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Original Contribution

MISSING POSITIVE CORRELATION BETWEEN THE SCANS OF VIDEO DERMATOSCOPY AND ELECTRICAL IMPEDANCE SPECTROSCOPY IN CLINICALLY APPARENT PIGMENT LESIONS

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ABSTRACT

Purpose: Early detection of melanoma is vital for treatment, outcome, and survival. The aim of this study was to determine if there is a correlation between the score of electrical impedance spectroscopy (EIS) Nevisense® and the score of the video dermatoscopy Fotofinder ® in the clinical examination of atypical melanocytic lesions (AMLs).

Methods: In this retrospective descriptive study twenty-eight patients with clinically suspicious naevi were screened and monitored with both Fotofinder ® video dermatoscopy system and the Nevisense® EIS system. Their score values were determined and correlated with each other.

Results: 28 patients - 19 males and 9 females were studied. The dermatoscopy score ranged between 0.38 and 0.73 of a possible 0.99. The EIS score was between 2 and 10 of a possible 10. There was no positive correlation between the two scores. The Pearson Correlation showed a correlation coefficient of R = -0.753 (p-value <0.001).

Conclusions: We conclude that the additional investigation of clinically or dermatoscopy suspicious AMLs with the EIS could provide additional, independent, risk assessment information. An algorithm for the systematic inclusion of EIS in the study path of AML would still have to be developed.

Key words: electrical impedance spectroscopy, dermatoscopy, correlation, atypical melanocytic lesion, monitoring

INTRODUCTION

The incidence of malignant melanoma continues to increase in most countries around the world, but with stagnating mortality (3). In order to improve the early diagnosis of melanoma, numerous new diagnostic methods have been developed in recent years. These include imaging methods and physical techniques that automatically assess lesions and provide results. Skin lesions can be visually assessed with the naked eye. However, a clinical diagnostic is limited by low resolution and penetration depth. In case of doubt, a biopsy must be taken, which is time-consuming and invasive. The combination of good diagnostic methods is needed to avoidunnecessary invasive examinations, especially in the field of oncology.

Dermatoscopy is a well-established research method that has been used for many years. For the experienced examiner is the dermatoscopy a suitable screening tool. It uses an immersion technique. As a result, the upper skin layers of the stratum corneum become transparent and the light can thus penetrate into the skin. Deeper structures are "illuminated" and thus visible (4). The dermatoscopic image shows numerous structures and colors that are not accessible to the examiner in a purely clinical examination.

Thanks to dermatoscopy it results an increase in preoperative diagnostic accuracy as opposed to the naked eye. Certain algorithms determine

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the dermatoscopic criteria for melanoma diagnosis used today. Most of these algorithms (ABCD rule of dermatoscopy, 7-point checklist, Menzies scoring method (2) use a reduced number of particularly important melanoma-associated criteria to standardize the distinction between melanoma and benign melanocytic lesions with high diagnostic accuracy (1).

Digital dermatoscopy uses digital images to study and document the lesions. Software-based systems for the analysis of individual naevi give extra security in the early detection of malignant melanoma. The mole analyzer Fotofinder ® is suited for melanocytic lesions only. Based on diagnostic algorithms, the lesion is evaluated with a malignancy score between 0.00 and 0. 99. The program is given to have a diagnostic sensitivity of 86% and a diagnostic specificity of 83% (9). The results from the examination of the AML are shown on the screen and can be used by the dermatologist as a means of communication with his patient. The experienced dermatologist uses Fotofinder ® as an additional diagnostic tool.

Although dermoscopy is a very good complement to clinical evaluation, there are always some lesions that lead to diagnostic uncertainty. To be able to identify and monitor these lesions without unnecessary excision, the additional use of electrical impedance spectroscopy is valuable.

Nevisense® (SciBase AB, Stockholm, Sweden) is a diagnostic tool based on electrical impedance spectroscopy (6). Electrical impedance spectroscopy is not an imaging method. It measures tissue resistance by administering alternating electrical currents at various frequencies to the skin. Normal and abnormal tissue differ with regard to cell size, shape, density and structure of cell membranes. These different properties influence the ability of the tissue to conduct and store electricity and can influence the results of an EIS measurement. The method does not provide a diagnosis, but only a value that determines the probability indicating malignancy. Studies have resulted in an algorithm in which EIS scores in the range of 0-3 in the Nevisense® system represent a negative predictive value (i.e., the probability that the lesion is not a melanoma) of 98%, and scores of 4-10 represent steadily increasing positive predictive values (7).

At our department of dermatology the combination of clinical examination Fotofinder® video dermatoscopy system and the Nevisense® EIS system has been used in the assessment of atypical melanocytic lesions to determinate whether they should be surgically removed or not.

MATERIAL AND METHODS

In this study, the clinical outcome of all patients with either clinically or dermatoscopic suspicious AMLs were followed with video dermatoscopy Fotofinder® combined with EIS measurements with Nevisense® during the period from February to May 2019, were analyzed. 28 patients with AMLs were monitored, the skin of the patients was intact (i.e., lesions were not ulcerated or bleeding), and the lesions were free of scars and fibrosis and located in skin areas were free from eczema, psoriasis, acute sunburn or terminal hair.

After a full-body skin examination, the same physician decided which suspected AML(s) should be followed using dermatoscopy and EIS. Applying the video dermatoscopy the presence of dermoscopic, changes were visualized and each lesion was evaluated with a malignancy score between 0.00 and 0.99. All images and score were stored in the patient's electronic journal. Subsequently, an EIS measurement was carried out with the Nevisense® instrument. The system measures bio-impedance of the skin at 35 different frequencies, logarithmically distributed from 1.0 kHz to 2.5 MHz. If the arrangement, size and type of skin cells are regular, the recorded curves are also moving moderately. In contrast to this, tumor cells by virtue of their polymorphism show irregular curves. The system calculates ones from the curve a score (from 1 to 10) that reflects the degree of abnormality of the lesion [6].

The data documentation and statistical evaluation were carried out with Software SPSS (Statistical Product and Service Solution) for Windows (Release 11.0.1. (15 Nov. 2001), Standard Version, Copyright© SPSS Inc. Chicago, Illinois 1989-2001). This is a modular program package for statistical data analysis. Based on the Pearson correlation coefficient we could count the correlation between the two scores from the dermatoscopy and from the EIS. The Pearson correlation coefficient (or bivariate correlation), is a measure of the linear correlation between two

variables *X* and *Y*. It has a value between +1 and −1, where 1 is total positive linear correlation, 0 is no linear correlation, and −1 is total negative linear correlation (7).

RESULTS

A total of 26 patients (18 men and 8 women) with each one AMLs were examined with both Nevisense® and the Fotofinder ® during the study period **(Table 1).** The median age of the patients was 46. 3 years (range 8 to 66 years).

Table 1. *Demographic data of all 28 patients and clinical/histopathological characteristics*

Lesion	Sex*	Age	EIS-score	Fotofinder Score	Location	Treatment	Histopathology
1	M	42	5	0,68	Abdomen	Excision	Dysplastic compound nevus
2	F	59	5	0,72	Hip	Excision	Dysplastic compound nevus
3	F	44	2	0,82	Back	Excision	Dysplastic compound nevus
4	M	42	7	0,55	Back	Excision	Dysplastic compound nevus
5	M	70	7	0,69	Gluteus	Excision	Melanoma in situ
6	M	56	7	0,47	Mamma	Excision	Dysplastic junctional nevus
7	M	30	6	0,54	Abdomen	Excision	Dysplastic compound nevus
8	M	62	5	0,69	Back	Excision	Dysplastik compound nevus
9	M	8	3	0,64	Back	None	Control
10	F	62	5	0,70	Back	Excision	Dysplastic junctional nevus
11	W	10	2	0,80	Back	None	Control
12	M	79	8	0,38	Back	Excision	Dysplastic compound nevus
13	F	28	2	0,68	Abdomen	None	Control
14	M	46	6	0,56	Back	Excision	Dysplastic junctional nevus
15	M	43	5	0,62	Back	None	-
16	F	41	6	0,46	Back	None	-
17	M	66	4	0,54	Abdomen	None	-
18	M	53	10	0,39	Back	None	-
19	M	59	5	0,54	Mamma	None	-
20	F	49	7	0,42	Back	None	-
21	M	51	6	0,52	Abdomen	None	-
22	M	44	6	0,55	Back	None	-
23	M	57	8	0,73	Back	None	-
24	M	14	3	0,82	Back	None	
25	M	32	6	0,45	Hip	Excision	Dysplastic compound nevus
26	M	57	6	0,39	Back	None	-

Eleven lesions (31%) were excised. Upon histopathological examination, one were melanoma in situ (dermatoscopy score of 0.69 and EIS score of 7), 7 were dysplastic compound nevi, 3 dysplastic junctional nevi and 1 was junctional nevus with pigment incontinence. All examined pigment foci were localized on the trunk or gluteal. The dermatoscopy score ranged between 0.38 and 0.82 from a maximum of 0.99 possible (0.57 average). The EIS score was between 2 and 10 of a possible 10 (average 5.46). Using a Pearson Correlation, we could not find a positive correlation between the two scores. We count a coefficient of R = -0.753 with a p-value of <0.01. **(Figure 1)**

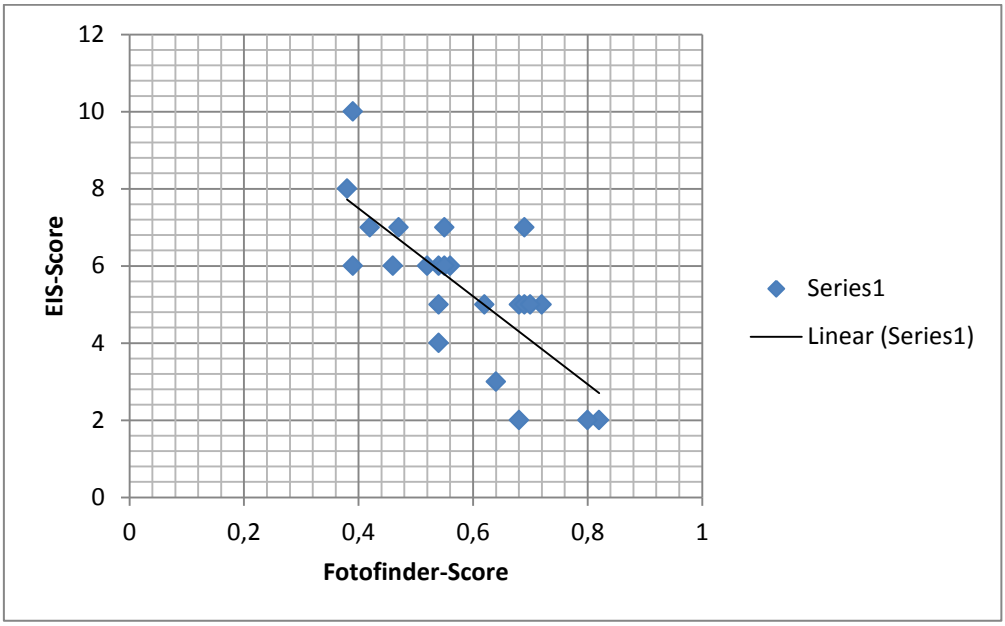

Figure 1. The figure gives a sense of how there is no correlation between the both scores- EIS – Score and Fotofinder ® -Score

CONCLUSIONS

Over the past two decades, there has been a rising trend in malignant melanoma incidence worldwide. Malignant melanoma may be clinically and dermoscopically indistinguishable from melanocytic naevi, making early recognition a diagnostic challenge. Very important is additional objective information that could assist the clinician in obtaining a correct diagnosis and in deciding whether to excise the atypical melanocytic lesion or not.

The attempt of this study was to find whether the scores of two important diagnostic tools- the score of electrical impedance spectroscopy Nevisense® and that of the Fotofinder ® video dermatoscopy correlate with each other. The application of EIS seems to provide additional help, but there is still necessary to find out an algorithm how EIS can complement the clinical examination and that with dermatoscopy. Some discrepancies between EIS scores and dermatoscopy scores were considerable in most of our cases, which raised concerns about the reproducibility and the possible interoperation variability of the method. Changes in both scores did not appear to correlate with each other. But still in the one case with melanoma in situ the both scores were high enough (EIS score 7 and Fotofinder Score 0, 69 resp.7) to perform an excision. Ceder et al. (10) published a study on 22 AMLs in 19 patients, in which lesions, with EIS scores of 0-6 were reevaluated 4 months later both with EIS and dermatoscopic images and were excised when dermatoscopic changes had appeared or the EIS score had increased. 32% of lesions were excised including one 0.4 mm thick melanoma and 4 dysplastic nevi.

There is a limitation to this study. The study was retrospectively designed and the sample size was small. There was no possibility to follow up all of our patients; some of them did not want an excision of the lesions and so there is not histopathological diagnosis of all the lesions. This would perhaps have allowed more certain evaluation of our results.

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