

Biomechanical damage induced by 1800 mhz electromagnetic field in skin: protective effect of Vitamin D

Burcu Demirbağ¹, Erkin Özdemir², Kezban Kibar¹, Coşar Uzun², Savaş Aktaş¹, Fatma Söğüt², Yılmaz Demir², Ayşegül Akar³, Ölkü Çömelekoğlu²

¹Mersin University, Faculty of Medicine, Department of Histology and Embryology, Mersin, Turkey

Email: purci89@hotmail.com, kezban.kibar@yahoo.com, saktas@mersin.edu.tr

²Mersin University, Faculty of Medicine, Department of Biophysics, Mersin, Turkey

Email: cosaruzun@gmail.com, erkinozdemir33@hotmail.com, yilmazdemir1903@gmail.com, ulkucomalekoğlu@mersin.edu.tr

³Mersin University, Health Services Vocational School, Mersin, Turkey; fatmasogut@mersin.edu.tr

⁴Mersin University, Faculty of Pharmacy, Department of Biochemistry, Mersin, Turkey; metinyildirim4@gmail.com, ayalin@mersin.edu.tr

⁵Öndokuz Mayıs University, Faculty of Medicine, Department of Biophysics; Mersin, Turkey; aysegula@omu.edu.tr

Abstract

Objective: Usage of devices, which are working with wireless communication technology, using 1800 MHz radio frequency waves, is increased with improving technology. As a result of this the influence rate of electromagnetic fields (EMF) increased. In this study, we aimed to investigate biomechanical damage induced by 1800 MHz EMF and role of vitamin D in recovering this damage.

Materials and Methods: In the experiments, 28 adult Wistar albino rats are used. Rats divided into 4 groups, each having 7 animals, as G1 (control), G2 (0,02 µg paricalcitol, 3 times in a week for 30 days), G3 (1800 MHz EMF for 1 hour, through 30 days), and G4 (1800 MHz EMF for 1 hour, through 30 days and 0,02 µg paricalcitol, 3 times in a week for 30 days). Specific absorption rate (SAR) is calculated as 0,048 W/kg. For biomechanical evaluation tensile test was applied on skin samples of all groups and values of breaking force, displacement, energy, stress, strain and toughness are calculated. In histological investigation, thickness of epidermis, count of leucocyte and mast cell are evaluated.

Results: In biomechanical evaluation while breaking force and stress in group G3 significantly decreased compared to G1 ($p<0,05$), there was no significant changes in energy, displacement and strain values compared to control. Stress, strain and toughness increased significantly in paricalcitol treated groups, G2 and G4, compared to control and G3 ($p<0,05$). No significant difference was found in epidermis thickness and leucocyte count. However, mast cell count of G3 group increased significantly compared to all other groups ($p<0,05$).

Conclusion: In this study, it is thought that 1800 MHz EMF impairs the quality of skin by triggering inflammation in skin. However, it is observed that using EMF together with paricalcitol, an analogue of vitamin D, might be eliminated this effect.

Keywords: Antioxidant, electromagnetic field, paricalcitol, skin biomechanics.