Grounding & human health – a review

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Abstract. Whilst grounding is often undertaken in industry as a matter of good practice in situations where the risk of excess charge exists, little thought is usually given to the biological effects that such measures may have, or possible benefits that may arise from the more widespread application of electrostatic and other ‘electromagnetic hygiene’ measures in hospitals and the general built environment. Research, which is still in its infancy, indicates that grounding the human body using suitable methodologies, particularly in low electromagnetic field environments, can significantly enhance biological functioning. It is proposed that there are often a number of electrostatic and ‘electromagnetic hygiene’ factors that need to be addressed before the beneficial effects of grounding the human body can be fully realised in many everyday environments.

1. Introduction
Though the often dramatic results of electrostatic discharge (ESD) events and ways in which these can be mitigated are well known in industry, the subtler effects that can occur to the human body as a result of the presence of excess charge, and its appropriate mitigation, are seldom documented. Suggestions of possible health benefits that may arise from grounding the body were discussed by White in the late 1920s [1]. This concept was later independently rediscovered by Ober in 1998 [2], with a number of clinical trials being undertaken by others (generally in low field environments) to test his hypothesis on the beneficial effects grounding individuals may have. Whilst the results obtained from such work appear encouraging, and may have far reaching implications related to how environments should be designed to aid performance and wellbeing, there is need for caution.

2. History
White [1] pioneered the scientific concept of grounding humans for health reasons after being informed by some individuals that they could not sleep properly “unless they were on the ground or connected to the ground in some way”. He undertook sleep studies, using beds that had been earthed using copper wire connected to individual grounding points, and reported that individuals appeared to sleep better under such conditions. This concept was not taken up by mainstream medical science, and remained in obscurity to the general medical profession.

Ober developed the concept of grounding the body independently in 1998, after wondering what the effects of individuals being insulated from the ground might have on their health. After conducting experiments on himself, and noting how his sleep appeared improved when being grounded at night, he conducted similar pilot trials on others [2], and then undertook a study with 60 individuals [3]. Some scientists were then intrigued enough by the results of his published research to conduct studies investigating the possible physiological effects of grounding.

In this paper the term ‘biological grounding’ is used to denote the deliberate grounding of the body intended to specifically aid biological functioning.

3. Relevant Scientific Studies
3.1 First Published Study
This was a 30-day trial conducted by Ober [3] investigating the possible benefits to subjects with
sleep problems of being ‘biologically grounded’ (on dissipative carbon-fibre mattress pads connected directly via a ground wire to a ground rod driven into earth) during sleep, as opposed to sleeping on unconnected grounding systems. As with his initial pilot studies, favourable effects were often indicated. In this work, he noted that, in addition to humans often becoming charged with static electricity in standard ungrounded modern environments, they can also be exposed to oscillating electric [and magnetic – present authors’ comment] fields, which can induce weak currents in their bodies that may cause biological effects.

3.2 Cortisol Study
As a result of the above work, Ghaly & Teplitz [4] undertook a pilot study on test-subjects (n = 12) suffering from sleep dysfunction, pain, and stress problems. This work, undertaken in the test-subjects’ own homes, and using a direct grounding system and methods similar to that in the previously mentioned study, investigated how grounding at night might influence the circadian secretion of cortisol, excess production of which is linked with stress, high blood pressure, high blood sugar levels, weakened immune-system functioning and obesity.

Most of the test-group, who had previously exhibited excess night-time cortisol secretions, tended towards idealised circadian secretions of it as a result of grounding. Reduced fatigue too was generally found. Sleeping grounded was also generally indicated as reducing incidence of pain, sleep dysfunction (time to go to sleep, incidence of waking up in the night) and stress.

While generally very favourable results were found, in 1 case a worsening of pain was noted. There was also one case where an increase of fatigue was noted and 1 case where increased stress levels were recorded. Though Ghaly & Teplitz [4] observed that both mains frequency fields and radiowaves could influence the results of parameters being assessed, no direct measurements were taken of these as potential confounders that might have influenced test-subjects’ results.

3.3 Brainwaves and Muscle Tone
Chevalier et al [5] undertook Electroencephalogram (EEG) readings on 58 healthy adults (including 30 controls) in a double-blind study to record the physiological effects of ‘biological grounding’ (clinical earthing utilising conductive adhesive patches on each test-subject’s feet connected via a ground wire to a ground rod driven into earth). Abrupt changes in brainwave patterns were shown in approximately half of those tested - with grounding occurring covertly halfway through the 56-minute test-period - with the right and left hemispheres of the brain of those subjects appearing to go into increased synchronisation with each other. This effect, which was not found in controls, continued during the remainder of the test periods.

Electromyography (EMG) readings (recordings of electrical activity in muscles) were also undertaken, which revealed increases in the electrical potential of skeletal body muscles (and improvement in muscle tone) of all those tested when grounded. This result is consistent with extra electrons (made available through the grounding) making cell membranes less positive, thereby increasing electrical potential and muscle contraction.

3.4 Thermographic Studies
Electrons can behave as anti-oxidants neutralising positively charged free radicals in the body that can otherwise cause inflammation [6]. It appears that ‘biological grounding’ can help remedy the body’s electron deficit and restrict such damage. Assessments of randomly selected outpatients from a clinical treatment centre were undertaken by Amalu [7], using high-resolution medical infrared imaging equipment. In these tests ‘biological grounding’ of the test-subjects was undertaken using either clinical earthing or by their sleeping grounded connected to earth via a ground wire and earthed ground rod. The results he obtained further indicate the benefits of using appropriate ‘biological grounding’ protocols. He stated that it showed great potential for treating both acute and chronic inflammatory medical conditions.

Chronic inflammation is implicated as a potential contributory factor in a number of diseases and ailments including: cardiovascular disease, allergies, Alzheimer’s, anaemia, arthritis, asthma, cancers, chronic pain, diabetes, eczema, intestinal disorders, kidney failures, multiple sclerosis and sleeplessness. It is caused, in part, by overproduction of free radicals. When there is a shortage of free electrons, free radicals often take electrons from normal cells & tissues, thereby exacerbating inflammation problems.
3.5 Dark Field Microscopy of Live Blood
As documented by Ober et al. [2], the effects of ‘biological grounding’ on live blood were assessed by Sinatra (in non peer-reviewed research) using dark field microscopy in 2008 (n = 12). Blood samples were taken both before and 40 minutes after grounding test-subjects, and revealed dramatic differences in their blood viscosity between the two conditions tested, with fewer formations of erythrocytes (red blood cells) associated with clotting and clumping being observed after grounding. Sinatra stated that the results obtained suggest ‘biological grounding’ could prove particularly beneficial for those with diabetes or cardiovascular problems.

4. Potential Confounders
4.1 Grounding/Earthing Conditions
Whilst grounding via the mains to reduce excess charge is often undertaken to prevent ESD, and is advocated by many companies selling equipment for ‘biological grounding’, its suitability for the latter has yet to be properly assessed. Grounding in this way may increase exposure to the high frequency transients and mains frequency harmonics sometimes carried on modern mains electricity and created by various electrical items. Indirect evidence of this risk indicates that for some people exposure to such transients when carried on mains electricity may increase incidences of a number of health complaints [8]. In situations where such conditions exist, it is proposed that grounding through the earth connection in the mains might further exacerbate health problems. As mentioned by Chevalier et al [5], the possibility also exists that fields from electrical wiring in rooms could create induced body voltages and that ground wires, such as used in the assessments they undertook, might act as antennae for stray electric fields unless suitable ‘electromagnetic hygiene’ precautions are taken.

4.2 Electrosmog
As previously mentioned, dark field microscopy demonstrates that grounding the body appears (in certain situations) to reduce blood viscosity, thereby reducing a major risk factor for strokes and heart attacks which are the leading cause of death for both men and women worldwide. However, exposures to ‘electrosmog’ from different types of commonly encountered electromagnetic field (EMF) regimes may act as potential confounders. Non peer-reviewed research by Havas [9] and others, indicates that whilst exposures to low EMF regimes can also result in reduced blood viscosity, raised field exposures (as can be experienced through exposures from certain types of unshielded electrical items, especially some microwave emitters), may cause clumping of red blood cells similar to that found in cancer patients. It appears that under such circumstances, the cells lose their negative surface charge and become attracted to each other, with this clumping resulting in reduced capillary circulation and oxygen distribution. Whilst the effect of ‘biological grounding’ under such situations has yet to be assessed, it would appear wise to reduce exposures to ‘electrosmog’ wherever practical.

4.3 Small Air Ions and Submicron Particles
Both the potential individuals are charged to, and the electromagnetic character of the microenvironments they occupy, can influence their uptake of small air ions (SAI) and charged and charge-neutralised submicron particles when grounded or ungrounded. Andersen [10] indicated that when individuals are at zero-potential in field-free zones, SAI of both polarities can be inhaled in the proportions that occur naturally in the measured air, and that increased DC potentials alter the proportions and concentrations of each polarity inhaled. We hypothesise that a similar situation would appear to be true with regard to charged submicron particles.

Whilst simulations assessing how a subject’s potential can influence SAI uptake have been undertaken, similar research does not yet appear to have been undertaken for nanoparticles and other charged and charge-neutralised submicron particles. We propose that it is important to do so, especially for particles in the nanoparticle size range, so that accurate predictions of inhaled and retained particle dosage under different charging and grounding regimes can be made. Such measurements and comparisons should also be undertaken to simulate standard situations where fields exist, as these too can influence local concentrations of SAI and submicron contaminants.
and their retention when inhaled.

In situations where individuals are grounded and adjacent to active alternating electric field emitters, they will register voltages approaching zero even if they experience induced charges on parts of their bodies (or are exposed to other types of fields that may also be biologically active). Under such conditions, body-voltage may be low but the current flowing through the body in response to the field is likely to be maximised, unless a better pathway to ground is supplied for it, as electricity always flows to the point of lowest potential. The low body voltage recorded in such situations can give a false sense of security. ‘Biological grounding’ in microenvironments where raised fields exist can cause individuals to experience a concentration of charge on areas of their body, such as their noses, when facing the field source whilst still retaining a net-neutral charge. Such situations can alter the ratio and concentrations of each polarity of SAI and charged submicron particles that they inhale. Additionally, in microenvironments where a high degree of charge exists, subjects will often still be exposed to lower concentrations of SAI and higher concentrations of charged submicron particles (which have been shown to be injurious to health) than would be the case under low field conditions [11]. As a general rule, low field environments should be sought - or created - when seeking to obtain the physiological benefits achievable with this type of grounding.

5. Conclusion
As can be seen by the above, whilst replicating ‘biological grounding’ as found in Nature holds great promise as a novel means of improving and maintaining human health (and also for helping revolutionise the design of the built environment), there is need for caution.

In instances where the comments of its critics are properly addressed, its proven potential can be refined and cost-effectively applied in many types of environment to provide the opportunity to help increase general wellbeing whilst reducing the likelihood, severity and incidence of a number of serious ailments.

Many of the concepts discussed can now be easily applied in hospital and general building design. ‘Biological grounding’ measures, alongside ESD prevention and other best practice ‘electromagnetic hygiene’ measures, have important roles to play in making the built environment safer, more biologically friendly and truly sustainable.

References
[1] White G S 1929 Finer forces of nature in diagnosis and therapy, Phillips Printing Company, USA.
[2] Ober C, Sinatra T and Zucker M 2010 Earthing: The most important health discovery ever?, Basic Health Publications, Inc., California, 260 pp.
[3] Ober C 2000 Grounding the human body to neutralize bioelectrical stress from static electricity and EMFs, ESD Journal, January 2000, http://www.esdjournal.com/articles/cober/ground.htm
[4] Ghaly M and Teplitz D 2004 The biological effects of grounding the human body during sleep, as measured by cortisol levels and subjective reporting of sleep, pain and stress, The Journal of Alternative and Complementary Medicine. 10, pp. 767-776.
[5] Chevalier G, Mori K and Oschman J L 2007 The effect of earthing (grounding) on human physiology, European Biology and Bioelectromagnetics, 1, pp. 600-621.
[6] Oschman J L 2009, Energy Medicine: Charge transfer in the living matrix, Journal of Bodywork and Movement Therapies. 13, pp. 215–228.
[7] Amalu W 2004 Medical Thermography: Case studies. Clinical earthing application in 20 case studies. International Academy of Clinical Thermography, Internet article.
[8] Havas M and Olstad A (2008) Power quality affects teacher wellbeing and student behavior in three Minnesota Schools, Science of the Total Environment, 402(2-3), pp.157-162.
[9] Havas M 2009 Live blood analysis & electrosmog, http://www.magdahavas.com
[10] Andersen I 1965, The influence of electric fields on the uptake of light gas ions of a model of man. International Journal of Biometeorology. 9, pp. 149–160.
[11] Jamieson I A, Holdstock P, ApSimon H M and Bell J N B 2010, Building Health: The need for electromagnetic hygiene?, IOP Conference Series: Earth and Environmental Sciences.

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