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On the Prospect of Creating a Diagnostic Robot Based on the use of Contact Scanning Thermography

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ABSTRACT

The article is devoted to the possibility and reality of the prospects of creating a diagnostic robot, created as an assistant doctor. This possibility is shown on the basis of clinical practice, obtained as a result of many years of experience in the use of the method of scanning contact thermography with high temperature resolution and the development of appropriate series of DOT devices that perform diagnostics of many nosology's covering the number of the most dangerous and common. DOT devices, in which this method is implemented, are intended for the potential replacement of modern diagnostic devices used in the clinic and me, inferior to DOT for a number of key parameters. which is confirmed by the certificates of Russia, the European Union, Israel and Mexico. DOT can be a topical assistant to a doctor if he has insufficient qualifications, and if they are absent in the region.

Keywords: *CM - Conventional diagnostic methods accepted in clinics in the present time, DVT - Thermal Volume Tomograph, CT - Computer Tomograph, MRI - Magnetic Resonance Imaging, US - Ultrasound Sonar, RM - X-Ray Mammograph, DT – Remote Thermal Imaging, PO - Area of Pathology, Rct - Cancer Tumor, DO - Benign Tumor, BC - Breast Cancer, FKM - Fibrocystic Mastopathy, VPC - Cavity in the maxillary bones of the skull, FCLQ - Film based on cholesteric liquid crystals, TN - Tumor neoplasm, TD-Time of doubling cancer cells.*

INTRODUCTION

The method of contact scanning thermography and the device for its realization were first proposed and patented in Russia and the USA [1-5] as an alternative to the widely used then and now conventional methods. Potential advantages of the new method were: early diagnostics of a number of nosologies, absolute safety, absence of discrimination of patients by age, the possibility of unlimited patient screening, self-sufficiency in nutrition, portability and cheapness of equipment.

Further advancement of the proposed method along the way of its use in the clinic has already proved the validity of the listed properties in practice, however, the known conservatism of the medical environment, justified by the fact that the new one can do harm, is only treated with difficulty and it takes, as an argument, a long test of this technique in practice. After 14 years, the authors of the new method provided clinical trials of the method and equipment in a number of the most developed countries, received the highest awards in the most representative forums and received corresponding certificates of compliance with the properties laid down in the develop.

PRINCIPLES OF DOT METHODOLOGY

DOT-method of examination of the state of human health is based on the physiological features of a living warm-blooded subject - the direction of the heat flow produced by normally functioning cells of the body orthogonally to the surface of the skin with which this heat is dissipated into the surrounding space by convection. This internal heat flux causes a thermal relief in the normal healthy body on the patient's skin surface. But if there is pathology in the path of this stream, then it will distort this flow, which will lead to distortion of the spatial relief of the temperature field in comparison with when this pathology was absent. At the same time, the smaller the characteristic size of such pathology and the deeper it lies under the skin, the less important will be the resulting temperature gradient with respect to the norm of the skin on this site. Therefore, when creating a DOT device, one of the central tasks was to ensure maximum temperature sensitivity, since the current temperature measurement technique

does not have a sensitivity of the order of degrees, whereas from the analysis of the problem for pathology in the human body, the magnitude of the temperature gradient requires sensitivity by orders of magnitude higher [6]. To provide the required sensitivity in the DOT device, a dynamic method of measuring the temperature gradient was proposed, which made it possible to bring this parameter to 10-3 0 C [7]. Therefore, the DOT device, being not invasive, is able to measure not only the value of the gradients mentioned, but also their sign, depending on the type of pathology.

DOT DESCRIPTION TECHNIQUE

As mentioned above, the acquisition of information about pathological zones in the DOT method is based on the use of the results of a survey with a norm in which pathological zones in the corresponding areas of the body are absent. Therefore, this method uses elastic masks that allow precise positioning when scanning the skin temperature field, provided that the topology of the research object has a small variability in the norm (body structure, for example). If an organ with a significant variability of the spatial structure (human face) is examined, the characteristic points on the object are taken as in normal state. Examples of masks for various configurations of the trunk organs on a number of objects: - (female breast) or the coarse-grained part of the trunk are shown in Fig. 1. These masks have holes through which the temperature sensor of the device contacts the skin and, accordingly, measures the temperature gradient at any of the points of the object of investigation in accordance with the numbers indicated on the mask and displayed on the instrument's display (see below).

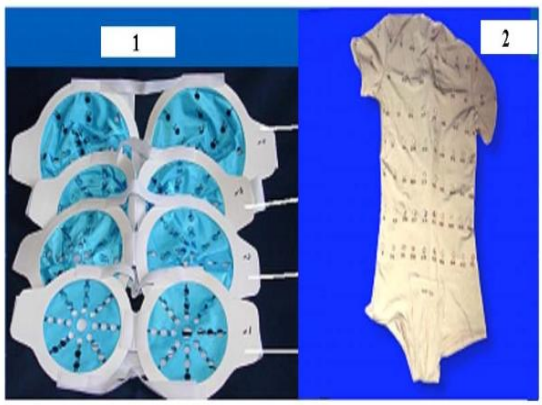


Fig1. *Complexes of elastic masks: 1- for mammology (4 standard sizes); 2 - for the body (3 sizes).*

The DOT unit itself and all its components are located in a 390 x 140 x 300 x 140 mm case with a gross weight of 2.5 kg.

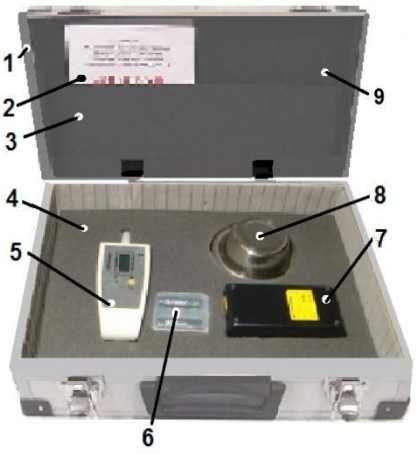


Fig2. DOT: 1-case; 2- Instruction and passport; 3- upper gasket; 4 - lower gasket; 5 - the head of the device; 6 - set of AA batteries; 7 - charger; 8 - cooling table; 9- connecting cables (under item 2).

VARIANTS OF DIAGNOSTIC TESTS CARRIED OUT USING DOT

The device provides two types of diagnostics:

- Method 1 using the internal heat flux in the patient's body.
- Method 2 using available thermo semiotic data.

If the method of using the internal heat flux is relatively new (it was patented in 2001 [2]), the second is based on the use of the results obtained in the period from 1960 to the present by the distant thermal imaging method (DT).

Method2.

The presence of a huge clinical experience with the use of thermal imaging methods in the surveys that led to the extensive library of thermo semiotic features characteristic of various nosology's, however, cannot be fully utilized due to the low temperature sensitivity of the thermal imaging survey method DT] mainly two factors: a) the angular dependence on the geometric shape of the object (Lambert's law) and the variations in the emissivity of patients skin, strongly dependent from its state. Method 2 with DOT is implemented using an adequate temperature sensitivity that is thousands of times greater than that available for DT. The lists of thermosemiological signs, compiled from the results of DT examinations for various nosology's, are given in the corresponding atlases [8]. For each of the nosology's, they are given the distribution of hypo or hyper

temperature gradients on the surface of the human body, through which a two-dimensional map of each of them is compiled for each of the nosology's and the corresponding computer program automatically issues a clinical diagnosis. Examples of the implementation of method 2 are given below.

Diagnostic methods 1 and 2 were evaluated in practice by clinical trials conducted between 2004 and 2016 in medical centers in Russia, CIS countries, the European Union and Israel. The most significant of them were conducted in clinics in Russia and in the clinic SHIBA (Ben-Ghana, Israel) for ten years. Especially large and clinically significant statistics (more than 4,000 patients) were obtained for the problem of breast cancer, including verification of the DOT method with the use of CM and subsequent mandatory histology and, if necessary, mastectomy [9-11].

ABOUT THE SPECIFICS OF THE USE OF DOT IN A CLINIC OF A NUMBER OF NOSOLOGIES

About Early and Safe Oncology

Cancer is one of the most dangerous diseases in a number of other human diseases. This disease can affect almost all the human organs. But for the methodology of the first pillar it is important to demonstrate the effectiveness of the new methodology (using its variant No. 1) within the framework of evidence-based medicine. This prompted us to choose m female breast as the main subject of the examination as an autonomous part of the body devoid of bone parts and besides her cancer is the number one problem in medicine. This disease has recently taken a leading place in malignant diseases of women, especially in the most blooming age from 30 to 50 years and the second in mortality [12]. Approximately 10% of women have breast cancer [9]. And over the past 50 years, the mortality from breast cancer in different countries has increased from 2 to 9 times [13]. At the same time, mortality from breast cancer in women aged 40-44 years is ahead of mortality from all other causes [14]. And in this age group, the effectiveness of mammographic screening is particularly low [15]. This is due to the great difficulties in differential diagnosis of cancer from diffuse and multifocal lesions of the breast. At the same time, malignant process occurs 3-5 times more often in their background than in the general population [16].

The development of a malignant tumor is a multi-stage process, most of which is at the preclinical stage. Beginning often at pubertal age, the cancer manifests mainly in pre- and postmenopausal women [17]. The development of a tumor node 1 cm in diameter can take 3 to 20 years [18]. The initial structural changes occurring in the breast tissue can not be detected by mammography [9]. In addition, it should also be taken into account that 20% of breast cancer is characterized by increased aggression and rapid growth. In this situation, classical screening examinations, conducted once in two years, may be stunted and do not guarantee the timely detection of the disease [19]. Taking into account the latter circumstance, one of the main tasks of diagnosis is the detection of the degree of malignancy, determined by the doubling time (DT) of cancer cells. According to the data of [20], based on the study of the growth rate in 106 patients with primary breast cancer, the mean value of DT is 116.5 ± 11.8 days, with the maximum of DT - 866 days. Since from the entire time of the development of the disease to the preclinical development of breast cancer accounts for 3/4 of the total time, with a small amount of TH, the remaining third of the time can cause the patient to die. With IV of the order of 300-400 days, breast cancer is practically harmless; the tumor does not reach life-threatening dimensions and the woman dies from other causes [21].

The growth of PO is characterized by an exponential law [22], starting from the time of appearance of the cancer cell, a diameter which is of the order of 10 μm and, accordingly, is described by

$$V_t = V_0 2^{nt}, \qquad (1)$$

Where Vt is a finite volume of PO, V0 is its initial volume, and nt is the number of cell divisions. The growth of tumor volume depends on the time t, the doubling time BV = t and, since BV is individual, Fig. 2 shows the growth curves of P0 for two values of BV in curves A andB.

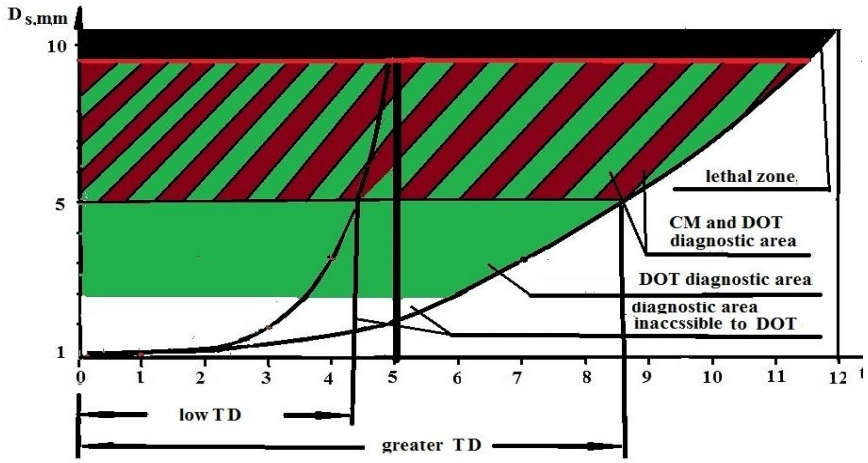


Fig2. *Growth of PO in time depending on the TD: TD A ≤ TD B, D - diameter of PO.*

It follows from (1) that the volume of PO depending on t can be determined a

$$\pi(D3)3/6= \pi\ (D0)3/6.e\ rt\ , \qquad (2)$$

Where k is the exponent. From (2) with D = 10 cm (lethal size of PO), it follows that

$$k = \ln[(Ds)\ 3//(D0\ )3]/\sum \Delta t\ , \qquad (3)$$

With the known value of the diameter of the cancer cell (10 μm), we have for the values k: k A = 0.27 (day) -1, and for k B = 0.11 (day) -1. Both these values characterize the rapid and aggressive growth of breast cancer in 20% of cases, in contrast to the average development of breast cancer, where the development of a tumor 1 cm in size takes 5 to 7 years [9].

From this graph it can be seen that the diagnosis of DOT, which provides diagnostics at the preclinical stage [23], gives the patient a time reserve before the manifestation of metastases begins approximately three-fourths of the total cycle in which the lethal outcome of the disease has already been established. This is advantageous because it allows, by screening, to select the optimal treatment regimen for the patient only when the neoplasm not only has not yet exhausted the patient's immunity, but also is itself unstable to the chosen therapy.

Such a conclusion can be undeniable or obvious for this type of nosology only if it is based on many years of experience working with a physician with an extensive clinical base of patients. This is available only to a large research center such as the Pasteur Institute (France), where under the guidance of Professor M. Gautherie, a study was conducted in 85,000 patients with AF. The method of his research was based on the introduction of needle thermocouples in the tumor and also in surrounding tissues. The statistical reliability of the results obtained by him [24] makes it possible to uniquely verify and interpret the methods obtained with other thermal methods, in particular, DOT. Thus, in . Figures 3=6, respectively, the data obtained by our methodology, illustrating the change in the temperature gradient of a malignant tumor on the skin of the breast.

The DOT method makes it possible to determine three-dimensional RcT coordinates in order to use them in a screening study of the course of the disease. (In this technique, all three spatial coordinates of the OP are estimated. The third spatial coordinate - the depth of occurrence is determined by a formula, the form of which depends on the type of tumor: for the fuel, it has the form

$$Z \approx r\left(\frac{2T^2}{T_0^{\ 2}-T^2}-1\right)^{1/2}, \qquad (4)$$

where - current temperature, - temperature in the isotherm pole, - current radius. For non-heat-producing tumors, the depth is estimated by formula

$$Z \approx \frac{r}{\left[\dfrac{\left(T_{cp}-T_0\right)^{2/3}}{\left(T_{cp}-T\right)^{2/3}}-1\right]^{1/2}} \qquad (5)$$

Where is the average temperature in the projection of this tumor. [24].

With the growth of the tumor, up to the touch of the skin, the sign of the temperature gradient changes from positive to negative. which is due to the fact that in this case the heat production of the tumor due to its growth becomes less due to

the exclusion of heat flow from the tissue in normal state.

The principal importance of this approach is the use of the nature of heat exchange at the preclinical stage, when the process of pronounced metastasis does not yet take place, and the RO retains its coordinates. As the tumor grows, screening reveals the degradation of the heat flux maximum in terms of the intensity of the positive temperature gradient, as shown in Fig.3, where we used our investigations by comparison with statistically reliable data in [24] to show as the Bio Criterion increases with the growth of the tumor.

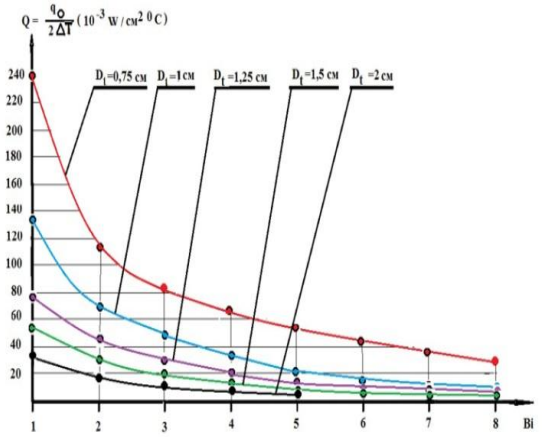


Fig3. *The Bio criterion increases with the growth of the tumor.*

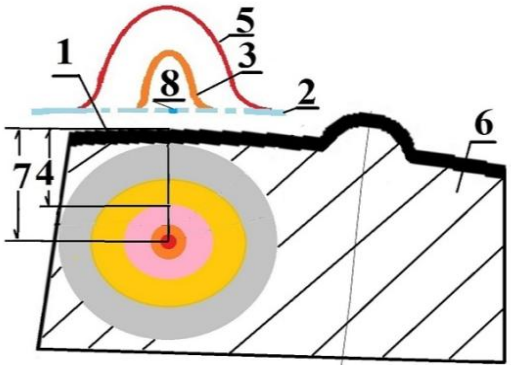


Fig4. *1- Breast skin; 2-positive temperature gradient is normal; 3- 4, respectively, a positive gradient map for an intermediate tumor growth. 5 - minimum Bio value; 6- the tissue is normal; 7 - coordinate of the tumor center; 8 - inversion of the gradient at the contact of the tumor wall to the skin of the breast*

Mammology

In Fig.5 .the technique of inspection of a mammary gland by an autonomous head device DOT is shown.

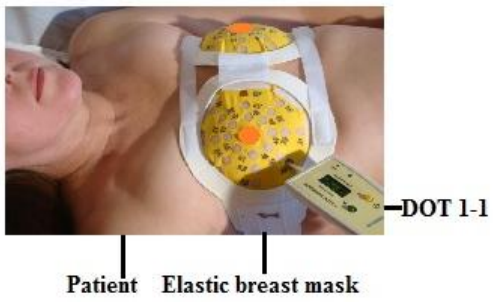


Fig5. *Tthe technique of inspection of a mammary gland*

A typical DOT of the mammogram is shown in Figure 6.

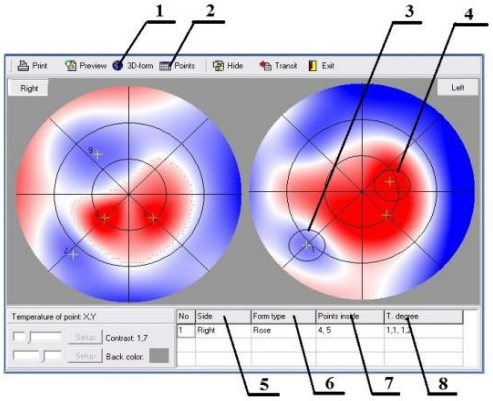


Fig6. *1- Call button for the three-dimensional version of the thermogram, 2- call button for the survey data table, 3- pole center position with negative gradient, 4 - pole center position with positive gradient, 5- type of gland (right, left),, 6 - the form of the potential tumor, 7 - the location of the positions of the poles, 8 - the temperature at the PO centers..*

Figure 7 shows an example of a three-dimensional mammogram.Onn the left gland there is a cancer with a typical form of "rose", in the right - benign software.

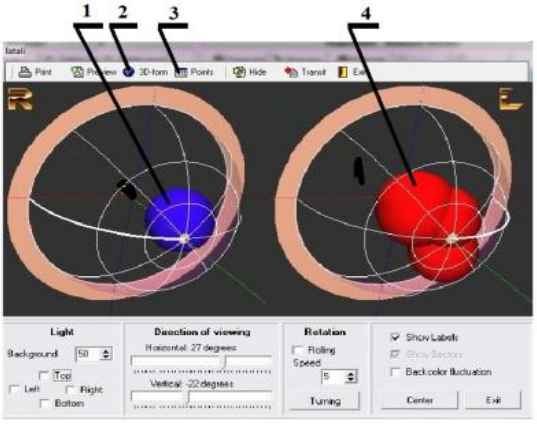
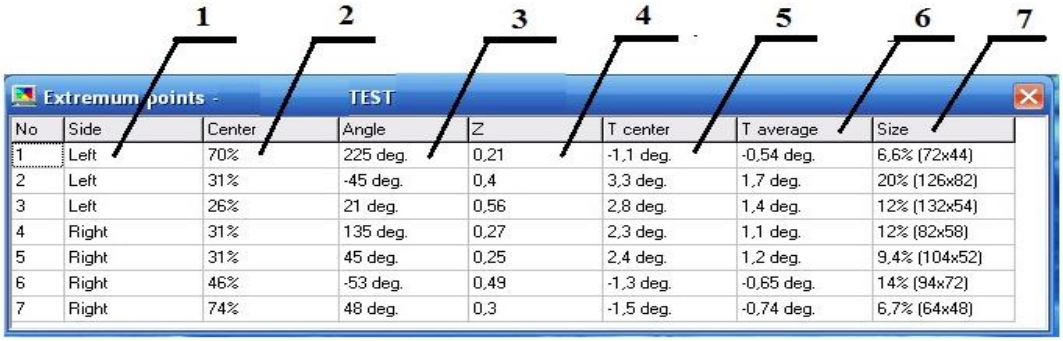


Fig7. *Three-dimensional mammogram.*

When you press button 1 on a two-dimensional mammogram, an array of data from the study is called up, as shown in Fig.8



No	Side	Center	Angle	Z	T center	T average	Size
1	Left	70%	225 deg.	0,21	-1,1 deg.	-0,54 deg.	6,6% (72x44)
2	Left	31%	-45 deg.	0,4	3,3 deg.	1,7 deg.	20% (126x82)
3	Left	26%	21 deg.	0,56	2,8 deg.	1,4 deg.	12% (132x54)
4	Right	31%	135 deg.	0,27	2,3 deg.	1,1 deg.	12% (82x58)
5	Right	31%	45 deg.	0,25	2,4 deg.	1,2 deg.	9,4% (104x52)
6	Right	46%	-53 deg.	0,49	-1,3 deg.	-0,65 deg.	14% (94x72)
7	Right	74%	48 deg.	0,3	-1,5 deg.	-0,74 deg.	6,7% (64x48)

Fig8. *The table of the data about co-ordinates of poles, temperatures and of the new growth sizes: 1 – pole numbers, 2 - their arrangement on the left or right MG, 3-4 - two-dimensional pole co-ordinates in polar form, 5 - depth of an arrangement of the new growth centres perpendicularly to MG surface, 6 - temperature in the pole centres, 7 - areas of new growths on MG skin its size in %.*

Further processing of data for the automation of diagnosis with DOT of malignant form of PO (RcT), in contrast to its predecessor (FKM), consisted of using a database of patients.

All examined patients depending on the condition of breast ("norm", FBD, RcT) were divided into 5 groups, each consisting of 12 patients: group 1 "norm"; group 2 with FKM in the left breast; group 3 with FKM in right breast; group 4 with breast cancer in the left breast and a group 5 of with breast cancer in the right breast. (Nosology in the form of FBD has been included by us as the object of study, since it is well known that this form is often a precursor of RcT [25]. For each patient group according to button 2 (in Figure 7) were drawn graphs shown in Fig.9. Further processing of these graphs is implementing a program that provides automatic delivery of the conclusions about the disease.

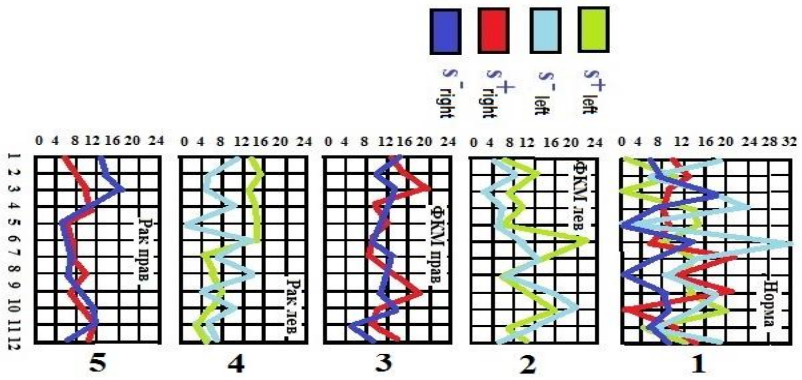


Fig9. *Graphs that used for automatic mode DOT diagnosing [26].*

Such an opportunity with the help of a program based on 899 surveys we have shown in Fig.10. When the program is modified in accordance with [26], DOT can automatically issue a medical report on the disease to the monitor.

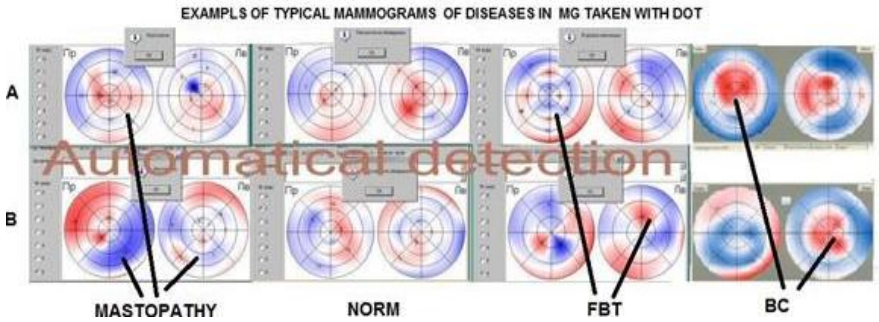


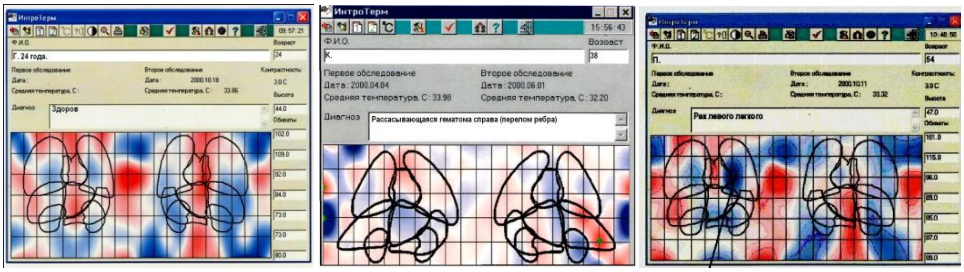
Fig10. About possibility to issue a medical report by DOT.

Statistical processing of the obtained results in mammology showed that when using DOT diagnostic method1, its sensitivity was 97.5%, specificity 87.1%, and accuracy to 88% [10].

The Results of the DOT Methodology No. 1 in a Number of Areas of Medicine

Bodies of the abdominal zone of the body

Examples of such studies are shown in Fig.11.

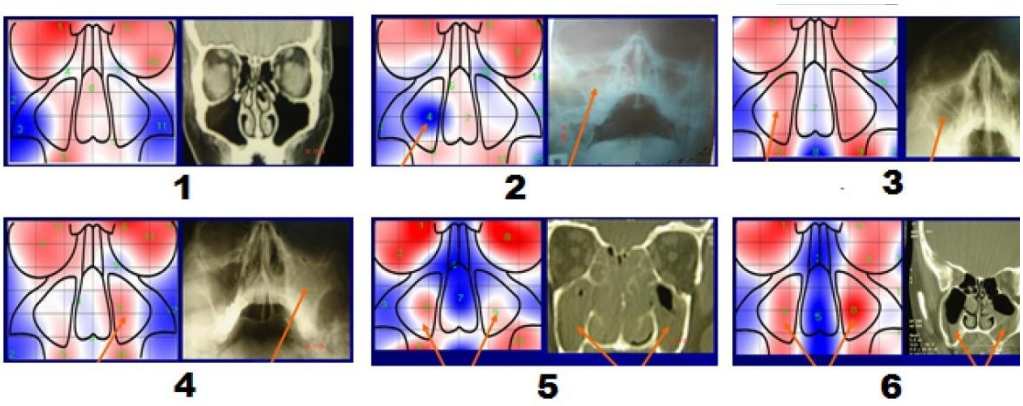


1 2 3

Fig11. *A range of nosologies in the patient's body:1- thermogram of a body of patient 24 y.o.,norm;2- patient 38 y.o. (a resolving hematoma on the right - edge crisis; 3-. patient, 54 y.o., a cancer in the left lung.*

Otolaryngology

In the field of otolaryngology, where research in the cavity of the maxillary bones with assistants is difficult. DOT received disease inclusions and observed the rehabilitation ginamiku, as shown in Fig.12.



1 2 3 4 5 6

Fig12. *1-mhermograms of the norm of VPC and nosologies in it: 1 - the norm; 2 - cysts in right cavity of the patient; 3- rehabilitation of the same patient; 4 - left sided maxillary sinusitis; 5 – polyposis rinusitis in both nasal sinuses of patient;: 6 - polyposis purulent sinusitis of both sinus.*

The DOT-diagnostics in arthropathy

In the field of arthrology, the DOT methodology was essentially only indicative, as it are conducted earlier on the basis of the Moscow Arthrocentre and in the Republic of Lithuania with a total clinical base of more than 25,000 patients. A sample of the DOT examination is shown in Fig. 13.In the field of arthrology, the otolaryngology of the DOT-based methodology was essentially only indicative, as they were conducted earlier on the basis of the Moscow arthrocentre and in the Republic of Lithuania with a total clinical base of more than 25,000 patients [ ]. A sample of the DOT examination is shown in Fig. 13.

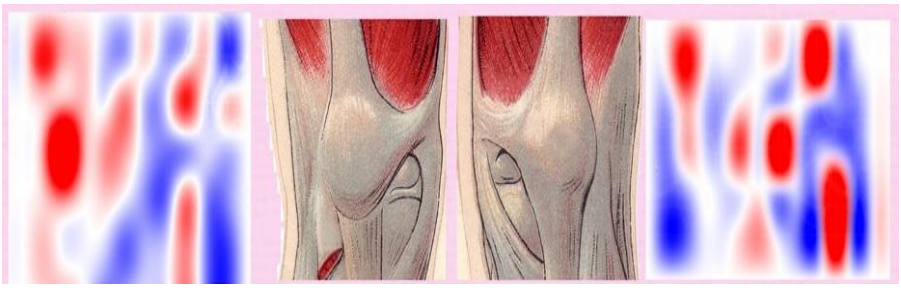


Fig13. *Thermogram of an inflammation of articulate bags of knee joints: 1-2 - zones of scanning of the right and left joints, accordingly. 3-4 - areas of an inflammation of articulate bags of the right and left joints.*

Type 1 diabetes

It is known that the acquisition of diabetes of the first type occurs unnoticed for a person in the villa of various kinds of circumstances, the main one of which is the person's over-cooling. Before the manifestation of this disease, a period of about a year passes, when the temperature response indicates the degradation of the Langerhans islets in the tail of the pancreas. responsible for the production of insulin. After that, a person becomes a chronicle, who needs insulin from the outside. which complicates his life. Early diagnosis using DOT techniques allows timely elimination of this disease [30-31].

On the thermogram Fig. 14 shows a demonstration of the onset of degeneration of the islets of Langerhans in patient D., 24 years old.

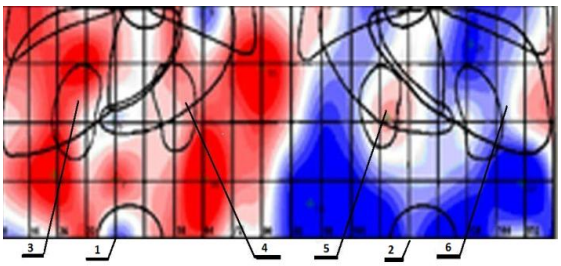


Fig14. *Thermogram illustrating the onset of the destruction process of β-cells in the pancreas: 1 - the thermogram of the anterior part of the trunk of the patient, 2 - the thermogram of the back of the patient, 3-4 - the projection for monitoring the onset of degeneration on the anterior part of the trunk, 5 - the projection zone of the tail of the pancreas (Mayo-Robson zone), 6 - the zone of the Mayo-Robson's bilateral zone.*

Urology

One of the problems is the analysis of the state of . testicles in the scrotum, because this organ is small. The object of examination is inside the dump with a comparatively weak blood supply. Trauma of the testicles may be a disease associated with both external effects and other causes. To conduct a survey of this body was made a portable hard mask, fixed, as shown in the figure to the patient's body. The result of examination of the testicles displayed in Fig. 15 was clinically confirmed, and the DOT method of such a survey was patented in Russia [32-33].

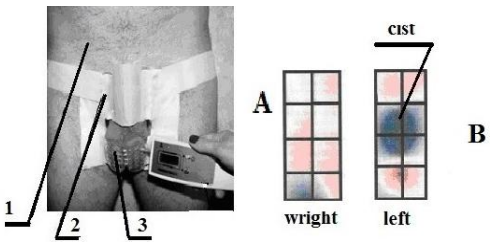


Fig15. *Thermogram of testes received at inspection in a scrotum: A – proceeding of nspection: 1- the patient; 2-the belts; 3- the mask: B- the thermogram with cist in the left testis.*

5.4.*Table with equalization s of conventional diagnostic equipment and DOT*

Comparison of the main parametes DOT and its analogues

parameter/device	radiation load	minim. diameter of the tumor,mm	temperature error grad.C	medical conclusion	dimensions, cm	gross weight, kg	price,thousand US $
roentgen	yes	5	-	not	200 x200x200	400	100
mammography	yes	10	-	not	200x100x100	300	50
US	yes	10	-	not	300x400 x400	15	20
RTM-01M	not	20	0,4	not	100x300x400	4	14
DOT	not	3	0,001	yes	19x5x2,5	2,5	3

ECONOMIC ASPECT OF EARLY DIAGNOSIS OF BREAST CANCER

Given the foregoing, it should be recognized that the problem of early adequate diagnosis in practice is not solved. Apparently, the female population understands this, which causes a high degree of their distrust of official medicine. This explains the treatment of doctors in the late stage of breast cancer, along with attempts to first find salvage in case of suspicions in alternative medicine, where a completely safe examination is certified and where wide advertising is called for.

Unfortunately, the population is not properly informed about the consequences of such a step - it does not read the special medical literature, and in the polyclinic it is usually suggested to conduct screening by the survey itself. Therefore, the words of the chief oncologist V.M. Sukharev are so precise and necessary for

the patient: "There are no effective methods for treating breast cancer other than official, recognized throughout the world. Treatment of psychics and other "healers" - the loss of precious time. And there was not yet a patient whose diagnosis was verified morphologically and which would be cured by such healers unfortunately, only in the peripheral medical journal" [32]. Against the backdrop of economic losses from breast cancer in the Russian Federation, which already amounted to 287.7 million rubles [33] in 1990, and the growth of diseases to date, it is clear that the problem of breast cancer, having reached the first place in the structure of cancer, social, but also an economic problem, where it is necessary to compare the losses with the costs of measures for early diagnosis of breast cancer, which lead to a reduction in economic losses.

Economic problems of early diagnosis of breast cancer are clearly visible on the example of prices for breast cancer therapy. If the localized stages (I and II) of cancer require only surgical intervention, costing 4 thousand rubles, then at stage III, preoperative radiation therapy (about 4 thousand rubles), surgery (about 4 thousand rubles) and 6-8 courses on chemotherapy (for 5,5 thousand rubles). The difference in cost is 60 thousand rubles. In this example, the direct benefit from early diagnosis is 56 thousand rubles / 32 /.

In mass diagnostics due to unsatisfactory qualities of X-ray mammography and ultrasound for early detection of breast cancer, it is even unprofitable to use them. So, in the Perm region, for the detection of one case of breast cancer in 1999 prices, 121556 rubles were spent, and excluding mammography and ultrasound, 7727 rubles, which is 33% cheaper and, most importantly, without compromising quality. It should be emphasized that, at the same time, the cost level in the clinic for preventive examination at Russian prices was significantly lower than for the similar abroad. On profozmotr in the Perm region spent on the patient 52.1 rubles) including: examination by a surgeon-oncologist - 7.6 rubles; for mammography - 15.7 rubles; ultrasound - 20.2 rubles; taking aspiration biopsies - 8.6 rubles [34]. In Spain, for example, a similar cost per patient was 4067 pesetas (about $ 30) [35], which is 17 times more expensive.

In the literature data on the costs of examining and treating breast cancer, as well as the economic losses from this disease are rarely discussed and often they are very contradictory. For example, the cost of a professional examination in Russia varies from $ 1.7 to $ 40; the cost of one case of detection of the disease for the period of 1991 prices was 1,500,995 rubles, and in the United States during the same period these costs ranged from $ 800 to $ 2,000 [31]. One year of the saved life of a woman is estimated from 3000 to 4000 pounds sterling [39].

To reduce mortality per case per year, it is necessary In the literature data on the costs of examining and treating breast cancer, as well as the economic losses from this disease are rarely discussed, and often they are very contradictory. For example, the cost of a professional examination in Russia varies from $ 1.7 to $ 40; the cost of one case of detection of breast cancer for the period of 1991 prices was 1,500,995 rubles, and in the United States during the same period these costs ranged from $ 800 to $ 2,000 / 31 /. One year of the saved life of a woman is estimated from 3000 to 4000 pounds sterling [39]; To reduce mortality per case per year, it is necessary to spend from 1 to 2 million dollars on an estimate in / 40 /. On average, the deceased in Russia from breast cancer loses 18.7 years of life (9.3 years of working age), and this corresponds to conditional economic losses in 1990 prices in the amount of 308.1 million rubles [37].

If we estimate the conditional economic losses from breast cancer and the death rate from it of the female population of Russia by 2003, based on known data on the average rate of disease growth by 3.4% per year (for the period from 1993 to 1997) and the number of patients registered 1997 (52 per 100 000 female population) [41] / with the number of detected breast cancer patients at 47500 in 2003 and taking into account the detectability of breast cancer of about 6% and the one-year mortality rate of 11.3% [38], the real loss pattern will look as follows : the number of cases of breast cancer is 791 thousand, and died Consequently, with the existing situation in the country, the identification of breast cancer patients costs at least 7 billion rubles. However, among the undiagnosed breast cancer, at least 20% of the total number of women with a tumor doubling time is available in a timely diagnosis, but although they fall into the interscriptive period, nevertheless they will also need therapy. Taking into account this factor, the total number of such patients will be 196200. Believing that the difference of 148700 is among the women,

where the diagnosis was held as early, the real saving on therapy of this number of women will amount to 8.3 billion rubles. Treatment of patients with stage III breast cancer is 15-30 times more expensive than at stage I. At the same time, only 5% of funds are spent for diagnosis, and 95% for treatment. The situation will change in a positive direction only if this ratio is changed in the direction of increasing the costs of diagnostics [42]].to spend from 1 to 2 million dollars on an estimate in / 40 /. On average, a woman who has died of breast cancer in Russia loses 18.7 years of life (9.3 years of working age), and this corresponds to conditional economic losses in 1990 prices of 308.1 million rubles / 9 /. is 17 times more expensive. In the literature data on the costs of examining and treating breast cancer, as well as the economic losses from this disease are rarely discussed, and often they are very contradictory. For example, the cost of a professional examination in Russia varies from $ 1.7 to $ 40; the cost of one case of detection of breast cancer for the period of 1991 prices was 1,500,995 rubles ($ 350), and in the United States during the same period these costs ranged from $ 800 to $ 2,000 [31].

One year of the saved life of a woman is estimated from 3000 to 4000 pounds sterling [39]. To reduce mortality per case per year, it is necessary to spend from 1 to 2 million dollars on an estimate in [40]. On average, the deceased in Russia from breast cancer loses 18.7 years of life (9.3 years of working age), and this corresponds to conditional economic losses in 1990 prices in the amount of 308.1 million rubles [9].

If we estimate the conditional economic losses from breast cancer and the death rate from it of the female population of Russia by 2003, based on known data on the average rate of disease growth by 3.4% per year (for the period from 1993 to 1997) and the number of patients registered 1997 (52 per 100 000 female population) [ ] with the number of detected breast cancer patients at 47500 in 2003 and taking into account the detectability of breast cancer of about 6% and the one-year mortality rate of 11.3% [38], the real loss pattern will look as follows : the number of cases of breast cancer is 791 thousand, and died , consequently, with the existing situation in the country, the identification of breast cancer patients costs at least 7 billion rubles (237 million dollars). However, among the undiagnosed breast cancer, at least 20% of the total number of women with a tumor with cell doubling time is available in a timely diagnosis, but although they fall into the interscriptive period, nevertheless they will also need therapy. Taking into account this factor, the total number of such patients will be 196200. Believing that the difference of 148700 is among the women, where the diagnosis was held as early, the real saving on therapy of this number of women will amount to 8.3 billion rubles. Treatment of patients with stage III breast cancer is 15-30 times more expensive than at stage I. At the same time, only 5% of funds are spent for diagnosis, and 95% for treatment. The situation will change in a positive direction only if this ratio is changed in the direction of increasing the costs of diagnostics [42].

ON THE SOCIAL DISCUSSION OF THE DEVELOPMENT OF DOT

The bibliography of the author's work, unfortunately, does not convince the medical community to pay attention to the merits of the development. In addition to receiving the highest marks and awards at national and international exhibitions, from the point of view of the developer in the United States, demonstrations of development involving the international jury in the framework of the first international competition for innovative equipment in Moscow in 2003, the author received the first prize and a decent award, as can be seen from a photo that has been showing for a long time on the Internet and is shown on Fig.16.

Fig16. *Prize winner with his prize*

A broad discussion of the development later (during 2009 was conducted by a large jury of domestic specialists in the framework of a multi-series television show as a contest within the framework of the "Factory of Thought" held under the auspices of the Moscow Mayor's Office.) Here a number of photographs illustrating the finale of this competition shown on Fig.17- 22.

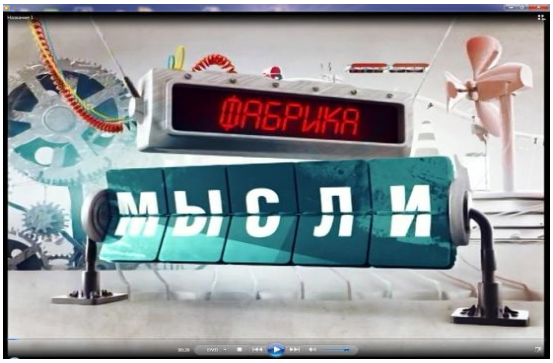


Fig17. *Screening of Competition*

Fig18. *This is the jury of the contest*

Fig19. *Display of the DOT device*

Fig20. *Survey object.*

Fig21. *Participants of the final*

Fig22. *Presentation by the deputy of the mayor of the letter of rewards to the winner*

CONCLUSION

- In contrast to the currently accepted methods, DOT-diagnostics provides the earliest, completely safe assessments of the clinical state of almost all major parts of the human body. The DOT device is a portable and stand-alone device, and it makes it possible to control and optimize therapy as often as possible, and also to monitor the patient's rehabilitation process. DOT technique allows you to detect a disease in the preclinical phase, when it has not yet managed to destroy the patient's natural immunity.
- The cost of DOT is low compared to conventional means, which makes it possible to apply it both in mass prophylaxis or in routine examinations.
- The database of DOT surveys both in Method 1 and Method 2, while on the Internet can, as shown in this paper, use DOT as a doctor's assistant, and in the absence of a specialist in the medical field to serve as a robot with an artificial intellect, which in combination with this base can exceed the amount of memory and, accordingly, the doctor.

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