

Skin Problems from Visual Display Units

Provocation of Skin Symptoms under Experimental Conditions

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Thirty patients having skin problems experienced being caused by work with visual display units (VDU) were tested double-blind with two VDUs. One VDU had strong electrostatic and electromagnetic fields and the other VDU had an identical appearance but the electrostatic field and electromagnetic fields were practically eliminated. Approximately 80% of the patients reacted with stinging or itching in the face during the 3 hours working period with 25% relative humidity in the room. No difference between the VDUs was found with regard to provoking these symptoms. At 60% relative humidity 13 patients of 19 experienced stinging or itching in the face. Those 13 that reacted were asked to come another time and were informed that the VDU was not turned on and that all electric fields that were present came from the cable to the VDU. A green cloth was put over the VDUs. This time 11 of the 13 patients reacted with stinging and itching in spite of the fact that the VDU was turned off. The present study does not indicate that electric and electromagnetic fields are of major importance in provoking subjective skin symptoms in patients experiencing skin problems when working with VDUs. *Key words: Facial problems; VDU-work; Provocation.* (Accepted August 10, 1988.)

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There have been several reports of skin problems in patients working with visual display units (VDU) (1-8). The changes that have been reported are mainly common dermatological conditions like rosacea, seborrhoeic dermatitis, acne, erythema and pruritus. It has been difficult to find any physical or chemical explanation for these problems (9-11). X-rays, ultraviolet light, electrostatic field and electromagnetic field have been implicated. There is great uncertainty about the reason for these problems, however. Interest from the professional associations, trade unions and the press has been very strong. We consider it important to investigate separate factors under controlled conditions, preferably in double-blind studies.

MATERIAL AND METHODS

The city of Gothenburg has a population of 450 000. The number of visual display units has been estimated to be over 30 000. There were about 30 referrals for skin problems from VDU to the dermatologists in the city during 1986. These patients were asked to take part in the present investigation.

For the experiments, a climatized room was used, in which the relative humidity and the temperature could be controlled. Two personal computers of identical appearance were used. The VDUs of these computers differed in the emission characteristics of electrostatic and magnetic fields, however (see Table I). The electrostatic fields were measured with a field mill type of meter mounted in the centre of a large metal plate so as to ensure a homogeneous field configuration at the measuring point.

In order to ensure that the electrical field from the patients themselves would not interfere with the fields from the VDUs, the patients were grounded by attaching an ECG electrode to one of their lower legs.

The magnetic field intensities were measured using a one-dimensional coil which was held in three orthogonal directions. The dominating component, in all cases the vertical, is given below. The other two components were always less than 30% of the dominating vertical component.

The values presented are the total peak-to-peak values in the frequency range 1 to 300 kHz and emanate mainly from the horizontal deflection coils of the VDUs, the basic frequency of which was approximately 32 kHz.

Because of the limited space in the climatized room, the magnetic field emitted by VDU B also contributed to a certain extent to the fields in front of VDU A when the units were on simultaneously. The mutual interference of the electrostatic fields was, however, negligible.

A simple check of the alternating electrical fields was also carried out and showed that such fields were of identical intensity, approximately 60 V/m, in front of the two VDUs.

Low frequency electrical and magnetical fields emanating from the electrical installations in the climatized room were not recorded.

The X-ray intensity in front of the VDUs was less than 30 nGy/h.

The patients were first asked to come after a period of 2 to 3 days without any work involving a VDU. A thorough dermatological history was taken. The patients worked initially with one of the VDUs for 3 hours. Subjective and objective skin complaints were noted before, directly after, 30 minutes after and 4–20 hours after the working period. Photographs were taken with a standardised technique, including a colour scale in each picture, at these times. The next day, the patient worked in the same way but with the other VDU. Approximately half of the patients were randomly allocated to VDU A and the others to VDU B the first day and vice versa the second day. During these two days of provocation, the relative humidity was 25% and the temperature 22°C in the climatized room. 24 hours after the second day, the patients were exposed to an UVB lamp (TL 12 tubes) with a dose corresponding to one-tenth of the MED for the average population.

Those patients who had had reactions, subjective or objective, at 25% relative humidity and 22°C were asked to come again, this time for provocation at 60% relative humidity and 22° in the climatized room, working with the VDU that they thought caused them most problems. Photography and registration of complaints was done as previously. Patients who noticed skin problems on this occasion were asked to return a third time, at least a week later, and were informed that the VDU was not turned on, the VDU was partly covered with a cloth and the only possible influence could therefore be coming from the electromagnetic field of cables connecting the VDU. Their problems were noted in the same way as previously.

Half of the 30 patients worked in banks or in private enterprise. The other half worked in the public sector. The main occupations were secretary, clerk and bank clerk. None of the patients held managerial positions except one who was service manager for a private company.

Half of the patients had been completely without skin disorders before beginning to work with a

Table I. For the three exposure situations used the following field intensities were recorded 30 cm in front of the VDU

VDU turned off: The electrostatic field was eliminated as the units had been switched off for at least 24 hours before exposure. There were no measurable magnetic fields from the VDUs

	VDU-A	VDU-B
<i>Relative humidity 25%</i>		
Electrostatic field	0.2 kV/m	30 kV/m
Magnetic field	50 nT	800 nT
Magnetic induction	23 mT/s	335 mT/s
<i>Contributing from neighbouring VDU</i>		
Electrostatic field	–	–
Magnetic field	17 nT	3 nT
Magnetic induction	7 mT/s	1 mT/s
<i>Relative humidity 60%</i>		
Electrostatic field	0.1 kV/m	6.5 kV/m

The magnetic field intensities were the same as at 25% r.h.

VDU, while the other half had had one of the following problems: eczema seborrhoeicum, acne during teens, atopic eczema, dryness, psoriasis, rosacea and ichthyosis (Table II). Only eight were regarded as having no skin problems immediately before taking part in the present study.

Twenty-six percent of the patients stated that they had symptoms within 3 hours of working with a VDU. The rest of the patients only noted symptoms after having been operating the VDU between 4 hours and 1 week.

Sixty percent of the patients stated that they had symptoms during the first year of operating the VDU. The remaining patients had not had symptoms until after 1–8 years.

Four of the thirty patients had experienced so much skin trouble that they had stayed off work for short periods. On a falling scale, the most common symptoms, according to the dermatological history, were, blushing, redness, heat, itching and acne. Forty-six percent of the patients were between 30 and 40 years old and 36% between 40 and 50 years. The oldest was 51, the youngest 22. Four of the 30 patients were men.

RESULTS

Of the 30 VDU workers that were referred to us because of facial skin problems that were felt to be caused by a VDU, 25 experienced similar skin problems after having worked with either of our two test VDUs for three hours. Thus, 17% of those considering themselves to have skin problems from a VDU could not be provoked in this way.

The subjective problems came some time during the three-hour provocation period. Of those 24 subjects reacting the first day, 16 had no symptoms the next morning and eight had slight symptoms. Of those that had slight subjective symptoms on the second morning before new provocation, four had used VDU A the first day and four VDU B. These eight patients with slight subjective symptoms on the second morning all experienced more discomfort during the second day's provocation. Five reacted differently on the two days; four reacted on the first day and not the second and one reacted on the second and not the first day. Of those that reacted only on the first day, two reacted when working with VDU A and two when working with VDU B. The one that reacted on the second day but not the first reacted to VDU B. The frequency of reactions was about the same for VDU A and VDU B. These tests were made at 25% r.h. and 22°C.

One patient reacted during the first provocation at 25% r.h. with Quincke's oedema around the eyes. This could not be reproduced at 60% r.h. with the same VDU. This patient reported that she reacted with Quincke's oedema when travelling by rail, when the heating system of the car was turned on and during some household work.

Those patients that had reacted on day 1 and/or 2 were asked some weeks later to work another 3 hours with the VDU they had reacted most strongly to but now at 60% r.h. Five did not want to, or could not, participate.

Table II. *Skin problems before VDU work*

	No.
Acne as teenagers	5
Seborrhoeic eczema	5
Atopic eczema	1
Psoriasis	1
Rosacea	1
Ichthyosis	1
Dry skin	1
No skin problems	15

Of the 19 thus tested, six, or 31.5%, did not react under these conditions.

Those thirteen that reacted were asked on a later occasion to repeat the 3-hour period of stay in front of the VDU but with it switched off and covered with a cloth. Eleven of the thirteen still reacted.

For the patients that reacted, except the one with Quincke's oedema, we could not detect any erythema in the photographs compared to pretesting photos but at the examination we had the impression that some were slightly redder in the face after having worked with the VDUs. The reactions noted were thus mainly subjective.

Table III shows the number of patients that reacted with different subjective symptoms to the two VDUs at 25% or 60% relative humidity and also when the VDUs had been switched off. No obvious difference between the two VDUs with regard to elicitation of subjective symptoms is evident.

None of the patients developed any subjective or objective complaints after being exposed to the UVB dose given to the face from a UVB treatment lamp.

DISCUSSION

This study was mainly aimed at elucidating the possible role of the electrostatic field in front of VDUs in provoking subjective or objective skin symptoms in patients complaining of skin problems from VDUs. The two VDUs differed markedly in both electrostatic and oscillating electromagnetic fields. The test situation thus differed in front of the two VDUs with respect to both electrostatic and electromagnetic fields. Both VDUs were used in the same room during the tests, generally simultaneously.

The influence of one VDU on the other is small and differs by at least a factor of 20 from what is present in front of the VDU influencing the other. Our conclusion is therefore that the experimental set-up was such that if the electrostatic or electromagnetic fields that are usually present at working distances from VDUs are a major cause of skin problems, the effect would be possible to detect. The only other electrical equipment in the room was a lamp on the ceiling. The experiments were carried out double-blind to avoid influence of bias. The subjects were also subjected to a UVB dose that is one-tenth of an average minimal erythema dose, which is very large compared to what one could receive from a whole day's VDU work. None of the patients reacted and we can therefore exclude ultraviolet radiation as playing any role in this situation.

It is not necessarily exactly the same factor that is the initial cause of the problem and

Table III. Reactions reported at end of provocation

	30 individuals 25% r.h.		19 individuals 60% r.h.		13 individuals 60% r.h. VDUs turned off
	VDU-A	VDU-B	VUD-A	VDU-B	
Heat or reddening	12	10	2	3	8
Itching	8	9	3	2	4
Stinging	8	6	0	4	4
Oedema	1	1	0	0	0
Others ^a	6	8	3	4	5
Total no. of patients reacting	22	23	6	7	11

^a For instance, feeling of dryness and a metallic taste in the mouth.

the provoking factor. In this study, we have analyzed provocation of symptoms and not the initial events causing the problems.

The fact that about 80% of the tested persons, who had earlier consulted a doctor because of skin problems, reacted indicates that the experimental conditions in the study were relevant. There was no difference between the two VDUs with regard to provocation of symptoms, however.

In the second experiment, where 19 of the 24 that had reacted in the first experiment took part, 60% relative humidity was used in the testing room and the subjects were put in front of the VDU that they thought caused most symptoms. In this case, only 13 of the 19 noticed any skin problems. A dry atmosphere may thus be of some, albeit minor, importance for provocation of subjective symptoms.

Finally, when the VDUs were turned off and a cloth was put over them, 11 out of 13 patients still experienced skin discomfort. This experiment was carried out at 60% relative humidity.

The different symptoms experienced in front of the two VDUs are listed in Table III. There does not seem to be any difference between the two VDUs with regard to provocation of different types of symptoms.

Our conclusion is thus that symptoms appear irrespective of which VDU is used, the one with strong or the one with very weak electrostatic and electromagnetic fields. The high percentage of subjects reacting when the VDU was turned off also indicates, in our opinion that it is unlikely that the electrostatic and electromagnetic fields in front of VDUs are of major importance with regard to provocation of skin problems.

Possible mechanisms for the skin problems that have been attributed to VDU-work are: blaming VDU-work for the occurrence of common facial skin problems, suggestions from other people or newspapers talking about it being dangerous to work with a VDU, stress followed by psychosomatic reactions, conditioned reflexes and physical effects.

The first three factors are probably important in causing VDU skin problems while factors 3 and 4 may be of importance in the provocation of symptoms in a patient who has earlier experienced skin problems, as in this study. We have no valid evidence of the importance of physical factors at present.

We would stress that the problem of skin reactions among people working with VDUs undoubtedly exists and should be taken seriously. However, it is our opinion that the reason for this problem is not mainly to be found in the physical situation caused by the VDU itself but rather in the unnatural working situation from a physiological and psychological point of view (11–12). Analyses of the physical environment around VDUs and its possible effect on a human being also indicate that it is unlikely that any biological effects of importance may occur (9–11). Our clinical experience from working with patients complaining of skin problems from VDU work is that they tend to blame the VDU for all their skin problems. After all, what has been reported is commonly occurring facial skin lesions and nothing specific.

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