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Research of beam position avoiding critical organ in voxel space

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INTRODUCTION

There are many critical organs in head, e.g. brain stem, eyeball. During radiation trea tment, there is some possibility they can be slightly or severely damaged. Of course man y commercial RTP softwares provide sufficient optimization method, but it greatly depend s on the physicist operates it. In this paper, an explicit research was performed about the beam position (gantry, couch angle) avoiding critical organ as below.

METHOD

With simplified patient model composed of several spheres and cylindrical tumor, suc cessive contour slices were obtained and from these slices voxel space was constructed.

Using a radiological path calculation technique, beam's profile was searched and it is judged whether the beam intersects critical organ contour. The critical organ has a differ ent density number compared with other contour, and density sum along beam profile wo uld be different if a beam passes it. The incidence position of beam is uniformly or rand omly determined by the gantry and couch angle. It is assumed that the beam is pencil-lik e.

RESULTS

By above method, the arc range (gantry, couch angle) intersecting critical organ was obtained. Resultant arc range shows good agreement with analytic solution when voxel si ze was small. But, as the voxel size becomes larger, the deviation tends to be large.

DISCUSSION

It was very time consuming process because it searches every-direction. If whole proc ess is based on polygon or contour space and adopts ray-tracing technique in computer g raphics, the processing time would be greatly improved.

It is worth of prior study of more complicated and difficult case in the real applicati on.

CONCLUSION

It shows the possibility of another dose optimization technique. That is, if physicist pl ans radiation treatment planning within resultant beam position, the radiation to critical or gan will be minimal, so it is a sort of optimization.