Conformal radiation therapy makes use of a three-dimensional anatomical description of the patient, target(s) and normal tissues, and requires optimization of the treatment plan(s) used so that the high dose volume conforms to the shape of the target(s), while minimizing the dose to normal tissues. In recent years, conformal treatment strategies have evolved from the use of multiple shaped fixed fields to various intensity modulated radiation therapy (IMRT) techniques, and optimization of those conformal treatment plans has evolved from the use of 3-D treatment planning techniques ("forward planning") to the use of automated optimization systems ("inverse planning"). In this work, a very general automated optimization system is used to perform quantitative comparisons between various kinds of conformal therapy techniques including static conformal, segmental IMRT (multiple MLC shapes per field) and full IMRT based on generalized checkerboard-type intensity distributions. In addition, optimized IMRT plans are compared against static conformal plans with optimized field shapes generated with an automated dose-based conformal shaping algorithm. These comparisons include plans developed for high dose (> 90 Gy) brain tumor treatments, and parotid-sparing head and neck treatments. This work will also illustrate methods for careful and quantitative comparisons of plans representing different optimization or treatment technologies.

Objectives:

1. Comparisons of Inverse-planned and Forward-planned IMRT plans.
2. Comparisons of optimized conformal plans based on static conformal fields, segmental IMRT, and full (checkerboard intensity distribution) IMRT.
3. Illustration of rigorous plan comparison techniques.
4. Comparisons of various conformal and/or IMRT techniques for high dose brain treatment and sparing of the parotid during treatment for head and neck cancers.