Conclusion: PRT offers high dose conformity to target volumes and steep dose gradients, thus leading to substantial NT sparing at high- and low-dose levels. For small tumors 3D photons were comparable in terms of dose conformity and high dose reduction to NT. Lateral photons resulted in inferior dose distribution with high radiation exposure of clinically relevant NT.

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Dosimetric imrovements following 3-D planning of tangential breast irradiation

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Purpose: To evaluate the dosimetric difference between a simple radiation therapy plan utilizing single contour and a more complex 3-D plan utilizing multiple contours, lung inhomogeniety correction and a dose-based compensator.

Methods: This is a prospective study of the RT plans of 62 patients with early breast cancer. All patients were considered for breast conserving management and treated by conventional tangentianal fields technique. Two plans were generated for each patient. The first RT plan was based on a single contour taken at the central axis and utilized two wedges. The second RT plan was generated by using the 3-D planning system to design a dose-based compensator after lung inhomogeniety correction had been made. The end point of the study was the comparison between the volumes receiving ≥105%, ≥110% of the reference dose as well as the magnitudes of the treated volume maximum dose. Dosimetric improvement produced by the use of 3-D planning was considered of potential clinical value if the volume receiving ≥105% by wedge plan was reduced by at least 50%.

Result:

	Vol. with ≥105% range, median	Vol. with ≥110% range, median	Vol. max. dose range, median
Wedge	3–48, 23	0–18, 3	107–121, 114
Compensator	2–30, 10	0–8, 1	107–124, 112
P Value	<0.0001	<0.0001	<0.0008

The dosimetric improvement in 36 plans (58%) was considered of potential clinical relevance.

Conclusion: Dose-based compensator plans reduced significantly the volumes receiving ≥105%, ≥110% and volume maximum dose.

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Commissioning and clinical use of a micro multi-leaf collimator for conformal radiosurgery

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Objective: The m3 micro multi-leaf collimator, developed by BrainLAB and Varian, has been commissioned and is now being used for conformal stereotactic radiosurgery. Treated targets have so far included brain metastases, an AVM, acoustic neuromas and recurrent glioblastomas.

Method: Clinical commissioning involved measurement of standard characteristics (transmission, leakage, beam penumbra, etc.) as well as the accuracy of field shaping and planned dose delivery in terms of geometric and dosimetric precision. For this purpose a shaped phantom was constructed and irradiated. Multiple Portal VisionTM images were acquired to verify the spatial accuracy of the planned field shaping, 3D image reconstruction and target positioning. A cubic solid water phantom and film was also used to verify the planned and delivered dose distributions. Both tests indicated high dose was delivered with a spatial precision of £1.5 mm. Absolute dosimetry with ionisation chambers and TLDs have shown isocentre dose delivered to an accuracy of ±3.5%.

Results: All treated patients had both standard stereotactic arc and mMLC conformal plans calculated. Unless targets were near-spherical and/or small (£1 cm3) the conformal plans always produced more normal tissue sparing in the >50% dose region. For an elongated acoustic neuroma (volume 0.57 cm3; longest dimension 17 mm, shortest 3 mm), the arc plan required two isocentres and, therefore, lead to dose inhomogeneity within and around the GTV. The mMLC plan, using six non-coplanar fields, provided a much more homogeneous dose distribution.

Conclusion: DVH analysis showed improved normal tissue sparing and homogeneous PTV dose coverage for all the mMLC plans relative to those with arcs.

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A comparative analysis of electronic portal image quality for patients receiving whole pelvic irradiation

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Purpose: To compare image quality using daily electronic portal imaging (EPI), in females receiving whole pelvic irradiation and to determine if there is a difference in image quality when comparing the standard automatic window and levelling (AWL) to a more sophisticated polynomial subtraction technique (PST). And if so are these difference clinically significant.

Method: Eight female patients with early stage cervical or endometrial carcinoma were selected. An objective sensitive algorithm was used and scored by three evaluators with different medical backgrounds. The scoring algorithm which has a clinical basis is adaptive to the specific treatment site and the viewing angle (AP-PA and Laterals). For each view at least 25 images were selected on a random basis. The images were displayed to the observers using AWL, polynomial subtraction and a hybrid technique using erosion (ERT) of field edges to determine the field edges and subsequent implementation of the AWL. A total of 52 images were scored and results analyzed. Additionally, a series of 316 images was scored using PST alone to estimate clinical feasibility.

Results: The mean scores for AWL, PST and ERT were: 3.85, 5.02 and 3.85 respectively. More in-depth comparison of the AWL and PST yields the following results: A higher score was found for PST in 80.8% of the images, while 3.8% received a lower score. Comparison of ERT and PST showed an increase in image quality in 76.9% of the cases and a lower score in 3.8% of the cases. ERT and AWL compared showed little differences the percentage of higher scores (25%) equaled the number of lowerscores. The majority of these images received identical scores (50%). The mean score for anterior images for the clinical assessment was 5.49, while lateral images received a 5.17 mean score. The lowest score (1) was given in 0.8% of the scoring instances.

Conclusion: The image quality increase for PST over the standard display technique (AWL) is highly significant. Moreover, the clinical evaluation showed that the enhancement introduced by the PST was robust and reliable as the image score was consistently high enough to warrant clinical use.

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Impact of new technology on radiation therapy treatment deviations at TSRCC

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Purpose: To report the results of the radiation therapy Quality Assurance Program using a prospective database in a large ambulatory cancer centre.

Methods and Material: Toronto-Sunnybrook Regional Cancer Centre, is the largest Canadian ambulatory radiation therapy center treating over 4000 new cases per year. Since 1988, we have collected treatment deviations using a prospective database.

The goal of the audit was to identify trends, and document if new technology such as Muitileaf Collimator (MLC), and record and verify systems impacted on the number of shielding deviations.

Results: From 1995 to 1997 treatment units equipped with MLC and record and verify systems were introduced. The total number of fractions increased by 40.5% from 54,490 (1995) to 74,022 (1997), however corresponding deviations decreased by 35% from, 0.12% (1995), to 0.06% (1997). This decrease is attributed mainly to 3 out of 10 units equipped with MLC, and 7 out of 10 units equipped with record and verify systems.

Conclusion: MLC and recorded verify systems decrease shielding, wedged and machine set up deviations. New technology introduces new deviations such as data entry. Prospective data collection and monitoring by the Quality Assurance Program at our center has resulted in continuous improvement in quality of service, and evaluation of the impact of new technology.