

AbstractID: 5085 Title: The influence of field length, pitch, and modulation factor on the quality of helical tomotherapy plans

Purpose: The planning process for helical tomotherapy plans is governed by three basic planning parameters: field length, pitch ratio, and modulation factor. The purpose of this work is to evaluate the influence of each parameter on the achievable plan.

Method and Materials: Using commercial treatment planning software (TomoTherapy, Inc.) the same head and neck case was re-planned by the same person using different planning parameters. The standard settings (field length of 25 mm, pitch of 0.287 and modulation factor of 2.5) were used to generate a baseline plan. Using the standard settings for two parameters the third parameter was varied for different plans. Three field lengths (10, 25, 50 mm), four pitch ratios (0.2, 0.287, 0.5, 1) and seven modulation factors were used (1.5, 2, 2.5, 4, 6, 8, 10). The plans were evaluated in terms of treatment time, target coverage, conformity, and sensitive structure sparing.

Results: Increasing the pitch ratio leads to an increase in the volume of unspecified tissues that receives prescription dose (less conformal plans) and an increase in the dose to sensitive structures. The treatment time did not significantly reduce with increasing pitch (there are fewer gantry rotation but the gantry rotation period increases). Similarly, an increased modulation reduces the dose to unspecified tissue and sensitive structures. However the cost is an increased treatment time. Using a larger field length increases the dose to unspecified tissue and sensitive structures while reducing the treatment time. All plans achieved acceptable target coverage and homogeneity.

Conclusions: Changing the planning parameters mainly affects plan conformity. It appears that with respect to our standard settings a slight reduction of the pitch or a slight increase in the modulation factor should improve plan quality with a modest increase in treatment time.

Conflict of interest: One co-author is employed by TomoTherapy, Inc.