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VDU workstations and vision in post office and bank operators

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Abstract. A cross-sectional study was carried out on a sample of 26 VDU operators in a post office and a bank, working regularly on video display units. The study aimed at (1) determining the physical working conditions, particularly lighting conditions, (2) assessing employees' complaints, (3) measuring visual defects among operators in VDU workstations. The following results are revealed: (a) ergonomic shortcomings in workplace and work station design were clearly noticed (b) noise level was between 60db and 78 db, (c) illumination parameters did not much the task and caused ocular symptoms and visual fatigue, (d) visual tests revealed vision defects in 84.6% of the cases, (e) visual fatigue was noticed at the end of the working day. The abnormal frequency of operators' complaints can be explained by the association of visual defects and inadequate working conditions

Keywords: VDU; illumination conditions, vision, visual fatigue, visual defects.

1. Introduction

The increase in the use of visual display units (VDU) in different work situations have modified the work tasks and introduced new risks due to ergonomic deficiencies in the workplace design and physical conditions in which operators are performing their work activities.

The rapid proliferation of computers has lead to large increase in VDU use in both the workplace and at home. In Algeria, VDU workstations were implemented in tertiary sector (post offices and banks) in the absence of the required ergonomic recommendations. They experience difficulties of technology transfer to developing countries, particularly unawareness of the different health hazards among both management and operators a like.

Scientific literature unanimously [1, 6, 14, 15] affirm the use of VDU does not cause health problems by itself, but through inadequate work conditions and ergonomic deficiencies like: physical environment, workstation layouts and work organization.

The objectives of the present study were: 1- Determining the physical working conditions, particularly lighting conditions. 2- Assessing employees' complaints. 3- Measuring visual defects among operators of VDU workstations.

2. Method and procedures:

A study of illumination, noise and thermal environment was conducted in eighteen (18) VDU workstations, on a sample of twenty six (26) VDU operators (16 females and 10 males), aged between 24 and 55 years, working regularly at daily rates, ranging from a minimum of 4 hours to a maximum of 8 hours, in a post office and a bank.

A questionnaire technique was used to identify: operators and workplace, workplace design, physical working conditions (especially lighting conditions), and workers' complaints and visual fatigue at the beginning and at the end of the working day.

At the same time, appropriate apparatus were used to measure: thermal heat, noise level, and illumina-

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tion parameters (level of illumination and luminance). Visual defects (hypermetropy, myopia, astigmatism and heterophoria) were systematically tested by visiotest Essilor and campitest in all subjects (n=26).

3. Results:

3.1. The workplace:

All work stations were set up in large premises, which have either, windows or openings giving outside. However, in the post office case, the openings were small and highly positioned.

In the majority of cases, preinstalled work surfaces were maintained. In seven out of eighteen cases (39% of cases) these were ordinary old desks, which have no enough space underneath to move legs, and did not acquire adequate height, depth and lateral distance specifications, beside the reflective and crowded work surfaces.

These work conditions are known to cause postural and visual discomfort. In order to meet ergonomics requirements, adjustment of the working areas becomes necessary, to fit the new equipment taking into account the different components of the activity zone (keyboard, mouse, display screen and document holder).

The hardware consisted of small size CRT monitors (38 cm, 15 inches), QWERTY keyboards and serial printers. Nearly a quarter of display screens were oriented facing the windows. Some work stations were located directly under VDT light fixtures.

3.2. Job characteristics:

Operators in the present study carried out tasks of data entry and word processing under time pressure. Tasks of this nature are characterized by monotony, sensations of general fatigue, dissatisfaction and complaints of visual fatigue. These are typical characteristics of sedentary work which provide little opportunity to move and take muscular recovery.

The quality of paper documents was very poor. In ten (10) out of eighteen (18) workstations (51% of the cases), these documents were: manuscripts' copies of bad quality, fax sheets of bad printing quality and a reflective photo paper was used to calculate telephone bills. The quality of the working documents, and the absence of document holders, was at the source of visual and postural discomfort.

3.3. Physical working conditions:

While air conditioning facilities neutralized the thermal factor in all work stations, noise level measurements were between 60 and 78 db, which was considered as a nuisance factor, for the frequent operators' complaints. Printers were the main source of noise.

3.4. Illumination conditions:

All work stations used a mixed (natural and artificial) illumination. A fluorescent type of light was used, but in the majority of cases not well positioned, which caused glare, visual discomfort and consequently visual fatigue. Table (1) shows the distribution of work stations by level of illumination which ranged from minimum and maximum values of 50 and 340 lux, respectively. In the large majority of work stations (16 out of 18), the level of illumination was under the required standards [2, 9].

Table 1
Distribution of workstations by level of illumination

illumination level (lux)	VDU work stations n	%
<150	13	72.2
150-250	03	16.7
250-300	01	5.5
> 300	01	5.5
Total	18	100

3.5. Brightness and contrast:

Although the level of illumination constitutes an important factor among others in determining the surrounding light, the luminance study showed values ranging from 5 to 900 cd/m² at the level of visual task (display, keyboard, working document) and the immediate environment (luminaries and bay windows), respectively.

Contrast measurements revealed luminance ratios fluctuating between 1/1 and 1/60. As can be seen from table 3, the distribution of measurement points according to contrast levels for visual tasks, indicates that, luminance ratios were in the recommended limits only in five (5) out of eighteen (18) points of

Table 2
The mean luminance values (cd/m²) at visual task level.

Measurement point	$\bar{X}$	SD	mini	max
Screen	13.9	9.4	5	45
Keyboard	12	7.7	5	30
Document	28	27	5	120
Bay windows	186	103	30	500
luminaries	122	225	10	900

measurement (screen/working document), and three (3) out of eighteen work stations in the case of key board/ working document. No work station was in the recommended limits in the case of screen/ keyboard measuring points.

Table 3
Distribution of the measurement points according to the contrast level for visual tasks.

Measurement point	Contrast		
	Null	good	high
Screen /document	12	5	1
Keyboard/document	12	3	3
Screen /keyboard	18	0	0

Luminance ratios were between 1/1 and 1/60 for the working and the surrounding areas, respectively. They were not up to recommended standards in any of the work stations studied, they were either too high or too low (table 4).

Table 4
Distribution of the measurement points according to the contrast level for surrounding environment.

Measurement point	Contrast		
	Null	good	high
Screen / bay windows	13	0	5
Screen / luminaries	14	0	4

3.6. Vision screening in VDU operators:

Results of visiotest and campitest (table 5) revealed visual defects in 22 subjects out of 26 (84.6%) of the cases.

Table 5
Evaluation of global vision.

Vision	n	%
Good	4	15.4
Defective	22	84.6
Total	26	100.0

Analysis of results (table 6) revealed the following visual defects:

- Far vision was defect in 17 cases (65% of the sample)
- Near vision was defect in 85% of the cases.
- Astigmatism was present in 11% of the cases
- Color vision anomalies were present in 15% of the cases.
- While heterophoria was present in 46% of the cases.

Table 6
Distribution of Visual defects among subjects *(n:26)*

Vision	Deficient		Normal	
	n	%	n	%
Far sight	17	65.0	9	34.6
Near sight	22	84.6	4	15.4
Color vision	4	15.4	22	84.6
Stereoscopic vision	6	23.1	20	76.9
Phorias	12	46.2	14	53.8
Astigmatism	3	11,5	23	88.5
Visual field	0	00.0	26	100.0

In spite of these visual deficiencies, the visual field was normal in all subjects. Visiotest and campitest have revealed refractive errors of the type: hypermetropia, myopia, astigmatism and heterophoria. Only seven (7) operators out of 26 use corrective glasses or lenses**.**

It is well admitted that visual fatigue occurs in bad illumination conditions**,** in uncorrected refractive errors of the eye, or in the case of affected eyes. Taking into account the work conditions in VDU work stations, and the multiple identified discomfort factors, through the measurements taken for illumination, luminance, contrast, and the above mentioned refractive errors of the eye, we might then conclude that all conditions for the occurrence of asthenopia are present.

3.7. Frequencies of visual complaints among operators before and after the working day:

Results of the questionnaire on workers' complaints and visual fatigue (table 7) shows the following major symptoms at the beginning of the working day: light sensibility, blinking, tingling/burnings, blurred vision, ocular heaviness. While, at the end of the working day there was an increase in the values of the following parameters: ocular heaviness, blurred vision, headaches, tingling/burnings. The difference between the two periods of the working day was statistically significant at $\alpha = 0.05$.

Table 7
Distribution of visual fatigue symptoms, before and after the working day.

Symptoms	Before n	%	After n	%
Ocular heaviness	4	15.4	16	61.5
Tingling/burnings	5	19.2	7	26.9
Friction	4	15.4	3	11.5
Blinking	7	26.9	5	19.23
Pain	2	7.7	2	7.7
Redness	1	3.8	0	0.0
Eye watering	3	11.5	1	1.5
Blurred vision	4	15.4	8	30.8
Light sensibility	9	34.6	10	38.5
Double vision	0	0.0	1	3.8
Headaches	2	7.7	13	50.0
Digestion trouble	2	7.7	1	3.8

The questionnaire results show the arbitrary layout of work stations, the inappropriate physical working conditions (ambient noise and lighting conditions). These factors among others (job characteristics, job organization, and poor medical care) are ultimately at the grassroots of visual fatigue, and hence, visual defects among operators, which may help to explain their complaints and visual fatigue symptoms before and after the working day, as shown in table (7).

4. Discussion:

Ergonomics of VDU work stations have been exhaustively studied in industrialized countries. Standards and regulations of the use of VDUs are well established [2, 3, 7-12]. While in industrially developing countries (IDC) ergonomics studies are in their embryonic stages.

Although, the International Labor Office (ILO) [7, 8] and the International Organization for Standardization (ISO) [9] provided guidelines of different aspects of man-machine systems, the implementation process in IDC is still lagging behind, as has been shown in the present study.

Visual fatigue symptoms are known to be pronounced among VDU working population [6, 11, 13, 14, 15]. This conclusion was confirmed in the present study (table 7), either before or after the working day.

Visual and ocular problems are well known to be associated with inadequate lighting conditions [10, 11-15], particularly in extended working time schedules [7, 4] and in inadequate work station design and work place layout [1, 3, 9]. Visual defect indicators shown in the present study could be well explained by the association of the above mentioned factors. Rey and Meyer [13] advocate that, half of VDU user populations display some kind of eye deficiency, and most of them use prescriptive lenses. In the present study, 84.6% of the sample cases showed some kind of visual defect, but only, one out of four operators (1/4) used corrective glasses. This might be explained by the limited medical care, low rate of screening examinations and the lack of correct sanitary culture.

Systematic ocular screening and visits to the eye specialist are always incorporated in occupational health programs for VDU workers [7, 8, 11, 12]. But these do not substitute the systematic improvement of the ergonomics of the workplace, equipment and task design, which goes along with the efforts on ergonomics promotion and awareness among concerned people in IDC. These, are some of the recommendations, which can be put forward by the present study.

5. Conclusions:

Results of the present study indicate clearly, that arbitrary layout of VDU workstations, and inadequate workplace design, are at the grassroots of many ocular and visual problems.

Inadequate working conditions on VDU work stations are a source of operators' complaints, and health hazards. Remediation can be achieved through an urgent ergonomics intervention, to alleviate the poor illumination conditions, which seem to be, the main cause of visual fatigue symptoms, at the beginning and at the end of the working day.

Sight parameters showed a number of visual defects. Hence, appropriate medical intervention of

sight practitioner, for eventual sight correction and medical surveillance, is to be sought.

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