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Mathematical relation between Thermal skin surface data and its electrical counterpart.

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1. Introduction.

Human skin is not just only considered by Medical investigations field as a barrier to protect body from injure (physical, chemical, bacterial..). In our computed and interconnected world we tend to think that skin should be also considered as an communication interface between two different but interrelated spaces: the little organic inner space (body) and its surroundings (Nature). As one of predictive Nature' laws is to function with lower energetic level, to reduce any unnecessary energetic waste in the body, permanent physiological adaptation has to occur, at any time. In this way of thinking, skin interface should be worked too as a determinant system to inform body of any outer change. Due to embryological development, back skin surface, for keeping track of dermatoma, is selected. Dermatoma is a physiological unit, easy to identify in the back region that associates in a delimited cutaneous territory, nerves, muscles, blood vessels and special organ functions that are projected on this vertical slice of skin.

Two Passive ways of investigation on skin surface are chosen to be linked: Infra red blood flow measurement and Bio difference of electrical potential (Bio-DDP).

Understanding, in a quick reliable passive mode of data capture, any change in skin pattern information of these dermatoma, should be lead us to catch functional disturbance to prevent any higher organic disorder in the future.

In previous works[1,2], statistical correlation between thermal and electrical matrices, allow us to foresee high possibility to be linearly correlated. Present mathematical investigation attempts to determine linear equation relating thermal to electrical data taken from particular points belonging to acupuncture (*Bei shu* points), as historically, the electrical field of these points are clinically known to reflect shifts in functioning of specific organs.

2 Material and method

- Data process

To get the two basic matrixes (thermal one and electrical one) to be interrelated, a couple of methods will be used: I.R. Thermography and electrical measurement. These will be made in the skin of the back of 8 patients, from the third dorsal to the fifth lumbar vertebras.

-Thermography is accomplished using an InfraMetrics Model 520 cooled Imaging radiometer.

-Bio DDP is based on a differential measurement of electric potential. A digital high input impedance electro voltmeter is chosen. Electrical reference point is situated on the front, to be known as one of the most electropositive point of the body. Interface skin- electrodes will be solved using electrochemical electrodes in order not to generate secondary electrode potential [3,4]. Capture of signal is done in an electromagnetic free environment. Filters are used too to guaranty a quite noiseless signal from patient.

At the end of the process two thermal and electrical matrices are built. First one comes from IR imaging, that is being analyzed after a standardized digitalized process involving only the double set of 10 *Bei shu* points, been previously localized on the global matrix picture. Electrical matrix is directly built in real time, picking up signals from the 10 symmetric *Bei shu* point localized with respect to the spinal bones. So both matrices to be correlated are ten rows and two, columns after these reducing data process from back skin dermatoma.

- Statistical process .

Regressive statistical analysis of this bio metrics data is done. Linear relationship is attempted to be determined between thermal and electrical matrix. Is it possible to stand a mathematical linear equation where Y stands for electrical matrix and variable is the thermal matrix?

To solve this equation, a set of variable is proposed. Definitive equation looks like:

$$Y=m1X1+m2X2\ldots..+m6X6+b$$

Where X1 stands for the thermal matrix.; X2 .Sex of patient is taken into account (1=Female;-1=Male) ; -X3. Maxima Arterial blood pressure from left side ;-X4.Minima Arterial blood pressure from left side.

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3. Results

Regression Variable Results

Parameter	Value	Standard Error	t-ratio	Prob(t)
m1	-0,557338	0,020277	-27,485692	0
m2	-0,252448	0,002438	-103,561285	0
m3	3,822182	0,088361	43,256413	0
m4	-5,104005	0,077576	-65,793385	0
b	1,477514	0,019812	74,577062	0

4. Interpretation, conclusion

Only it was possible to write electrical matrix as a linear combination of thermal data and other variables like arterial pressure. To better understand the reason why only one way of mathematical linear expression is possible, it is important to know about how Bio-DDP arise from skin (J.Pontigny engineer's hypothesis). Bio-DDP is the sum of three quantifiable biological sources of electrical potential. Primary bioelectrical difference of potential takes form from epidermis. It is a stable dc -40 mV voltage. Secondary and tertiary Bio-DDP are variables. Both of them arise from dermis histological structure. Secondary bio-difference in electrical potential, originate itself from rich blood vessels. 95% of blood vessels in the dermis serve autonomic nervous system function purposes. Blood should be understood as an electric charge carrier and of course as a thermal fluid. Tertiary Bio-difference in electrical potential takes form from the interplay between skin and autonomic nervous system regulating tonal fluctuation of the blood vessel according to local possible feed back control loop between environment and inner organ functions.

To establish only one way linear relationship between theses two different matrix origins, shows that Bio_DDP is not only an exclusive function of thermal data but too of nervous trains of impulse.

To relate thermal to electrical data on a linear mode with a set of easy personal data to get, allows indistinctly in the future, the use of thermal as electrical data. Thanks to linear conversion, versatility in the data capture methods will increase biometrics information database.

Linear equation linking thermal data to electrical ones should be part of higher project allowing skin information capture to foresee functional disturbances, to prevent organic failure, in the body.

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