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QUALITY EDUCATION AND HEALTH SCIENCE FOR PATIENT BENEFIT

Quiz & Solution

Solution: Problem (July 2025/ Volume 7/ Issue 2)

1. A patient has to be treated by a direct 6 MV posterior spinal field of size 6 cm (width) x 48 cm (length) at an extended SSD of 120 cm. The prescribed dose is 1.8 Gy at a depth of 5.5 cm.

Data (output at d_{max} for 100 cm SSD, TMR) are given in the tables below. Using ONLY the data given in the tables, find out the treatment MUs.

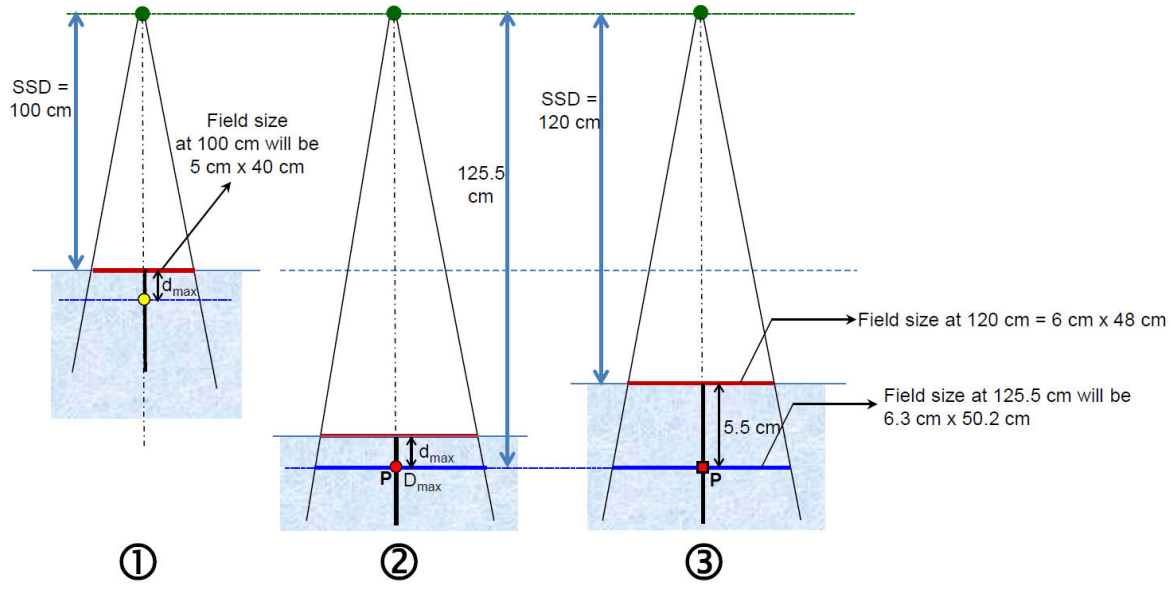
Note: For equivalent square field, use the formula: Side of the square = 4(area/perimeter)*

6 MV photons - Output at the depth (d_{max}) of dose maximum (SSD = 100 cm) *[Output (cGy/100 MU) is given at a depth of 1.5 cm in phantom, i.e. at a distance of 101.5 cm from the source]*									
Equivalent square side *(cm)* →	**7**	**7.5**	**8**	**8.5**	**9**	**9.5**	**10**	**10.5**	**11**
cGy/100 MU →	96.3	97.0	97.6	98.2	98.7	99.4	100.0	100.4	100.8

6 MV photons - TMR data for selected field sizes									
Depth *(cm)*	**Equivalent square field size** *(cm x cm)*								
	6x6	**7x7**	**8x8**	**9x9**	**10x10**	**11x11**	**12x12**	**13x13**	**14x14**

4.0	0.944	0.949	0.951	0.952	0.953	0.954	0.954	0.955	0.957
4.5	0.928	0.931	0.934	0.935	0.936	0.937	0.938	0.940	0.942
5.0	0.912	0.914	0.916	0.918	0.919	0.921	0.922	0.925	0.927
5.5	0.895	0.898	0.901	0.903	0.906	0.908	0.911	0.914	0.917
6.0	0.878	0.883	0.886	0.889	0.892	0.896	0.899	0.903	0.906

Solution:



Please see Figs 1, 2 and 3
Field size at the extended SSD 120 cm = 6 cm x 48 cm
Field size at the treatment depth of 5.5 cm *(i.e. at 125.5 cm from source)* = 6.3 cm x 50.2 cm
Field size at the nominal SSD 100 cm = 5 cm x 40 cm

To use TMR data, the relevant geometry is Fig 2 and 3. The ratio of dose at the treatment depth of 5.5 cm to the dose at the same point with only d_{max} thickness of overlying tissue (i.e., the dose at red square in Fig 3 to the dose at the red circle in Fig 2) is the TMR for the field size of 6.3 cm x 50.2 cm. The equivalent square is 11.2 cm x 11.2 cm. The TMR (11.2 cm, 5.5 cm) = 0.9086.

To know the output at point P (the red circle) in Fig 2, we need to know the output at the d_{max} depth (yellow circle) in Fig 1.
Output for the field size of 5 cm x 40 cm (eq. sq = 8.9 cm) at 100 cm SSD = 98.6 cGy/100 MUs
Applying inverse square law, 98.6 cGy/100 MU * $(101.5^2/125.5^2) \approx$ 64.5 cGy/100 MUs at P (red circle)

The dose rate at the treatment depth (red square in Fig 3) = 64.5 cGy/100 MUs * 0.9086
= 58.6 cGy/100 MUs

To deliver a dose 180 cGy the required MUs = 100 MU/58.6 cGy * 180 cGy = 307 MUs