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## Studies of Eye Complaints induced by VDT

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**Abstract** Sixty two outpatients who visited the eye department of the Ehime Labour Hospital, suffering from visual display terminals (VDT) operation-related diseases were classified into 4 categories.

Category 1 consists of mainly so called middle management personnel aged around 50 years old.

Category 2 consists of the female operators of VDT in their early twenties.

Category 3 consists of workers of young age. Re-occurrence of central retinitis, glaucoma, or Keratoconjunctivitis sicca is thought to be due to the engagement of VDT operation.

Category 4 consists of a group patients suffering from cataract induced by microwaves emitted from prolonged and continued usage of out-of-dated VDT machines, as suggested by Zaret.

It is expected to understand the concept of health care guidance even in the various terminal divisions of a company, though the type and content of work are different in the various departments.

*Key Words* : Eyestrain, Analysis of eye-patients, VDT cataract (Zaret)

### I. Introduction

With the rapid development and frequent usage of visual display terminals (VDT), many VDT operators have complained about eye-function impairment.

In the Labor Accidental Hospitals, the development of appropriate treatment for occupational neck-shoulder-arm syndrome and health problems arising from vibration had not kept pace with the introduction of new complaints. In order to discover preventative measures for the ocular disorders induced by VDT, study groups are now being set up in nationwide Labor Accidental Hospitals to research and investigate

precautional measures which may be used to prevent occupational health problems. In this way data and opinions on health care practice from physicians may be exchanged and discussed, which in turn may result in useful solution<sup>1)</sup>.

The classification of these diseases fell into 4 categories which were considered to be convenient and easily describable by the patients.

### II. Classification

As part of the medical supervision for occupational health care from a Labor Standards Bureau medical supervisor, VDT operators were invited and their workplaces were inspected. It

appeared that only a small portion of people who suffered from occupational disease or illness actually visited the hospital. It was revealed that there were not only one, but many causes which resulted in eyestrain and that these tended to overlap each other. List below is our classification of eye-function impairments resulting from VDT work.

Category 1. Included in this category are the so called "experienced management personnel" with an age of around 50 ; engaged in desk work as chiefs of the groups for a long time and who introduced VDT equipments into workplaces. Difference of viewing distances between the eyes and the display screen, the keyboard and the document surface is large enough to cause strain for the worker's eyes, which results in diminished capacity of dynamic amplitude of accommodation. Furthermore, the patient's pupil under the dim light used in the office dilates and shortens its focal depth, which requires in turn, a further task of the eye for the amplitude of accommodation.

Compliants generated from this group of patients are mainly originated from the difference of the working condition between operating the VDT and the regular desk work. Generally speaking, an age of 35 is proposed to be a retirement age an assigned VDT operator<sup>2)</sup> and a worker can be allowed to operate a VDT until at the most 40 years of age.

Category 2. Included in this category are the female operators in their early twenties complaining eyestrain and myopia and who have not received an eye examination on joining the company.

It is proposed to examine workers at the time of enrolment, find out those who have tendency to suffer from eyestrain and investigate if they become affected more easily during an observational period of a trial-based assignment on VDT.

The probability of VDT operators to develop myopia before the age of 25 is higher than that of those over 25. However, this is also true of other occupations. Just as myopia in young people who watch television for long periods, myopia in the VDT operators appears to develop because of the prolonged forced assignment of repetitive work. This myopia of VDT operators is one of the major problems to be investigated by health care societies in industry.

Abnormality in color adaptation is considered to be one of the responsible factors of an alarm-bell in the manifestation of myopia<sup>3)</sup>.

Category 3. Included in this category are those

who appear to be healthy, but when subjected to an occupational health eye test, they are diagnosed to have central retinitis, glaucoma or keratoconjunctivitis sicca.

Furthermore, the personal histories of these operators reveal the same diseases. Re-occurrence of the diseases is thought to be due to the engagement of VDT operation. The symptoms described in categories 1,2, and 3 are reversible with the possibility of prevention from re-occurrence by the modification and reselection of the workplace circumstances.

Category 4. Included in this category are the patients with subcapsular cataract induced probably by the microwaves generated and emitted from the VDT machines, as suggested by Zaret<sup>4,5)</sup>. In its slow progress of cataract, other symptoms, not yet clarified, may occur concomitantly.

It is considered that this kind of disease, cataract, could be manifested by the microwaves after the prolonged utilization of out-of date and poor quality office automatic equipments. However, the only conventional method available to the ophthalmologist for the detection of cataract is the slit-lamp microscope, because of the difficult availability of microwave detectors.

Development of more efficient and accurate methods to diagnose cataract in the early stages is an urgent problem to be rectified.

### III. Results

Table 1 summarised the numbers of patients with VDT-induced diseases, who visited the eye department in this hospital and also local opticians in the area.

Table 1 Analysis of Eye patients due to VDT

Category 1.	16 (26%)
Category 2	30 (49%)
Category 3	7 (11%)
Category 4	9 (14%)
Total	62

The total number of the patients in Category 1 was 16, out total of 62 (approximately 26%), their ages ranging from 48 to 62. This group of patients well understood the conditions responsible for the causes of eyestrain in young aged workers and cooperated in improvement and correction of the working

conditions in order to prevent the occurrence of this disease.

It is difficult for this group of patients to do continuous operation of VDT machines, even with the aid of corrective glasses for presbyopia, due to the different viewing distances between the eyes and various materials concerned. The complaints of unimproved eye-strain, even with corrective glasses, are agreeable from the ophthalmological point of view.

Category 2 consisted of 49% (30 patients) of the total group. Recently, (1984, December 20), the Ministry of Labour reported the necessity of the health examination and its management in the for Occupational Health Care of VDT Operators Engaged in their Workplaces. Industrial ophthalmologists wish to form a committee for the prevention of occupational diseases, or a similar society<sup>6)</sup>. Thus, they can discuss and exchange their opinions on workers' eyes, who are to be engaged in work requiring hard use of the eye, on their enrollment and their change of jobs.

In a previous paper on Industrial Safety and Health, we reported the results of the eyes examination on VDT operators who desired to change their line of work. When these case reports were reexamined one year later, the cause of the complaint due to VDT usage was eliminated, as the office work was based on a rotation system and none complained about VDT work.

Category 3 included 7 patients out of 62. On examination, their eyes were revealed to be suffering from central retinitis, glaucoma or keratoconjunctivitis sicca and had the past history. As Suzumura described, past assignment of VDT operation might play a responsible role in the onset of these disease.

A case report (Category 3) :

A 38 years old female, worker was checked up to have ocular hypertension and was treated with eye drops three years ago. The next year, she was employed in a company with the eye trouble and operated the computer for steel goods in stock. One and a half years later, she suffered from blurred vision during the operation with a visual acuity of the right and left eye of 0.8 and 0.9, respectively, as-

sociated with intraocular pressure of 23mmHg-25mmHg. After hospitalization, peripheral iridectomy on both eyes was performed. Intraocular pressure was well controlled with eye drop therapy. Laser trabeculoplasty was performed to treat the recurrence of high intraocular pressure 6 month after rejoining her workplace. She is now retired from company with normal intraocular pressure and visual field. Category 4 included 9 patients out of 62 (14%). We present a follow-up of one typical case.

A 53 years old male factory supervisor visited our hospital with the symptom of abnormal vision of his eye on June 1984. He said that he had been seized with his reduced visual acuity of his left eye for one year. His visual of his right eye was 1.2, while that of his left eye was 0.4, which were uncorrectable, even with glasses. He had been working as a clerk since November 1948. For the early 27 years he had been healthy and no abnormalities had been found at the half year health examinations. His visual acuity, 1.2 of both eyes, had always been recorded. On January in 1977, he started to operate a computer, inputting factory data all in his working hours. The machine was the Kiserider display machine (JVC data system, type VG-2). The operation in the workplace was conducted by a team of 4 people and he had played a central role including working overtime. He had been aware that his eyes were sensitive to the heat generated by a fan, which was always switched on during work. The reduction of sight in his left eye was found to be due to cataract and one year later his right eye suffered from subcapsular cataract together with an increased growth of fiber surrounding the vacuole in the early phase of the disease.

Gradual exacerbation in cataracts in both eyes was observed with a slit-lamp microscope with specific characteristics to the opacity in lens. Visual acuity of right and left eyes were reduced to 0.7 and 0.1, respectively, when examined on April 10 in 1986. Extracapsular cataract extraction and I.O. L. implantation in the left eye was conducted, resulting in the increase of visual acuity of 0.7 (1.2.X+0.75Dcy1-1.5DA 180°). Nucleus

lentis was histologically determined to be normal.

#### IV. Discussion

In addition to the effects on the vision, VDT operation also causes abnormalities in other parts of body. In particular, an epilepsy like syndrom, otherwise known as migraine, is called scintillating scotoma in ophthalmology. This illness causes trouble for the patient to view objects at a short distance. Although VDT operation is suspected to cause the spasm of blood vessels in brain, incidence of the attack before engaging the operation of VDT machine appears to be one of the important causative factors for the symptom of scintillating scotoma.

The occurrence of facial eczema and the abnormalities in birth among VDT operators were considerable high compared with those not engaged in VDT work. Patients suffering from VDT operation-induced cancer, hearing disorder and neurological problems are suing their companies in the law courts in foreign countries.

Among VDT machine operators, there are 3 types of operators; the first, those who perform exclusively in continuous VDT operation throughout the working hours; the second, those who perform VDT operation in an on-and-off mode alternatively with other workers; and third, those who perform VDT operation for only a short time of the day; this appears to be the largest group. Eyestrain is the major complaint from VDT operators together with the so called "Join an actual patient in a sickness" syndrom. In addition, patients also complain to suffer from myopia and the exacerbation originating from eyestrain. Recently Takahashi<sup>7)</sup> stated in his book that the size of letter displayed, space between letters, shapes of letters, flicker of screens, and brightness were major important factors to be considered to the eye-function impairment. Most of his proposal, such as space of 20-50% between letters, space of 100-150% between sentences, and positive display were extensively discussed in ophthalmological societies 50 years ago.

My former teachers, Funaishi and Sasaki<sup>8)</sup> compared the legibility of kanji with Katakana and under the agreement of professor Ishihara, they stressed the usage of Katakana rather than Kanji because of its legibility. However, usage of Katakana has not been widely accepted. At this junction, a proposal for the revision of Japanese letter toward the simpler Kanji should be considered seriously.

The flicker, brightness and contrast of the screen have, for a long time, been thought to be important factors in eye damage. Old proposals appears to require re-evaluation under the light of new developments in Ergonomics, such as working conditions, methods of lighting and detailed knowledge of posture in operating. There are plenty of detailed researches concerning the effects of a display with various colors on workers with color abnormality. However, in practice, this seems less important to general office workers, and eye examinations of this type of worker may not be necessary. Major problems in VDT operation are abnormalities in accommodation and convergence. As described previously, corrective glasses for presbyopia, with a capabilities of perfect adjustment of visual focusing to the three different viewing distances are almost impossible to prepare at present.

One of the important factors in preparing a work schedule is the duration of working hours. We advise an operating period of 45-50 min with a break of 10-15 min, and a total of 4 hours of work per day, 5 days a week.

Overtime and late night operations should be avoided as much as possible, and periodical health examinations should be conducted every 6 months.

It is recommended to reduce a total VDT operation per a worker under the rotational work system. increasing the number of workers assigned to operate the VDT machines. The factories which introduce the above occupational health care policy are considered to be reasonable place of work. However, putting these occupational health care policies into practice depends much on the eagerness and the understanding of the company. It takes several years to manifest the symptom of cataract induced by hazard-

ous ray's or electro-magnetic waves. Opacity begins to occur in the subcapsular area with its center in the posterior pole of the lens. The progress of cataract induced by micro-waves still remains unclear and it requires the detailed clinical investigation by research physicians.

Tominaga<sup>10)</sup> described the necessity of a strict monitoring of radiation leakage and electro-magnetic waves emitted from VDT machines. The amount of leakage of the waves from our recently produced VDT machines is strictly managed by the quality control act and it is small enough to pass the regulation of standard in the Soviet Union, which is known to be one of the severest regulations of its kind. However, the effect of the waves on the lens and testis, in which general metabolisms much slower than in other organs and blood supplies are also less, may be different from other organs. Ogi<sup>11)</sup> considered occupational eye care problems in his book on occupational health care, in which the various aspects of preventative measures, including biotechnological ones and the job-created diseases are discussed. However, problems with cyclophoria and vertical strabismus, which are known very common diseases, were not mentioned in his proposed examination checklist.

In a guideline for the occupational health care recently published from the Ministry of Labor, detailed methods for proper management of vision are included. It requires a good cooperation between ophthalmologists and health care supervisors to carry out the above health care guidelines efficiently.

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