Official Journal of TESMA
Regenerative Research
www.regres.tesma.org.my
E-ISSN 2232-0822
Tissue Engineering and Regenerative Medicine Society of Malaysia

Regenerative Research 7(1) 2018 98

INFLUENCE OF FREEZING TEMPERATURE ON THE BIOMECHANICAL PROPERTIES OF IRRADIATED FROZEN ALLOGRAFTS

Harmony TCY, A Mansor, Norimah Yusof*

ARTICLE INFO

Published: 26th August 2018
*Corresponding author: Norimah Yusof
Email: nynorimah1@um.edu.my

KEYWORDS

Mesenchymal stem cell;
TRAIL;
Apoptosis;
Cancer stem cell;
Lung cancer

SUMMARY

Concerns regarding the undesired adverse effects of gamma irradiation on the biomechanical properties of cortical bone allografts are omnipresent. However, available literature mentioning these effects had conflicting conclusions, especially pertaining to the effects of temperature *during* irradiation. The purpose of this study was therefore to examine the influence of freezing temperatures during gamma irradiation on the biomechanical properties of human cortical allografts. Five human cadaveric femoral midshafts were cut into cubes measuring $4mm^3$, with each assigned to one of 3 experimental groups. The first group was subjected to gamma irradiation at temperatures below -40°C (RD group), the recommended long-term storage temperature for bone allografts. The second group was subjected to irradiation within a temperature range of -40°C to 0°C (RG group). The Control group did not receive irradiation treatment. Irradiation dosage was set at 25-35kGy. All samples were subsequently subjected to compressive load to failure to determine their biomechanical properties. Allografts irradiated at a higher freezing temperature range (RG group) were observed to have significantly lower yield point, ultimate tensile strength, resilience and toughness in comparison to those which were not irradiated (Control) and those irradiated at deep freezing temperatures (RD group). The above four parameters of the Control and RD group samples were comparable. No difference in Young's modulus was observed in all three groups. The results suggest irradiation at deep freezing temperatures confers protection to the biomechanical properties of cortical femoral allografts. This may have resulted from the immobilization of water molecules when deep frozen; with its inability to participate in the formation of free radicals via its radiolysis in the frozen state, the deleterious effects of radiation on collagen architecture are hence attenuated. The apparent loss of this protective effect when a higher temperature range was employed during irradiation substantiates this theory.