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Morphological Analysis of Micro Computed Tomography (micro-CT) Images of Human Tendon Tissue Sterilized by Ionizing Radiation

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There is a growing interest in the advancement of less invasive surgical techniques, especially in tendon and ligament reconstructions, which has driven research into the use of allografts sterilized by ionizing radiation. The use of these allografts eliminates the need for a second surgical approach to remove autologous grafts, reducing post-operative morbidity, surgical time and the risk of infections. The application of this technique as a final sterilization method is safe and leaves no residue, promoting reliability and effectiveness in the procedures. This approach is assisting medical practice by ensuring high levels of safety and success in interventions, further encouraging the development and adoption of more reliable approaches in orthopedic surgery. The present study aimed to evaluate the effects of applying ionizing radiation, produced by a Co-60 source, on pre-processed human tendon samples, kept at temperatures of -80 °C from multi-organ donors, obtained through collaboration with Tissue Banks. The doses applied in radiation processing were 12.5 kGy, 15.0 kGy and 27.5 kGy, with their respective non-irradiated control. The samples were evaluated using Micro Computed Tomography (micro-CT) and the results were compared with previous histological, optical and biomechanical tests, with the aim of analyzing possible morphological and structural changes. Analyzing the images generated by the micro-CT confirmed the data previously obtained by the same group, where it was possible to observe a slight structural modification at the dose of 12.5 kGy, corroborating the data obtained in the biomechanical tests. Based on the analyses, we can conclude that the samples irradiated at 15.0 and 27.5 kGy presented characteristics similar to the non-irradiated control. This study contributes significantly to the understanding of the effects of ionizing radiation on human tendon allografts, highlighting the importance of an adequate dose to preserve the structural and biomechanical properties essential for the success of surgical reconstructions.