 (100)	0 (NA)
1989	2	1	1	0	0	0	0	1 (50)	1 (50)
1990	2	2	0	0	0	0	1	2 (100)	0 (NA)
1991	4	3	0	0	0	0	1	1 (33)	3 (66)
1992	8	5	0	0	0	0	3	5 (63)	3 (37)
1993	15	8	3	3	0	0	1	13 (87)	2 (13)
1994	15	9	0	5	1	0	0	9 (60)	6 (40)
1995	13	10	0	2	1	0	0	9 (69)	4 (31)
1996	27	13	11	2	1	0	0	26 (96)	1 (4)
1997	31	19	1	7	1	2	1	19 (61)	12 (39)
1998	29	21	1	3	3	1	0	20 (69)	9 (31)
1999	37	26	2	4	2	2	1	26 (70)	11 (30)
2000	56	42	6	3	1	1	3	46 (82)	10 (18)
2001	71	53	7	5	1	2	3	60 (85)	11 (15)
2002	95	63	5	2	16	5	4	86 (91)	9 (9)
2003	84	56	16	3	1	4	4	66 (79)	18 (21)
2004	124	69	20	8	10	4	13	102 (82)	22 (18)
2005	113	59	20	8	7	3	16	96 (85)	17 (15)
2006	158	81	17	18	20	3	19	132 (84)	26 (16)
2007	165	87	18	17	18	5	20	136 (82)	29 (18)
2008	185	92	24	20	12	7	30	150 (81)	35 (19)
2009	250	121	38	32	26	14	19	188 (75)	72 (25)
Total	1490	842	191	142	124	53	138	1198 (80)	292 (20)



**Figure 1** Total number of publications on dermoscopy per year of publication (1985–2009).

**Table 2** Most productive countries on lead in research in dermoscopy field

Country	Dermoscopy publication	International collaboration	Total no. of publication on dermatology	MM incidence	GDP per capita (\$)	Population number (million)
Italy	435	155	9513	6,9	31 200	58.128
USA	327	110	55 950	14,7	46 300	307.212
Austria	217	132	5494	11,3	38 300	8.210
Germany	140	40	25 947	8,2	34 200	82.330
Spain	108	35	5168	5,4	33 100	40.525
Japan	97	20	16 389	0,4	33 400	127.079
Australia	75	38	1677	33,6	36 700	21.263
Switzerland	75	40	5464	13,3	40 000	7.604
England	46	14	14 199	8,4	35 500	61.113
Turkey	42	4	2759	0,9	11 800	76.806
France	40	16	13 827	8,9	32 800	64.058
Brazil	29	12	1469	2,4	9400	198.739
Canada	22	8	3173	8,7	38 700	33.487
Denmark	18	4	3049	13,1	37 200	5.501
Belgium	17	3	2296	4,9	36 200	10.414
Poland	15	1	1655	4,2	15 500	38.482
Taiwan	12	3	1409	0,3	29 500	22.974
Greece	10	3	969	2,5	30 000	10.737
South Korea	10	3	3217	0,3	25 800	48.510
Argentina	9	9	383	2,4	12 500	40.914

**Table 3** The 10 most-productive authors between 1985 and 2009

Rank	Author	Publication	Citation	H index	Country
1	Argenziano G	128	2009	23	Italy
2	Soyer HP	117	2316	27	Austria*
3	Zalaudek I	82	857	17	Austria
4	Marghoob AA	88	1040	19	United State
5	Malvey J	63	893	15	Spain
6	Puig S	60	882	15	Spain
7	Hofmann-Wellenhof R	59	1080	17	Austria
8	De Giorgi V	58	1140	16	Italy
9(tie)	Caril P	51	1166	16	Italy
9(tie)	Ferrara G	51	798	14	Italy

\*The last nine publications of the author were done in Australia

**Table 4** Top-30 most prolific journals involved in dermoscopy and their impact factor (IFs)

Rank	Journal title	No. of articles	Impact factor (2009)
1	Archives of Dermatology	209	4.76
2	Journal of the American Academy of Dermatology	161	4.105
3	British Journal of Dermatology	113	4.26
4	Dermatologic Surgery	85	2.343
5	Dermatology	76	2.741
6	Melanoma Research	50	2.061
7	Journal of Investigative Dermatology	49	5.543
8	Journal of the European Academy of Dermatology and Venereology	47	2.787
9	Skin Research and Technology	43	1.307
10	European Journal of Dermatology	31	2.251
11	Clinical and Experimental Dermatology	29	1.55
12	Clinics in Dermatology	26	3.107
13	Hautarzt	29	0.434
14	International Journal of Dermatology	24	1.117
15	Acta Dermato-Venereologica	24	3.007
16	Dermatologic Clinics	19	1.294
17	Seminars in Cutaneous Medicine and Surgery	19	1.813
18	Annales de Dermatologie et de Venereologie	19	0.391
19	Experimental Dermatology	16	3.239
20	Journal of Dermatology	17	1.008
21	Paediatric Dermatology	16	1.031
22	Computerized Medical Imaging and Graphics	14	1.041
23	Australasian Journal of Dermatology	11	0.973
24	American Journal of Dermatopathology	10	1.295
25	Archives of Dermatological Research	9	1.844
26	Journal der Deutschen Dermatologischen Gesellschaft	8	1.403
27	Cancer	7	5.418
28	Cutis	7	1.019
29	Journal of Cutaneous Medicine and Surgery	6	1.096
30	Journal of Telemedicine and Telecare	6	0.921

**Table 5** The top 50 most-cited articles in the field of dermoscopy (as assessed on <http://isiwebofknowledge.com>, 21–23 July, 2011)

Rank	Article	Citations
1	Pehamberger H, Steiner A, Wolff K. In vivo Epiluminescence Microscopy of Pigmented Skin-Lesions. 1. Pattern-Analysis of Pigmented Skin-Lesions. <i>J Am Acad Dermatol</i> 1987;17:571–83.	312
2	Argenziano G, Soyer HP, Chimenti S, et al. Dermoscopy of pigmented skin lesions. Results of a consensus meeting via the Internet. <i>J Am Acad Dermatol</i> 2003;48:679–93.	282
3(tie)	Kittler H, Pehamberger H, Wolff K, Binder M. Diagnostic accuracy of dermoscopy. <i>Lancet Oncol</i> 2002;3:159–65.	222
3(tie)	Nachbar F, Stolz W, Merkle T, et al. The ABCD Rule of Dermoscopy – High Prospective Value In The Diagnosis Of Doubtful Melanocytic Skin-Lesions. <i>J Am Acad Dermatol</i> 1994;30:551–9.	222
5	Binder M, Schwarz M, Winkler A, et al. Epiluminescence Microscopy – A Useful Tool For The Diagnosis Of Pigmented Skin-Lesions For Formally Trained Dermatologists. <i>Arch Dermatol</i> 1995;131:286–91.	214
6	Steiner A, Pehamberger H, Wolff K. In vivo Epiluminescence Microscopy of Pigmented Skin-Lesions. 2. Diagnosis of Small Pigmented Skin-Lesions and Early Detection of Malignant-Melanoma. <i>J Am Acad Dermatol</i> 1987;17:584–91.	211
7	Kenet RO, Kang S, Kenet BJ, et al. Clinical-Diagnosis of Pigmented Lesions Using Digital Epiluminescence Microscopy – Grading Protocol and Atlas. <i>Arch Dermatol</i> 1993;129:157–74.	198
8	Argenziano G, Fabbrocini G, Carli P, et al. Epiluminescence microscopy for the diagnosis of doubtful melanocytic skin lesions – Comparison of the ABCD rule of dermoscopy and a new 7-Point checklist based on pattern analysis. <i>Arch Dermatol</i> 1998;134:1563–70.	196
9	Stolz W, Riemann A, Cognetta AB, et al. ABCD Rule of Dermoscopy – A New Practical Method for Early Recognition of Malignant-Melanoma. <i>Eur J Dermatol</i> 1994;4:521–7.	140
10	Soyer HP, Smolle J, Hödl S, et al. Surface microscopy. A new approach to the diagnosis of cutaneous pigmented tumors. <i>Am J Dermatopathol</i> 1989;11:1–10.	138
11	Menzies SW, Ingvar C, Crotty KA, McCarthy WH. Frequency and morphologic characteristics of invasive melanomas lacking specific Surface microscopic features. <i>Arch Dermatol</i> 1996;132:1178–82.	135
12	Bahmer FA, Fritsch P, Kreuzsch J, et al. Terminology in surface microscopy. <i>J Am Acad Dermatol</i> 1990;23:1159–62.	131
13	Bafounta ML, Beauchet A, Aegerter P, Saïag P. Is dermoscopy (epiluminescence microscopy) useful for the diagnosis of melanoma? Results of a meta-analysis using techniques adapted to the evaluation of diagnostic tests. <i>Arch Dermatol</i> 2001;137:1343–50.	128
14	Yadav S, Vossaert KA, Kopf AW, et al. Histopathologic Correlates Of Structures Seen On Dermoscopy (Epiluminescence Microscopy). <i>Am J Dermatopathol</i> 1993;15:297–305.	127
15	Menzies SW, Ingvar C, McCarthy WH. A sensitivity and specificity analysis of the surface microscopy features of invasive melanoma. <i>Melanoma Res</i> 1996;6:55–62.	119
16	Langley RGB, Rajadhyaksha M, Dwyer PJ, et al. Confocal scanning laser microscopy of benign and malignant melanocytic skin lesions <i>In vivo</i> . <i>J Am Acad Dermatol</i> 2001;45:365–76.	107
17	Kittler H, Pehamberger H, Wolff K, Binder M. Follow-up of melanocytic skin lesions with digital epiluminescence microscopy. Patterns of modifications observed in early melanoma, atypical nevi, and common nevi. <i>J Am Acad Dermatol</i> 2000;43:467–76.	103
18	Moncrieff M, Cotton S, Claridge E, Hall P. Spectrophotometric intracutaneous analysis. a new technique for imaging pigmented skin lesions. <i>Br J Dermatol</i> 2002;146:448–57.	97
19	Steiner A, Binder M, Schemper M, et al. Statistical Evaluation of Epiluminescence Microscopy Criteria for Melanocytic Pigmented Skin-Lesions. <i>J Am Acad Dermatol</i> 1993;29:581–8.	96
20	Menzies SW, Gutenev A, Avramidis M, et al. Short-term digital surface microscopic monitoring of atypical or changing melanocytic lesions. <i>Arch Dermatol</i> 2001;137:1583–9.	92
21(tie)	Ganster H, Pinz A, Rohrer R, et al. Automated melanoma recognition. <i>IEEE Trans Med Imaging</i> 2001;20:233–9.	91
21(tie)	Garbe C, Eigentler TK. Diagnosis and treatment of cutaneous melanoma: state of the art 2006. <i>Melanoma Res</i> 2007;17:117–27.	91
23	Soyer HP, Smolle J, Leitinger G, et al. Diagnostic Reliability of Dermoscopic Criteria for Detecting Malignant-Melanoma. <i>Dermatology</i> 1995;190:25–30.	88
24	Argenziano G, Zalaudek I, Corona R, et al. Vascular structures in skin tumors – A dermoscopy study. <i>Arch Dermatol</i> 2004;140:1485–9.	84
25(tie)	Binder M, Poespöck-Schwarz M, Steiner A, et al. Epiluminescence microscopy of small pigmented skin lesions. Short-term formal training improves the diagnostic performance of dermatologists. <i>J Am Acad Dermatol</i> 1997;36:197–202.	82
25(tie)	Elbaum M, Kopf AW, Rabinovitz HS, et al. Automatic differentiation of melanoma from melanocytic nevi with multispectral digital dermoscopy. A feasibility study. <i>J Am Acad Dermatol</i> 2001;44:207–18.	82

25(tie)	Mayer J. Systematic review of the diagnostic accuracy of dermatoscopy in detecting malignant melanoma. <i>Med J Aust</i> 1997;167:206-10.	82
28	Pehamberger H, Binder M, Steiner A, Wolff K. In vivo Epiluminescence Microscopy - Improvement of Early Diagnosis of Melanoma. <i>J Invest Dermatol</i> 1993;100:S356-S62.	74
29(tie)	Menzies SW, Westerhoff K, Rabinovitz H, et al. Surface microscopy of pigmented basal cell carcinoma. <i>Arch Dermatol</i> 2000;136:1012-6.	73
29(tie)	Soyer HP, Kenet RO, Wolf IH, et al. Clinicopathological correlation of pigmented skin lesions using dermoscopy. <i>Eur J Dermatol</i> 2000;10:22-8.	73
31	Schmid P. Segmentation of digitized dermatoscopic images by two-dimensional color clustering. <i>IEEE Trans Med Imaging</i> 1999;18:164-71.	69
32	Gerger A, Koller S, Kern T, et al. Diagnostic applicability of <i>in vivo</i> confocal laser scanning microscopy in melanocytic skin tumors. <i>J Invest Dermatol</i> 2005;124:493-8.	68
33	Kittler H, Seltenheim M, Dawid M, et al. Frequency and characteristics of enlarging common melanocytic nevi. <i>Arch Dermatol</i> 2000;136:316-20.	66
34	Slade J, Marghoob AA, Salopek TG, et al. Atypical Mole Syndrome - Risk Factor for Cutaneous Malignant-Melanoma and Implications for Management. <i>J Am Acad Dermatol</i> 1995;32:479-94.	65
35(tie)	Andreassi L, Perotti R, Rubegni P, et al. Digital dermoscopy analysis for the differentiation of atypical nevi and early melanoma - A new quantitative semiology. <i>Arch Dermatol</i> 1999;135:1459-65.	63
35(tie)	Carli P, De Giorgi V, Crocetti E, et al. Improvement of malignant/benign ratio in excised melanocytic lesions in the 'dermoscopy era': a retrospective study 1997-2001. <i>Br J Dermatol</i> 2004;150:687-92.	63
37(tie)	Gniadecka M, Philipsen PA, Sigurdsson S, et al. Melanoma diagnosis by Raman spectroscopy and neural networks: Structure alterations in proteins and lipids in intact cancer tissue. <i>J Invest Dermatol</i> 2004;122:443-9.	61
37(tie)	Piccolo D, Smolle J, Wolf IH, Peris K, Hofmann-Wellenhof R, Dell'Eva G, et al. Face-to-face diagnosis vs teledagnosis of pigmented skin tumors - A teledermoscopic study. <i>Arch Dermatol</i> 1998;135:1467-71.	61
37(tie)	Seidenari S, Pellacani G, Pepe P. Digital videomicroscopy improves diagnostic accuracy for melanoma. <i>J Am Acad Dermatol</i> 1998;39:175-81.	61
37(tie)	Steiner A, Pehamberger H, Binder M, Wolff K. Pigmented Spitz Nevi - Improvement of The Diagnostic-Accuracy by Epiluminescence Microscopy. <i>J Am Acad Dermatol</i> 1992;27:697-701.	61
41(tie)	Binder M, Kittler H, Seeber A, et al. Epiluminescence microscopy-based classification of pigmented skin lesions using computerized image analysis and an artificial neural network. <i>Melanoma Res</i> 1998;8:261-6.	60
41(tie)	Saida T, Oguchi S, Ishihara Y. In-Vivo Observation of Magnified Features of Pigmented Lesions on Volar Skin Using Video Macroscope - Usefulness of Epiluminescence Techniques In Clinical-Diagnosis. <i>Arch Dermatol</i> 1995;131:298-304.	60
41(tie)	Wolf IH, Smolle J, Soyer HP, Kerl H. Sensitivity in the clinical diagnosis of malignant melanoma. <i>Melanoma Res</i> 1998;8:425-8.	60
44(tie)	Braunfalco O, Stoiz W, Billek P, et al. The Dermatoscope - A Simplification of Skin Surface Microscopy of Pigmented Skin-Lesions. <i>Hautarzt</i> 1990;41:131-6.	59
44(tie)	Carli P, de Giorgi V, Chiarugi A, et al. Addition of dermoscopy to conventional naked-eye examination in melanoma screening. A randomized study. <i>J Am Acad Dermatol</i> 2004;50:663-9.	59
46(tie)	Marghoob AA, Swindle LD, Moricz CZM, et al. Instruments and new technologies for the <i>in vivo</i> diagnosis of melanoma. <i>J Am Acad Dermatol</i> 2003;49:777-97.	58
46(tie)	Westerhoff K, McCarthy WH, Menzies SW. Increase in the sensitivity for melanoma diagnosis by primary care physicians using skin surface microscopy. <i>Br J Dermatol</i> 2000;143:1016-20.	58
48	Gerger A, Koller S, Wager W, et al. Sensitivity and specificity of confocal laser-scanning microscopy for <i>in vivo</i> diagnosis of malignant skin tumors. <i>Cancer</i> 2006;107:193-200.	57
49(tie)	Argenziano G, Fabbrocini G, Carli P, et al. Epiluminescence microscopy. Criteria of cutaneous melanoma progression. <i>J Am Acad Dermatol</i> 1997;37:68-74.	56
49(tie)	Piccolo D, Smolle J, Argenziano G, et al. Teledermoscopy-results of a multicentre study on 43 pigmented skin lesions. <i>J Telemed Telecare</i> 2000;6:132-7.	56

**Table 6** Frequency of author keywords used more than 10 times in world dermoscopy publications

<b>Author keywords</b>	<b>Publications</b>	<b>Rank, %</b>
Dermoscopy	258	1
Melanoma	221	2
Dermatoscopy	100	3
Epiluminescence microscopy	72	4
Malignant melanoma	49	5
Diagnosis	44	6
Skin cancer	32	7
Pigmented skin lesions	26	8
Computer-aided diagnosis	18	9
Image analysis	22	10
Basal Cell carcinoma	17	11
Nevus	14	12
ABCD rule	13	13
Segmentation	13	14