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A NON-INVASIVE SYSTEM TO ASSESS THE EXHALED BREATH CONTENT IN PATIENTS WITH MULTIPLE CHEMICAL SENSIBILITY DISORDER

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Multiple Chemical Sensitivity (MCS) is a complex disorder initiated by chemical exposure, in particular through the airways. Symptoms could include asthma-like signs, rhinitis, fatigue, cognitive dysfunction, psycho-physiological alteration, and other specific tissue reactions resembling hypoxic and oxidative stress effects. MCS patients report sensitivity or intolerance to low levels of a wide spectrum of chemicals. A biological concentration of oxygen keeps functional the cell enzymatic machinery. However, when hypoxic and oxidative stresses are established, physiological reactions induce multiple changes in the body ventilation, and the cardio-circulatory and psycho-physiological systems. A cumulative result of oxidative damage induced in cells by reactive oxygen species (ROS) derives from aerobic metabolism. Physiological antioxidant defenses maintain ROS at harmless levels preventing damage. Thus, such balance is strictly related to a constant oxygen concentration. When this balance falters, for instance in aging or chronic exposure to pollutants, a reduction in homeostatic adaptation to metabolic requirements occurs, through the activity of such enzymes as endothelial nitric oxide synthase (eNOS). Chronic hypoxia, per se, promotes a remodeling of the structure and function of the cardio-respiratory system, brain, kidney, liver, and muscles. Anyone or all of the elements above outlined may be involved in the generation of the symptoms of MCS.

In order to recognize physiological signs that allow a diagnosis of MCS in a non-invasive way we investigated the potential application of a new sensor system. In healthy volunteers, who provided written informed consent and the procedures were performed in agreement with the Ethical Standards of the Helsinki Declaration, we measured the exhaled breath content in the control condition and under exposure to olfactory stressors that mimic hypoxic or pollutant stressors. The recording system used in this experiments was an iAQ-2000 (AppliedSensor, Warren, NJ) equipped with a metal oxide semiconductor (MOS) having a sensing range of 450-2000 ppm CO2 equivalents, which is able to detect a broad range of volatile organic compounds such as alcohols, aldehydes, aliphatic hydrocarbons, amines, aromatic hydrocarbons, CO, CH4, LPG, ketones, organic acids) while correlating directly with CO2 levels. A Wohler A600 gas analyzer was used to verify the O2 and CO2 measurements done by the iAQ-2000. The exhaled breath was collected into a face mask for the measurements.

Preliminary results indicate that the recording system employed was suitable for the analysis of the breath exhale content in humans. Interestingly, the system was able to detect and discriminate between the exhaled breath content taken from the control condition and those from conditions under stress that mimicked exposures to pollutant and/or hypoxia playing a potential role in the generation of the MCS disorder. The results suggest that chronic hypoxia could be involved in the MCS disorder.