

Comparison of Actual Psoriasis Surface Area and the Psoriasis Area and Severity Index by the Human Eye and Machine Vision Methods in Following the Treatment of Psoriasis

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The lack of a quantitative method for assessing psoriasis severity poses a problem for quality control in dermatology. Quantitative estimation of involved surface area is important, as in the psoriasis area and severity index (PASI), but the reliability of many methods is poor. The purpose of this study was to assess the involved surface area of 15 psoriasis patients before and after different anti-psoriasis treatments using the human eye method and a computer image analysis (CIA) system based on colour segmentation. The human eye assessments were compared with the results of the CIA system and the resulting effects on the PASI score were also compared. The human eye estimates were higher than those obtained by the CIA method and, as a consequence, the values of the PASI by the human eye method were also higher than those by CIA. The human eye estimates differed most in cases where the PASI was under 15. The changes in the PASI by the human eye method before and after treatments differed significantly from those by CIA. The CIA system offers a possibility to quantify actual surface in patients with psoriasis, and will be an alternative for developing quality control when evaluating different treatment efficacies.

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Psoriasis is a common skin disease and its treatments involve significant cost and disability. The lack of standard systems for assessing disease severity poses a problem for the introduction of rational quality control in dermatology (1). The most frequently used method is the Psoriasis Area and Severity Index (PASI) (2, 3). During recent years, however, new techniques have been developed. Self-administered PASI (SAPASI) is a structured patient self-report instrument designed for use in large epidemiological studies (4, 5). Some investigators have used computer-assisted methods in assessing the extent of psoriasis, e.g. Ramsay & Lawrence (7) from whole-body black-and-white photographs and Marks et al. (6) from colour photographs by the planimetry method. In many methods the quantitative assessment of involved surface area is important, but the reliability of the methods used has been poor (6–8). We recently published a new computer image analysis (CIA) method in which the assessment of actual psoriasis surface area is based on colour segmentation (9). In this study, the involved surface area estimates were assessed in following the treatment of psoriasis by the human eye method and by the CIA system based on colour segmentation. The results were compared and also the effects on the PASI.

MATERIAL AND METHODS

Fifteen patients (14 males, 1 female; mean age 51 years, range 20–78 years) with chronic plaque psoriasis were selected in the Department of Dermatology and Venereology of Oulu University Hospital. The involved skin surface area of the patients was assessed by the human eye method and from digital photographs using the CIA system. Digital photographs (digital camera Nikon E25 1280 × 1000, 24 bit) were taken by two professional photographers in a studio using the constant illumination (studio flashlight Prophoto 1200; background Colorama Ceramic blue n:o 171) from parallel areas as in the PASI (1, none; 2, 1–9%; 3, 10–29%; 4, 30–49; 5, over 50%), dividing the body into eight parts, excluding the head, neck and groin areas. The skin area assessment and the other parameters of the PASI (erythema, scaling, the thickness of psoriasis lesions) were estimated by the author (EA) on the same day as the photographs were taken. To evaluate the method as a measure of treatment efficacy, the photographs were taken and the human assessments of actual psoriasis surface area with the other parameters of the PASI were estimated before and after various treatments, including psoriasis day care, system therapies, ultraviolet light treatment, and topical care (Table I).

RESULTS

Single assessments of involved surface area with psoriasis were higher by the human eye method than by the CIA, and the difference was highly significant ($p < 0.001$) by the sign test. The values of the PASI by the human eye method were higher in 22/30 (73%) and lower in 3/30 (10%) than those by the CIA method. They were equal in only 5/30 (17%) (Table I). The human eye estimates differed most in the cases where the PASI was under 15. The difference was highly significant ($p < 0.001$) by the Wilcoxon signed-ranks test. The value of the mean PASI before treatments was 8.8 (range 1.8–19.9) by the human eye method and 6.7 (1.6–19.9) by the CIA method. After treatments, the mean PASI values were 3.5 (0.7–9.6) and 2.7 (0–9.6) (Table I). The possible difference between the changes of the PASI estimated by these different methods before and after treatments was also assessed. The difference was significant ($p = 0.003$) by the Wilcoxon signed-ranks test.

DISCUSSION

In this study, a CIA method based on a new technique of colour segmentation was used to assess involved surface area in patients with psoriasis. The actual surface area of psoriasis was estimated from digital photographs twice: at the beginning and at the end of different anti-psoriasis treatments. The parameters of the PASI were also assessed twice, i.e. on the same days as the photographs were taken. The human eye estimates of involved surface area were significantly higher than those obtained by the CIA method. As a conse-

Table I. Clinical details of psoriasis patients studied by the human eye and image analysis methods before and after different anti-psoriasis treatments. Individual PASI values are shown in each case

Case	Gender/age	Treatments	PASI values before treatment/after treatments			
			Human eye	Image analysis	Human eye	Image analysis
1	M 20	bathPUVA 0.93 J/cm ² topical dithranol 0.5%, topical tar 0.5–2%	1.8	1.6	2.4	1.6
2	M 62	acitretin 50 mg/day, topical calcipotriol	9.5	6.7	6.6	5.0
3	M 41	bathPUVA 2.11 J/cm ² , topical calcipotriol	9.3	4.2	2.6	1.2
4	M 36	creamPUVA 0.94 J/cm ² , topical corticosteroids	5.9	2.0	4.7	3.2
5	M 71	bathPUVA 1.81 J/cm ² , topical calcipotriol	11.5	8.7	5.4	4.2
6	M 31	bathPUVA 1.37 J/cm ² , topical calcipotriol	9.9	4.9	1.4	0
7	M 58	bathPUVA 5.2 J/cm ² , topical calcipotriol	7.1	5.1	1.5	1.5
8	M 50	UVB 0.89 J/cm ² , topical calcipotriol	6.3	4.8	2.2	2.2
9	M 61	bathPUVA 1.13 J/cm ² , topical calcipotriol	10.5	8.0	2.3	1.4
10	M 70	UVB 1.36 J/cm ² , topical calcipotriol	5.7	3.0	2.3	1.5
11	M 58	UVB 1.56 J/cm ² , topical calcipotriol, topical corticosteroids	6.5	4.0	0.7	0.2
12	F 78	creamPUVA 0.17 J/cm ² , topical calcipotriol	15.3	15.3	9.6	9.6
13	M 44	bathPUVA 1.21 J/cm ² , topical tar 0.5–2%	19.9	19.9	4.0	4.4
14	M 46	creamPUVA 0.13 J/cm ² , acitretin 50 mg/day, topical calcipotriol, topical corticosteroids	4.0	5.6	1.9	2.5
15	M 42	bathPUVA 2.5 J/cm ² , topical calcipotriol, topical corticosteroids	8.3	6.2	5.1	2.4
		The values of the mean PASI ($p < 0.001$)	8.8	6.7	3.5	2.7

quence, the values of the PASI by the human eye method were also higher than those by CIA, because the only variable parameter was surface area of psoriasis. The human eye estimates differed mostly in the group of psoriasis patients whose PASI was under 15. The mean value of the PASI before treatments was 8.8 by the human eye method and 6.7 by the CIA method. After the treatments, the mean PASIs were 3.5 and 2.7, respectively. The changes in the PASI assessed by the human eye method before and after treatments also differed significantly from those obtained by CIA. In the present study the human investigator consequently overestimated the involved body surface area, which led to higher PASI values. However, the total area of skin involvement in psoriasis patients is important when estimating psoriasis severity and for the generally used PASI. The reliability of previously used methods has been poor (6–8). The CIA method used in this study was found to be reliable and practicable in a recently published study (9). The method requires high quality photography, and is technically demanding and time-consuming, even though the use of a digital camera made image processing faster. The CIA system is an objective method for quantifying involved surface in patients with psoriasis, and it will be an alternative for developing quality control in the evaluation of different treatments for psoriasis.

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