clinical data were measured by means of a variance analysis approach. The reproducibility of each individual observer / method is computed from the distribution of differences in analysis results between the observers / methods. The accuracy is quantified by the mean differences in analysis with respect to the human expert. Differences unacceptable to both human observers are defined as failures.

Results: The reproducibility of the expert in the analysis of AP pelvic fields was found to be about 0.5 mm translation and 0.5° rotation. Two times larger standard deviations were observed for the trainee and 1.5 times larger for the automatic analysis. The automatic analysis failed for 4% of the AP images. For lateral images, both human observers have a reproducibility of 1 mm and 1°. The automatic analysis has a two times larger standard deviation in rotation. MTT filtering yields 30% failures on lateral images, MMA 10% failures. Failures have, however, decreased in time probably due to increasing experience in delineating simulator features (Fig. 1). The accuracy of all observers was within 1 SD.

Conclusions: Automatic analysis is accurate for both AP and lateral pelvic fields and the reproducibility is comparable to that of human observers. The automatic method shows less failures for AP fields than for lateral fields. For lateral images, MMA filtering causes less failures than MTT filtering.

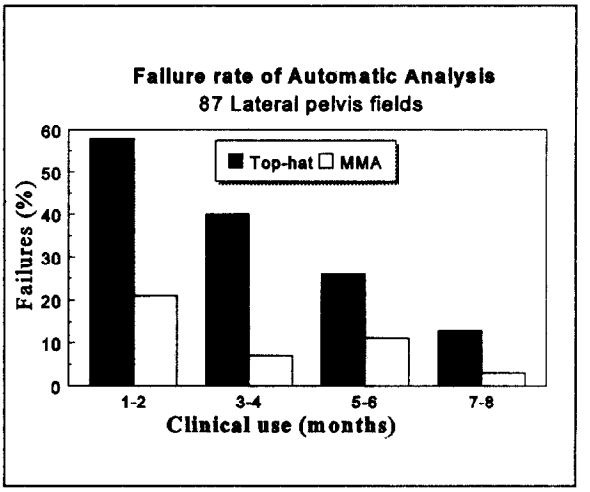

Figure 1

132

SET-UP ACCURACY FOR PELVIC FIELDS AFTER APPLICATION OF A 3-D CORRECTION PROCEDURE USING DIGITAL PORTAL IMAGING

Vos PH[1], Bel A[2], Poortmans PMP[1], Vlaun V[1], Rodrigus, PTR[1], Lebesque JV[2]

Dr. Bernard Verbeeten Institute, Tilburg, The Netherlands [1], Radiotherapy Department, The Netherlands Cancer Institute, Amsterdam, The Netherlands [2]

PURPOSE: To perform a retrospective analysis of the difference between the planned and the actual isocentre for pelvic fields and to evaluate a 3-D method for correction of systematic set-up deviations.

MATERIALS & METHODS: 32 patients with prostate carcinoma were treated with a 4-field box-technique for 35 fractions. Digital portal imaging was performed in the anterior and left lateral fields for 6-10 fractions in the first two weeks of the treatment and once a week in the remaining 5 weeks. In total 329 combinations of images were obtained. The absolute 3-D displacement of the isocentre (D_{iso}) was computed for each set of images.
Set-ups were corrected retrospectively, according to a 3-D extension of the 1-D model, described by Bel*. Only translational errors were considered. The average value of D_{iso} for the first n fractions (n=1 to 4) was compared to an action level based on the distributions of the set-up errors. The action levels were 10, 7.8, 5.6 and 5 mm for the first 4 fractions respectively. A correction was applied if the average value of D_{iso} over the last n fractions exceeded the action level and the procedure started again. If after 4 images no correction was required the procedure was applied using an average of D_{iso} over the last 4 images in combination with the last action level (5 mm) for the rest of the fractions. Only corrections more than 2 mm were applied.

RESULTS: Σ: SD of distribution of individual systematic set-up errors, σ: SD of distribution of day-to-day variation.
Translation directions: x (medio-lateral), y (cranio-caudal), z (ventro-dorsal).

	no correction [mm]			*incl. correction [mm]*		*fraction with first correction decision [% of fractions]*	*nb. of corrections required for correction of first syst.dev. [% of patients]*	*total number of corrections/patient [% of patients]*	*% fractions with D_{iso}> 10 mm [% of fractions]*
	Σ	σ		Σ	σ				
x	2.4	2.4	x	1.5	2.7	1 in 6.3%	0 in 43.8% [47.3%]*	0 in 28.1%	no correction: 10.4%
y	3.3	2.5	y	1.3	2.7	2 in 12.5%	1 in 50.0% [38.9%]*	1 in 40.6%	incl. correction: 2.7%
z	3.4	2.1	z	1.5	2.5	3 in 9.4%	2 in 6.3% [9.9%]*	2 in 25.0%	after first corr.:1.4%
						4 in 28.1%	3 in 0.0% [2.7%]*	3 in 6.3%	
						>4 in 6.3%	>3 in 0.0% [1.2%]*	>3 in 0.0%	

(* percentages expected for distributions with Σ=3.0 mm and σ=2.5 mm). The results show a significant ($p<0.005$) reduction of the standard deviations of the individual systematic errors. The reduction of the large deviations (D_{iso}>10 mm) is in good agreement with the theoretical calculations. The number of corrections that had to be performed agreed reasonably well with the predicted number of corrections, considering the difference between the actual values for Σ and the values used in the theoretical computation.
In one patient where three corrections were required a change in the position during the course of the treatment was seen; in the second patient with three position corrections the set-up variability was more than normal.

CONCLUSION: Individual systematic set-up deviations can be effectively corrected at an early stage in the treatment with the decision method described. The number of corrections seems an adequate compromise between set-up accuracy and the workload for radiographers.

* Bel et al., Radiotherapy and Oncology 29 (1993) 253-260