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The radiobiology of proton therapy: Accelerator and laser-based approaches.

Abstract: Proton Therapy is going through a period of rapid expansion due to its clinical utility related to the favourable dose deposition pattern delivered by the Bragg peak. Despite this, it is becoming increasingly clear that changes in relative biological effectiveness (RBE) towards the end of the particle range are significant and have clinical implications. Recent radiobiological studies have shown that RBE is related not only to the physics of the beam but underlying biological mechanisms related to DNA repair which have implications for precision medicine approaches. To date clinical facilities use particle accelerator based approaches for beam delivery. Laser-accelerated proton beams have been developed by several groups and have the potential to produce beams at clinical energies. These beams however, produce protons at considerably higher dose-rates than conventional accelerators and further work is need to understand the impact of this on biological and potential clinical response.