Development of a Novel Bolus Material for Radiotherapy Applications

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The aim of radiotherapy is to protect the surrounding healthy tissues and organs while giving the maximum radiation dose to the tumor tissue. In the treatment of tumors close to the skin, materials called boluses are placed on the surface to be irradiated, increasing the skin protection effect of the radiation and allowing the planned dose to be adjusted with high precision. The bolus must be tissue equivalent, non-toxic, have a mass density close to 1 g/cm3, and an electron density close to 1. Our project aims to produce an organic, recyclable, locally manufactured bolus that can be used during radiotherapy. The objective is to make the material produced be prepared easily, be tissue equivalent, biocompatible, individually applicable and low cost. Hydrogels containing agarose, a natural polysaccharide, and different concentrations of antifungals were used. Molds to pour bolus into, were printed at different depths using ABS and PLA filaments in a 3D printer. The density and homogeneity of bolus materials prepared in various thicknesses were determined by scans done on a computerized tomography (CT) device. In the results obtained, it was determined that boluses were homogeneous, the density was 1 g/cm3, and there was no air gap at any point. Radiation characteristics of boluses and RW3 solid water phantom were compared by irradiating 6 MeV electrons and 6 MV photons in a linear accelerator. The measurements made determined that the boluses produced showed similar properties to the RW3. The boluses we produced are safe and suitable for use. The personalized and biocompatible boluses are thermo-reversable. The use of a domestically produced, natural, easily available, fast and easy-to-produce, low-cost bolus in this area will contribute to the health sector.

Awards Won:
The Scientific and Technological Research Council of Türkiye TUBITAK: 1st Prize Award