Intensity modulated radiation therapy (IMRT) is superior to conventional 3D in paraspinal sites where the planning target volume (PTV) surrounds the spinal cord and a steep dose gradient is required between the PTV and the organ at risk (OAR). The gradient achieved is affected by the MLC penumbra, and by many planning and optimization parameters, such as beam arrangement, intensity profile smoothing method and spatial distribution of structure points used for optimization. The purpose of this study was to characterize the effect of planning and optimization parameters on IMRT dose distributions and to determine which parameters lead to the steepest dose gradient. A cylindrical phantom enclosing a circular OAR and a ring-shaped PTV was used to study the improvements afforded by increasing the number of fields and using "shell" structures in the PTV-OAR interface region for the optimization. The best technique leading to a steep dose gradient and acceptable OAR and PTV maximum doses was applied to a clinical paraspinal case. The results indicate that a beam angular increment of 20° or less is necessary to achieve a PTV dose uniformity of 120% and an OAR maximum dose of 30%. Optimizing with a PTV "surface rind" at the interface with the OAR allows the best dose constraints to be found quickly and the dose gradient to be maximized. Depending on the techniques and parameters used, a dose gradient of 11%/mm, similar to the physical penumbra of the MLC, is achievable.