

COST 244: Biomedical Effects of Electromagnetic Fields; Graz-E.M. Hypersensitivity

**"ELECTROSENSITIVITY",
"ELECTROSUPERSENSITIVITY"
AND "SCREEN DERMATITIS":
PRELIMINARY OBSERVATIONS
FROM ON-GOING
STUDIES IN THE HUMAN SKIN**

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1. INTRODUCTION

Recently, a new category of patients has been described in the literature (cf. Refs. 1 and 2), namely those who claim to suffer from subjective and objective skin- and mucosa-related symptoms, such as itch, smarting, pain, heat sensation, redness, papules, pustles, etc., after exposure to visual display terminals (VDTs) as well as other electromagnetic devices, both at their work and in their home. Some patients also have symptoms from internal organ systems, such as the heart and the central nervous system. Clinical dermatologists often describe these patients as suffering from either some kind of earlier acknowledged skin disease, e.g. seborrhoic keratosis or rosacea, or from so-called 'techno-stress', a term first used in Japan for work-related stress. Also Pavlovian-type conditioning has been attributed to this group of patients. So far, however, very little is known about the exact cause of the above-mentioned symptoms and, thus, generally very little treatment can be offered.

2. AIM and MATERIALS & METHODS

The aim of the on-going study is to investigate possible changes, in the cellular and neuronal systems of the patients' skin, after provocations with electric and/or magnetic VDT-fields. As controls, age- and sex-matched persons working with VDTs (however, without any subjective or clinical symptoms) will serve. Immunohistochemistry using antisera to the previously characterized marker substances of interest in this specific patient category is utilized (cf. Refs. 3-6).

3. RESULTS & DISCUSSION

Initially, we have done the following:

a) Investigated the presence of intraepidermal nerve fibers in normal human skin from healthy volunteers (n = 66) using the new marker protein gene product (PGP) 9.5. The intraepidermal nerve fibers are varicose or smooth with different diameters, running as single processes or branched, straight or bent, projecting in various directions and terminating in the stratum basale, spinosum or granulosum. They are found as close as 20-40 μm from the surface of the viable skin (7), which makes it highly possible that weak electromagnetic fields may affect them. They have also been further characterized using conventional electron microscopy and ultrastructural immunocytochemistry (8), as well as the nerve densities have been calculated for different body regions (9). In addition, a general and profound innervation of the dermis, including the different accessory structures, such as Meissner's corpuscles, hair follicles, arrector pili muscles, around the eccrine and apocrine sweat glands and around certain blood vessels, is also observed (7). Finally, numerous weakly-to-strongly PGP 9.5 immunoreactive cells are found both in the epidermis and in the dermis (7).

b) Performed a 'pilot'-study to elucidate possible changes in certain cellular (immunologic, connective tissue, etc.) markers, as well as in sensory and autonomic nerve fibers. From the preliminary data, it seems plausible to conclude

that the patients (n = 9) differ from both healthy controls (n = 3) as well as from rosacea patients (n = 2), however, further control experiments are needed.

c) Studied, in an open-field situation, the effect of electro-magnetic fields (EMFs) from an ordinary TV set (duration: 30, 60 or 210 minutes; distance 50 cm) on the cellular/neuronal populations of the skin of sampled patients (n = 2). In the biopsies taken before provocation, a remarkably high number of somatostatin immunoreactive dendritic cells was found in the dermis, preferentially around the blood vessels and hair follicles as well as in the basal layer of the epidermis. Furthermore, a profound amount of histamine positive mast cells could be detected before the start of the provocation. After provocation, no somatostatin immunoreactive cells at all could be revealed in the patients investigated using the presently employed immunohistochemical method. Regarding the histamine cells, no changes in morphology, number or fluorescence intensity were observed after the provocation, as compared to the pre-provocation state. There were no differences in the substance P, calcitonin gene-related peptide, neurokinin A, galanin, vasoactive intestinal polypeptide, peptide histidine isoleucine amide, neuropeptide tyrosine, methionine-enkephalin, dynorphin, protein S-100, neuron-specific enolase or PGP 9.5 immunoreactivities before and after the provocation, and the patterns generally looked normal. From these studies, it is evident that certain paramount and profound changes in the dermis and epidermis take place, however, the material still is very small (10).

d) Investigated the presence of mast cells in skin from patients using histamine-based immunohistochemistry (11, 12). From these studies (13; cf. Fig. 1), it

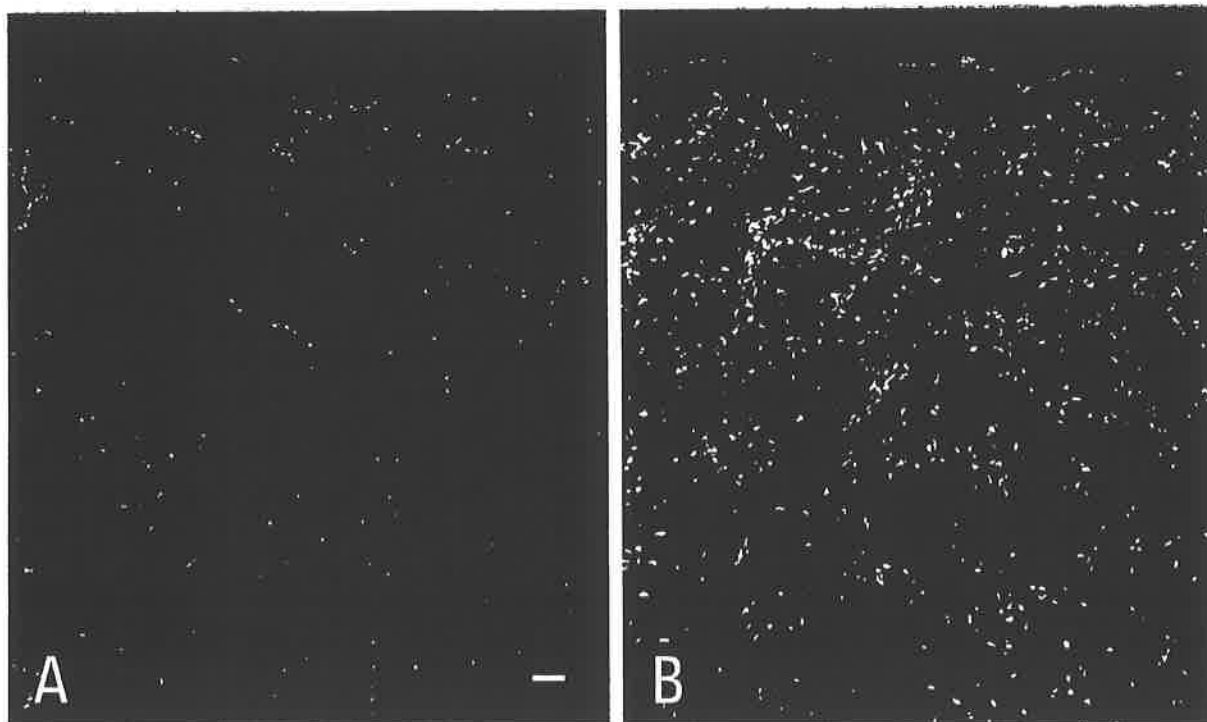


Fig. 1. Immunofluorescence micrographs using histamine antiserum of skin from a normal healthy volunteer (A) and from a screen dermatitis patient (B). Please, note the large difference in distribution and number of the immunoreactive cells. Bar indicates 100 μ m.

is clear that the number of mast cells in the upper dermis is increased in the screen dermatitis patients (n = 15) as compared to normal healthy skin (n = 15). A different pattern of mast cell distribution also occurs in the patient group, namely, the normally empty zone between the dermo-epidermal junction and mid-to-upper dermis has disappeared in the patient group and, instead, this zone has a high density of mast cell infiltration. Finally, in the patient group, the cytoplasmic granules are more densely distributed and more strongly stained than in the control group, and, generally, the size of the infiltrating mast cells is found to be larger in the patient group as well (13).

e) Started to investigate possible stimulus-response couplings, during blind provocations (duration: 60 minutes; distance 30-50 cm) with electric and/or magnetic fields using verbal descriptors (n = 7). The study is in an on-going phase, and therefore only preliminary observations have been made. However, in summary, it is already obvious that several background milieu factors may interfere in such provocation studies.

4. SUMMARY

In summary, it is evident from our preliminary data that major biological changes may be present in the patients suffering from EMF exposure. In view of the recent epidemiological studies pointing to a correlation between long-term exposures from magnetic fields and cancer (14, 15), our data ought to be further analyzed.

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