

Expert system, as component of diagnostics system of man's sight

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Summary. The analysis of existing methods and information systems of spatial contrasting sensitivity diagnostics is carried out. New computer diagnostics based on more exact valuation method of spatial man's sight, and also the module of expert system of the primary diagnosis setting are offered.

Key words. Computer diagnostics of sight, expert system.

INTRODUCTION

The large rate of life of people requires more rapid analysis of the state of health of man: nobody already wishes to expend the enormous amount of time in search of the best doctor and expectation in turns to him, it results in that more frequent than all patients begin self-treatment is can only aggravate a situation. Actual are creations of such informative systems (IS) and technologies which will give possibility to conduct primary examination without a doctor or consulted with him staying in a house or office.

Development IS medical setting gives possibility to work out these problems [14]. Today in a medical informatics large attention is taken to development of the intellectual systems of support of acceptance of medical decisions and formalization of his knowledge's as consulting models. Such systems have a few considerable features: allow to conduct diagnostics without a doctor, to do raising of diagnosis automated and expressly to outline the new symptoms of diseases, select them from plenty of indefinite factors.

ANALYSIS OF PUBLICATIONS, MATERIALS, METHODS

The computer methods of measuring of the state of the visual system of man are widespread in medical practice [6, 7]. They are realized in such hardware and software complexes, as VCKuser [19], ILDK "Academician" [1] and as on-line-testing of sight with the use of tables of Sivtseva-Golovina or Rings of Landolta on the official sites of many known ophthalmology clinics of the world. Such methods give a certain result, but does not allow quickly and without intervention from a doctor to get information, in relation to a spatial contrasting sensitiveness which gives possibility to warn development of many pathologies on the early stages.

PURPOSE AND RAISING OF RESEARCH TASK

Improvement of process of diagnostics of diseases in ophthalmology due to development of the module of consulting model for the system of computer diagnostics of eye diseases of "SOTA".

MATERIALS AND RESULTS OF RESEARCHES

For simplification of inspections and accumulation of necessary information computer

realization of reverse of hexagonal method of measuring of spatial contrasting sensitiveness (SCS) of "SOTA" [8, 10, 13] was developed. In times of the use of this program some conformities to law, which allowed to show out a few normative curves, were got (Fig.2-9). Value of curves were confronted with the generally accepted indexes [4] and supposition was pulled out, about possibility of their further using for the leadthrough of diagnostics as standards. However found out it was, that each time to examine the chart of SCS, coming running to the analysis each of curves in all ranges of frequencies not comfortably. A decision to improve the comfort of the use of the diagnostic program and enter in the complement of the system the module of consulting model [18] which will be able right after diagnostics to pull out supposition was accepted, in relation to development of one of possible pathologies or its absence.

As reliable expert estimations, also there were the used materials of the leading Russian ophthalmologists of Shamshinova A.m., Volkova V.V. and mathematics of Belozeroва A.E. [3, 4, 17].

A base of knowledges of consulting model is edited [2, 20], it enables at the protracted use of the program, on the basis of the accumulated statistics, to save the exposed conformities to law, as new diagnosis.

A consulting model supposes the presence of list of questions, which have direct attitude toward facts [12] which result in a certain decision and choice of diagnosis. As "questions" the graphic image of hexagonal nets, shown out on the screen of computer, is used in a consulting model (fig.1).

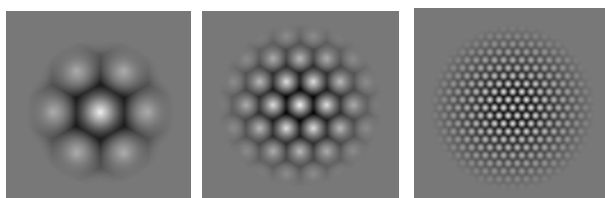


Fig. 1. "Questions" of consulting model

A dialog with an user is carried out by the answers of type "See - does not see" at producing to him grates of different frequency and contrasty [9]. With the purpose of increase of authenticity of answers (exception of possibility to answer "at" random) a certain mechanism is foreseen in the program: stimuli are produced by turns for left, for

a right side or after the center of screen of monitor, thus, probability of guessing of next position of stimulus is eliminated [11]. This mechanism also allows practically fully to remove the effect of "remaining perception" - when eye of man long time fixed in one point of the produced object (especially in the case of bright object), then yet some time after translation of look aside we see the afterimage of this object.

A consulting model uses information got on the stage of diagnostics, that information about a spatial contrasting sensitiveness for different spatial frequencies (table 1).

Table 1. Example of entrance information for ES

№ measurings	Spatial frequency, cycle/grad											Sensitiveness, dollar
	0,5	0,8	1	1,5	2	3	4	6	8	12	16	
1	42	45	49	53	56	57	59	52	48	41	37	
2	40	41	51	53	52	56	58	51	50	45	40	
3	38	38	50	55	60	50	51	45	39	35	33	

According to the diagnosis offered by the system it is possible to do the followings conclusions about the state of health of the visual system of patient:

- Healthy (fig.2);

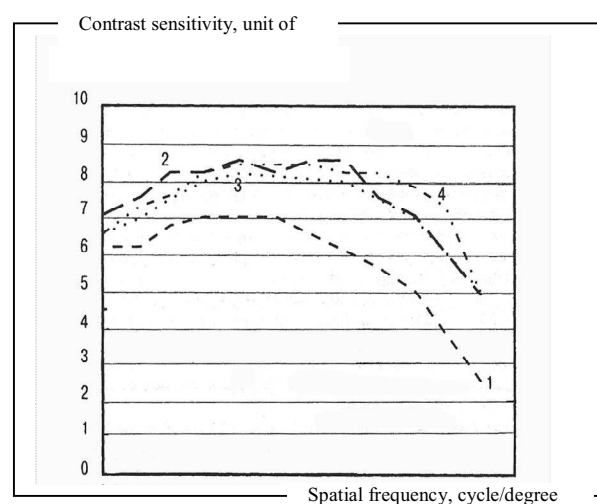


Fig. 2. Normative curves of contrasting sensitiveness on a black background. 1 - dark blue; 2 - green; 3 - red; 4 - white

- Rods disfunction (nightly blindness) takes place - SCS higher than norm in all range, especially on high-frequencies (fig.3);

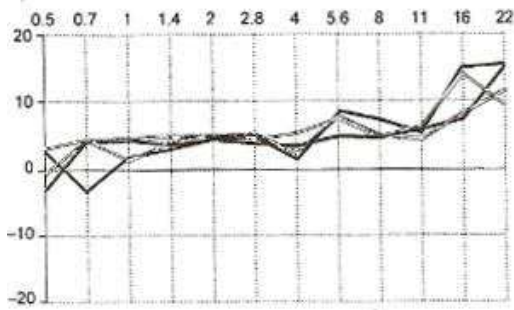


Fig. 3. Rods disfunction

- Optic neuritis - SCS goes down evenly in all range (fig.6);

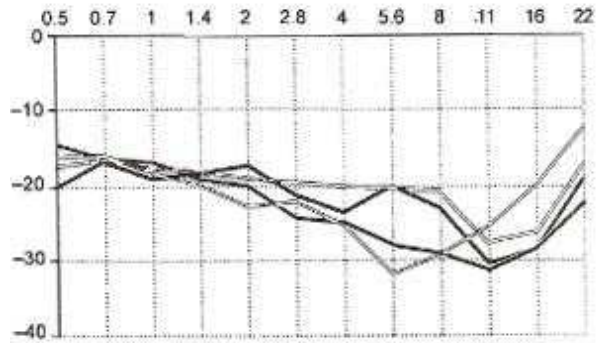


Fig. 6. Optic neuritis

- Cones disfunction takes place - SCS mionectic a greater measure on midfrequencies (fig.4);

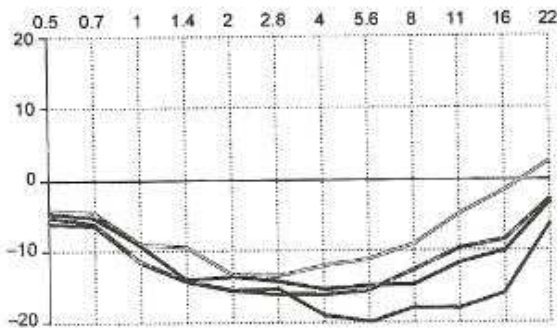


Fig. 4. Cones disfunction

- The defeat of visual bark (craniocerebral trauma) takes place is a characteristic not-even brokenness of curve of SCS on all frequencies, thus breaking does not meet for the different colors of researches (fig.7);

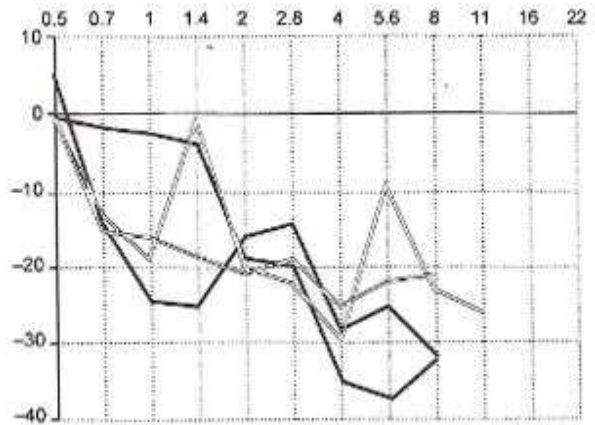


Fig. 7. Defeat of visual bark

- Central dystrophy of retina (illness of Shtargardta) takes place - a sensitiveness is fully absent on high-frequencies (fig.5);

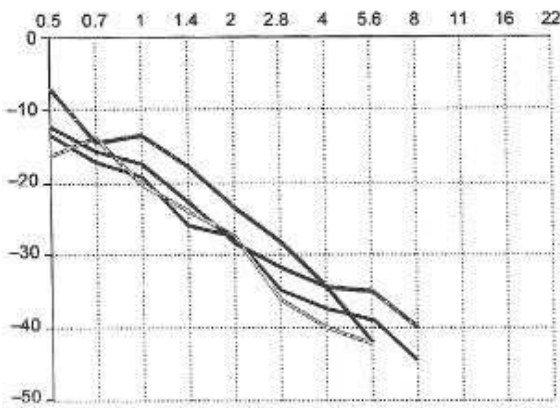


Fig. 5. Dystrophy of retina

- Different forms and stages of amblyopia:
 - 1) Optic amblyopia of weak degree is a smooth decline and in the following подъем curves on middle and high frequencies (fig.8);

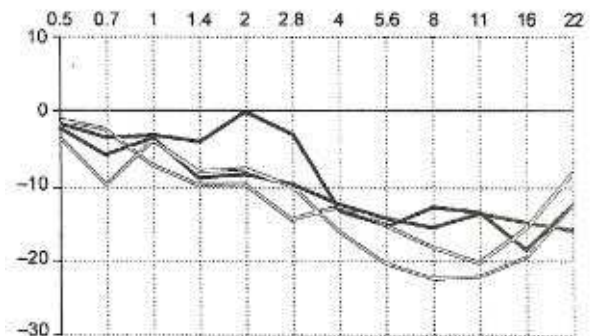


Fig. 8. Disbinokulyar amblyopia

2) Refraction and anisometric amblyopia is a decline of SCS on high and middle spatial frequencies (fig.9).

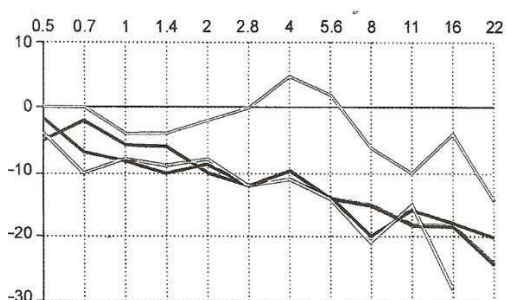


Fig. 9. Refraction and anisometric amblyopia

A job of ES performance is a preliminary diagnosis and to recommendation on the further chart of treatment of this patient which hatches for every measuring in the alphanumeric field. In addition, a job of consulting model performance is plugged in a printing report in a column "Diagnosis ES".

On this design time ES allows to define seven types of rejections in the visual system of man, which can in future result in difficult consequences и/или become reason of serious eye diseases up to the loss of eyesight.

CONCLUSIONS

There are no doubts, that not looking on progress which did not go round a side medicine, major in the end for a patient there is knowledge and ability of doctor. Therefore, destiny of this ES consists in a help to the doctor-ophthalmologist to accept a faithful decision in relation to the further method of treatment: on the got results an ophthalmologist draws conclusion about the necessity of setting of additional inspection of patient, with the purpose of confirmation or refutation of diagnosis.

The use of similar consulting models is special topically in those cases, when in medical establishment skilled enough specialists absent or not possibility or technical base, to expose a rejection physically, also the similar systems come for help to the young doctors without experience of diagnosticating and treatment of rare, difficult diseases [5].

Introduction of this system (or similar systems) in everyday practice of doctor of ophthalmologist can considerably reduce the risk of eye diseases, shorten time expended on

prophylactic examinations, to simplify the estimation of level of diseases in the separately taken district, city, areas et cetera Today there are some limitations from the side of legislative base for introduction of the similar systems (additional certification, limit on the use of the personal information and electronic card indexes), however, similar problems can be worked out due to effective activity of government [16].

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ЭКСПЕРТНАЯ СИСТЕМА,
КАК СОСТАВЛЯЮЩАЯ СИСТЕМЫ
ДИАГНОСТИКИ ЗРЕНИЯ ЧЕЛОВЕКА

*Григорий Пантелеев, Султан Рамазанов,
Константин Кривошеев*

А н н о т а ц и я . Проведен анализ существующих методов и информационных систем диагностики пространственной контрастной чувствительности. Предложено новую компьютерную диагностику на основании более точного метода оценки пространственного зрения человека, а также модуль экспертной системы постановки первичного диагноза.
К л ю ч е в ы е с л о в а . Компьютерная диагностика зрения, экспертная система.