

For the first time we can define targets in 3D space, set normal tissue dose constraints and instruct computers to generate treatment plans and use outcomes to justify the investment in this technology. At UCSF forward and inverse planned Segmental Multi-leaf Collimation (SMLC) and Sequential Tomotherapy (ST) types of IMRT have been the studied in detail.

The majority of prostate cancer patients treated with IMRT at UCSF have been treated using a technique originally called "Static Field Intensity Modulated Radiotherapy" (SF-IMRT). Based on conventions proposed by the NCI IMRT working group, SF-IMRT is now considered a type of SMLC IMRT. As used at UCSF, SF-IMRT is equivalent to "Forward Planned SMLC IMRT (F-SMLC)". At UCSF, F-SMLC IMRT (or SF-IMRT) evolved from a previously described six-field three-dimensional Conformal Radiotherapy (SF-3DCRT) technique. In 1996 investigators at UCSF demonstrated the feasibility of selectively intensifying the dose to a single dominant intra-prostatic lesion (DIL). Using F-SMLC and online portal imaging these investigators demonstrated that the entire prostate could be treated at 180 centigrade daily, to a dose exceeding 73.8 Gy, while treating tumor-bearing regions of the prostate simultaneously to 90 Gy. Previous studies conducted at UCSF have shown that MRI / MRS imaging can be used to define regions within the prostate that are high risk for involvement by tumor.

Several hundreds of patients have been treated to doses exceeding 73.8 Gy using F-SMLC. Preliminary assessments suggest that the complication rates have been low. Most remarkable thus far are their observations among patients who received doses well in excess of 82 Gy to portions of the prostate. Forty-three patients were treated with radiation therapy for prostate cancer between 6/92 and 8/98 at UCSF receiving a maximal dose within target volume ($D_{max} \geq 82$ Gy). The median D_{max} for this series was 84.5 Gy (range: 82.0-96.7 Gy). One patient experienced an acute grade 3 GI toxicity. No other grade 3 or greater acute toxicity was observed. The 2-year actuarial rate for freedom from late GU and GI morbidity was 87.7% and 80.8%, respectively. Daily monitoring during treatment using online portal images is now a customary practice at UCSF. The magnitude of set-up error reduced by this approach is sufficient to increase the tumor control probability (TCP) and probably decrease the normal tissue complication probability as well.