

**Purpose:**

Dose painting is useful in prescribing dose based on the biological information and in correcting the hot/cold spot from previously delivered fractions in adaptive therapy. The feasibility of planning and delivering of voxel-based dose painting plan in TomoTherapy system using a complementary dose approach is studied.

**Methods:**

The current intensity modulated radiotherapy (IMRT) treatment planning aiming at uniform target coverage, is not readily adaptable to dose painting that requires voxel-based prescription. TomoTherapy Optimizer is modified to read a complementary dose from disk. The complementary dose converts the voxel based prescription into the uniform target coverage. Four dose painting plans are created on a phantom for evaluation. The plans are delivered to the phantom with film measurement to verify the deliverability and accuracy.

**Results:**

The conformity of plans to prescriptions is found to be exceptional. The difference between 1% volume and 99% volume for quality volume histogram (Q1-Q99) is around 0.017 for simple plans and 0.1 for complex plans. Since the prescription become a uniform target prescription with complementary dose, the conformity index for the combined dose can be evaluated with conventional metrics. The D1-D99 is around 1Gy for simple plan and 5.5Gy for complex plan with combined prescribed dose at 80Gy. Although the dose paint plan prescribes maximum dose of 80Gy, the delivery time for most plan is almost the same as the plan with uniform 60Gy prescription. The dose painting plans are delivered to a phantom with TomoTherapy system and the film measured dose showed excellent agreement with planned dose.

**Conclusions:**

This study shows the TomoTherapy system is capable of creating and delivery voxel based dose painting plan accurately.

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The authors are current and former employees of TomoTherapy Inc.