



Proton Minibeam Radiation Therapy

VISION

Complete Therapeutic Lights
Uncomplicated Cancer Cure

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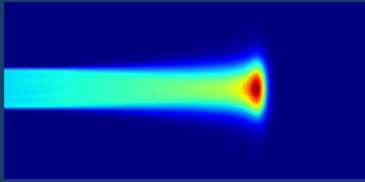
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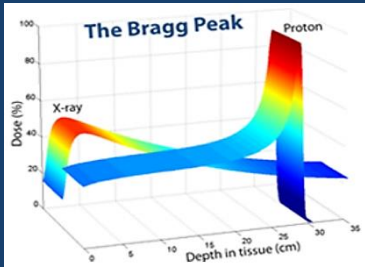
Proton Therapy

➤ Bragg Peak (BP)

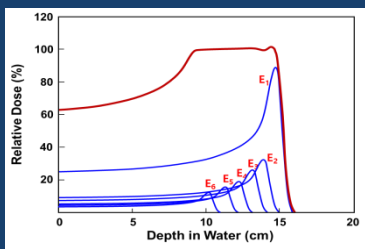
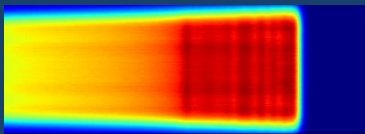
- Proton Bragg Peak



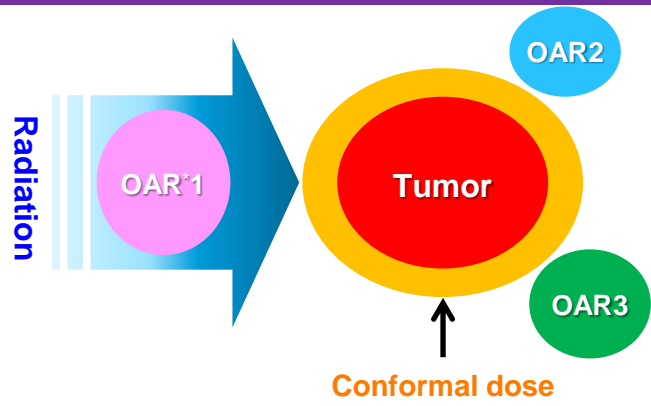
- Proton vs. X-ray



➤ Spread-out BP



Scheme of EBRT



Radiation Toxicity on Beam Pass

1. Permanent Hair Loss

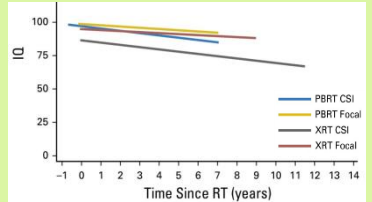


2. Skin Damage



3. Change in Intellectual Ability

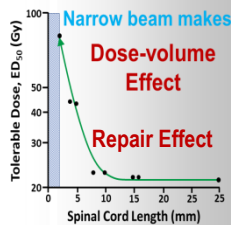
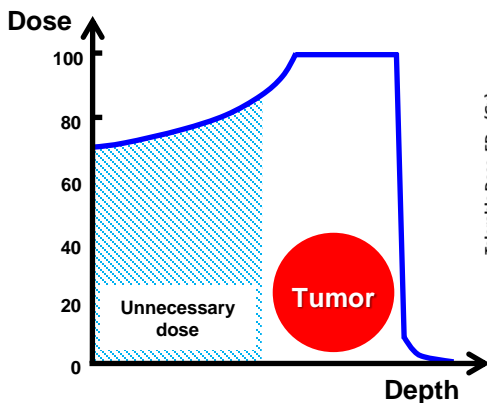
- Decline in language ability
- Regression of IQ* (Intelligence quotient)



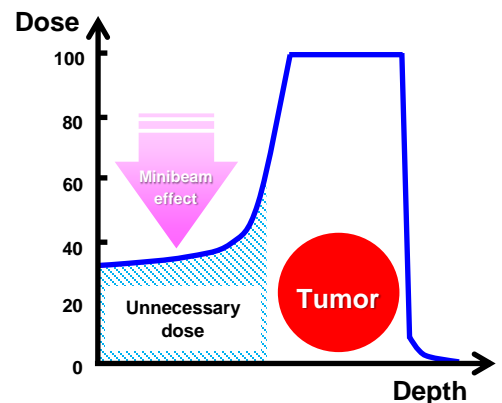
*J Clin Oncol. 2016 Apr 1;34(10):1043-9

Coventional PT vs. Proton Minibeam RT

• Conven. Proton Therapy



• Proton Minibeam Therapy



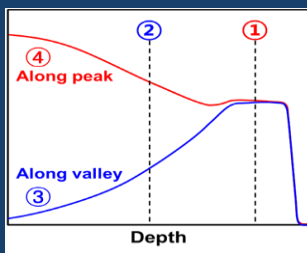
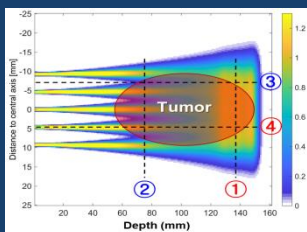
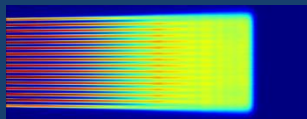
Proton Minibeam Radiation Therapy

Proton Minibeam

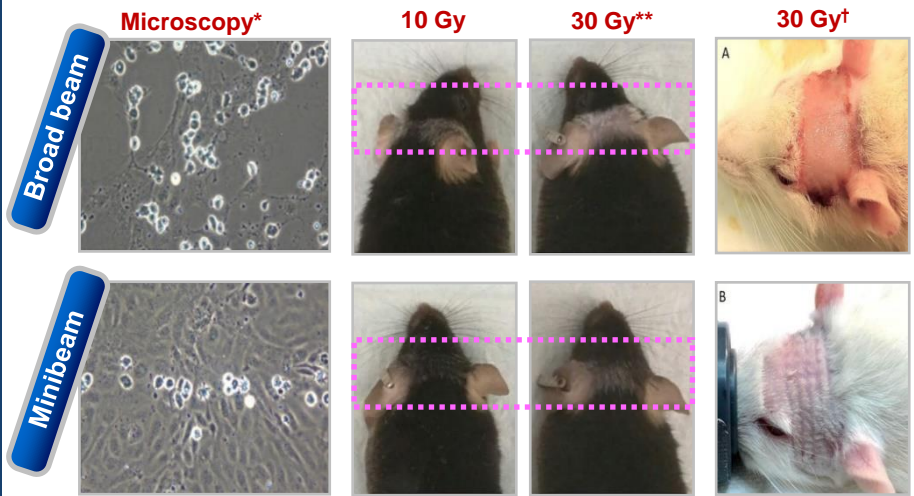
- Generation (Slit collim.)



Dose Distributions



Biological Evidence of pMBRT

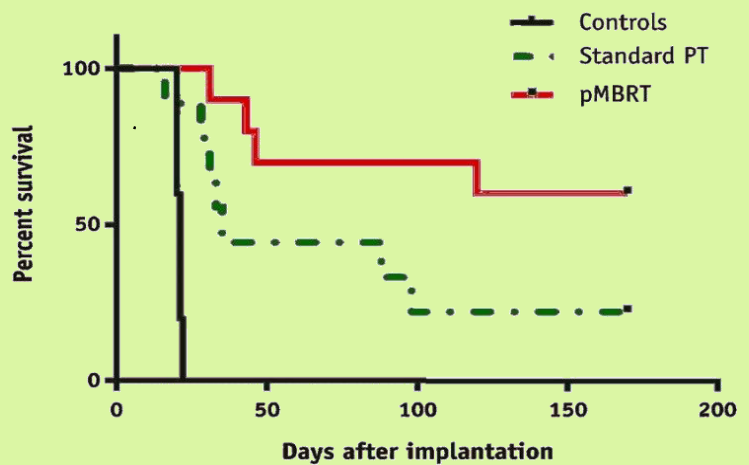


*F Avraham et al. Tissue-sparing effect of x-ray microplanar beams particularly in the CNS: Is a bystander effect involved, Experimental Hematology, 2007;35: 69-77

**J Eley et al. Pilot study of neurologic toxicity in mice after proton minibeam therapy, Sci Rep, 2020;10:11368

†A Bertho et al. First Evaluation of Temporal and Spatial Fractionation in Proton Minibeam Radiation Therapy of Glioma-Bearing Rats, Cancers, 2021;13:4865

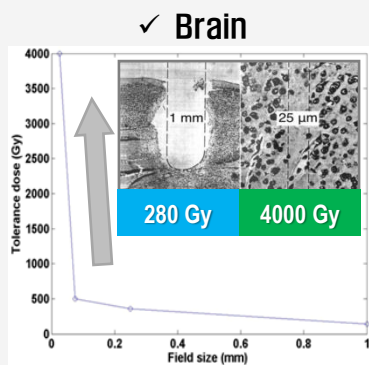
Comparison of Survival (Mouse)



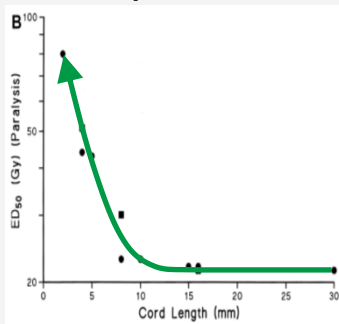
Int J Radiat Oncol Biol Phys. 2019 Jun 1;104(2):266-271

Organ Sparing Mechanism

• Dose-Volume Effect*

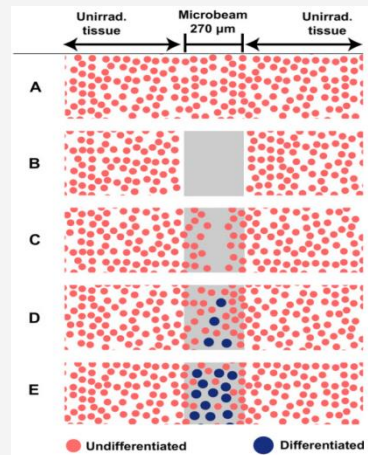


✓ Spinal cord



✓ *The smaller the field size is, the higher the tolerance.*

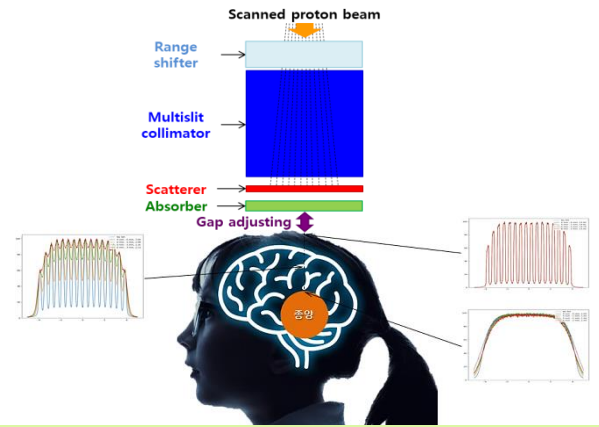
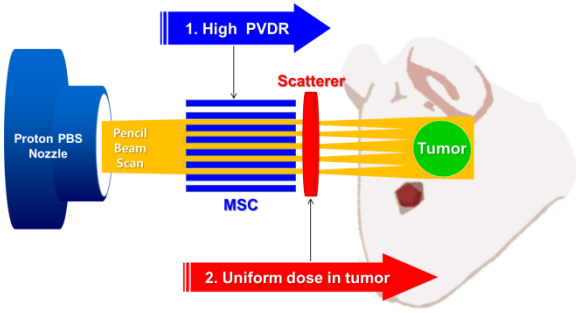
• Repair Effect**



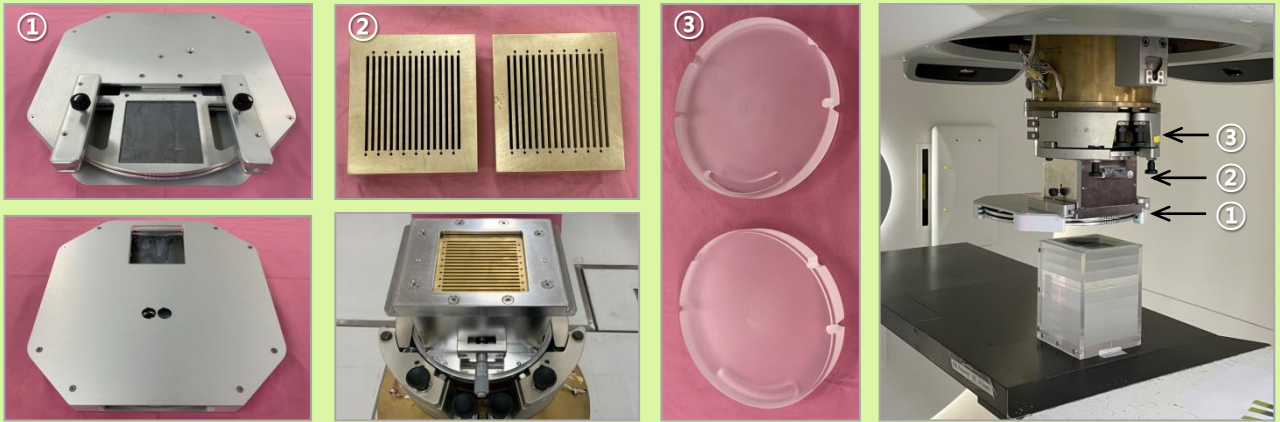
*JW Hopewell, K.R. Trott, Volume effects in radiobiology as applied to radiotherapy, Radiotherapy and Oncology 2000;56:283-288

**F Avraham et al. Tissue-sparing effect of x-ray microplanar beams particularly in the CNS: Is a bystander effect involved?, Experimental Hematology, 2007;35:69-77

● Principle of RaphaRAD's System

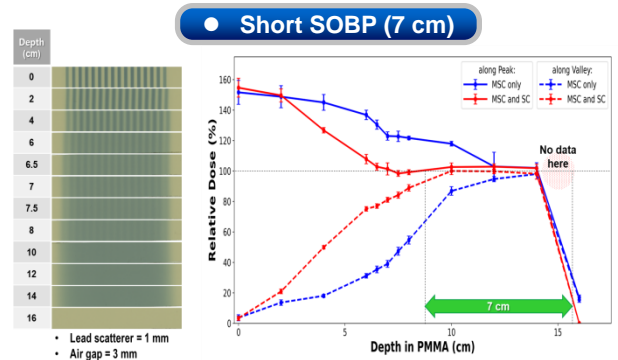
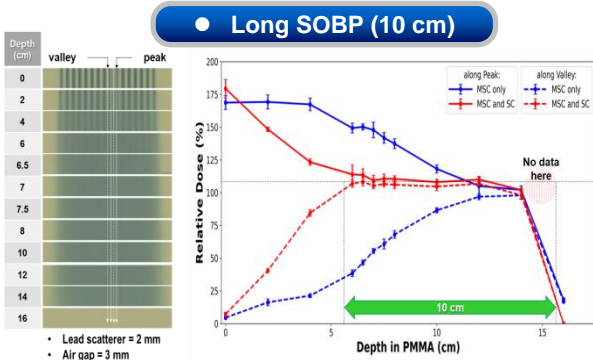


● Main Components of pMBRT

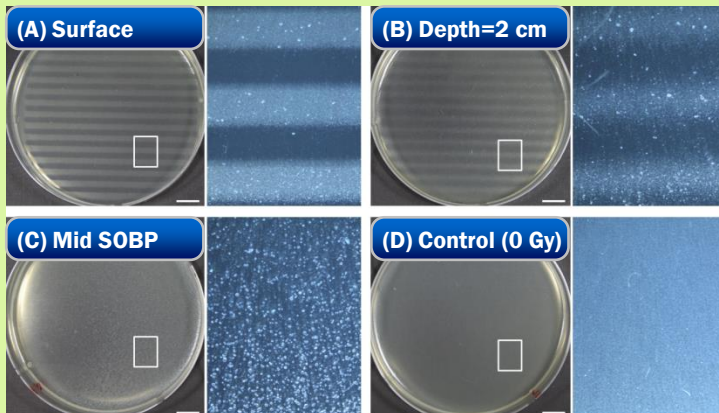


① & ② Longitudinal & Transverse beam modulators (Scatterer & MSC) ③ Range shifter ④ 2nd particle absorber ⑤ Mounting system (SNOUT) ⑥ Dose calculation engine

● Depth-dose Distributions



● Biological Response



*Scale bars indicate 1 cm.

● Paper Publication

cancers MDPI

Article
Dose Profile Modulation of Proton Minibeam for Clinical Application

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