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Effects of EZFluence planning software on dosimetric parameter compliance for early-stage breast cancer

Introduction

Breast cancer is the most common type of cancer for the female population with 1 in every 8 women developing the disease over the course of their lifetime and over a half million deaths worldwide each year from the disease (Brentall et al. 2018). Due to the prevalence of the disease, new treatment options are being studied rigorously.

Automated planning software such as EZFluence, have helped the 3D field in field (FiF) breast treatment planning process become faster and more streamlined. Is there a cost to the quality of the treatment plans created using the automated method? This study aimed to take a quantitative look at breast cancer plans and common dose constraints of interest when planned manually using field in field technique and planned automatically utilizing EZFluence software.

Methods

The patients chosen for this study were the first 27 patients treated for breast cancer after acquiring ClearCheck software, both the original 3D FiF planner and the EZFluence plans used the same 27 patients. The patients were all prescribed a hypofractionated treatment regimen of 266cGy daily for 16 treatments to a total dose of 4256cGy. No boost treatments were included in the study.

The original planner used a mixture of 6x and 16x beams with an average of 4-8 subfields per tangent. The new planners were left to their own discretion regarding whether to use 6x, 16x or a combination of both. The breasts were all planned as FiF treatments and within the EZFluence software, the maximum number of segments is set at 5 with the minimum number of monitor units (MU) set to 8. These guidelines were set by the radiation physicist when the software was installed and for the purpose of continuity in the study, the numbers weren't adjusted while replanning the patients. The prescription called for delivering 95% of the dose to 95% of PTV_WB_EVA for both FiF and EZFluence planning.

After the replanning process was complete, the ClearCheck data was transferred into Microsoft Excel in order to complete further analysis and comparisons.

Results

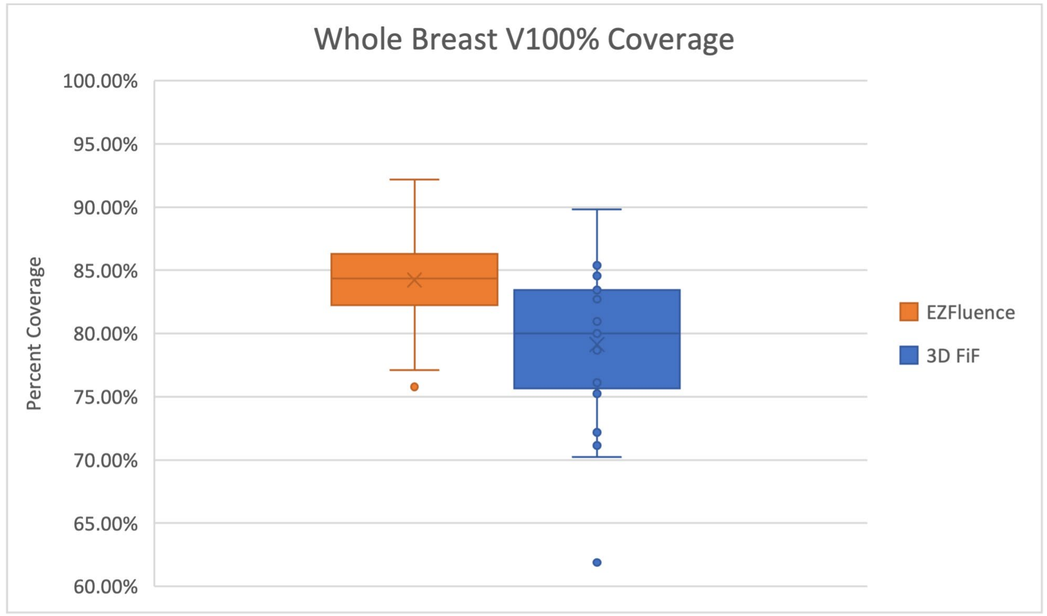

Fig 1. Two-tailed t-test comparison of 3D FiF vs EZFluence V100% whole breast coverage. Box and whisker plot, boxes display lower 25% of data, mid 50% and upper 75% of data. EZFluence plans show less variation in coverage than the 3D plans.

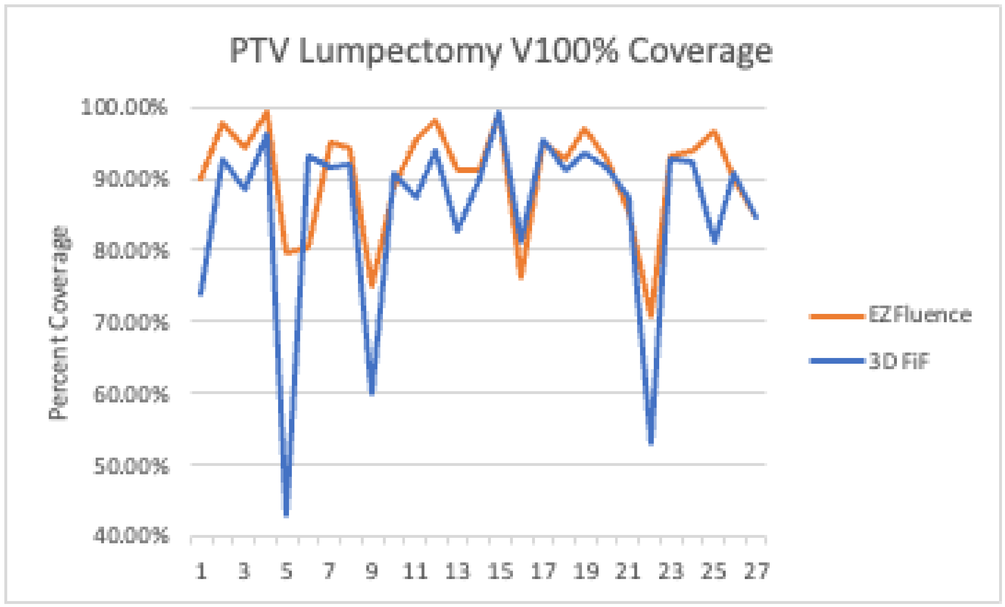

Fig 2. Two-tailed t-test comparison of 3D FiF vs EZFluence V100% PTV lumpectomy bed coverage.

Structure	Constraint	Goal	3D FiF Average	EZFluence Average	p-value
PTV Whole Breast	V100%	%	79.13%	84.22%	<0.0001
PTV Whole Breast	V103%	%	36.46%	47.30%	<0.0001
PTV Whole Breast	V105% ≤	10-15%	6.15%	4.46%	0.0050
PTV Whole Breast	V107%	%	0.18%	0.02%	0.0013
PTV_Lumpectomy Cavity	V100% ≥	95%	85.54%	90.28%	0.0130
Hotspot	V103%	cc	488.41	653.32	<0.0001
Hotspot	V107% ≤	2-10cc	3.76	1.10	0.0037
Ipsilateral Lung	V1600cGy ≤	10-15%	8.84%	8.76%	0.0206

Table 1. Dosimetric constraints of interest with 3D FiF average vs EZFluence average and p-value via paired sample t-test.

Results

The use of EZFluence resulted in statistically significant improvements in certain PTV_WB_EVA parameters (V100 (%), V105 (%), V107 (%), and Do.03cc), body parameters (V107 (cc), V108 (cc), and Dmax), and PTV_Lump_EVA parameters (V100 (%)). The use of EZFluence resulted in statistically significant worsening in certain PTV_WB_EVA parameters (V103 (%)) and body parameters (V103 (cc)). The extent of these differences is illustrated in figures 1 and 2 as well as table 1. There were no clinically significant differences in ipsilateral lung, contralateral lung, heart, and left anterior descending vessel dosimetric parameters for FiF versus EZFluence treatment planning.

Conclusion

Radformation's EZFluence software helped achieve greater breast coverage and lumpectomy bed coverage when looking at the V100% of both in comparison to the 3D plans. The traditional 3D plans were superior at keeping the lower range hotspots, V103% and V105%, under control while the EZFluence plans did better at controlling the higher range V107% hotspot.

For equivalent whole breast PTV coverage with 95% of dose (V95), EZFluence resulted in improved coverage with 100% of dose (V100) with cooler and less extensive hot spots (as assessed by V105, V107, V108, Do.03cc, and Dmax). This improvement in target coverage and hot spots came at the expense of increased intermediate range dose (V103), although this is likely to be clinically insignificant.

Given the comparable, if not better, dose constraint metrics, user-friendly design of the EZFluence software and the time-saving aspect (a study by Benyaun et al found a 70% reduction in planning time when compared to traditional 3D planning), it could be concluded that the use of EZFluence software should be a discussion and clinical consideration in sites around the world.

Limitations

The study had a relatively small sample size with 27 patients included and the treatment planning utilizing EZFluence software was done retrospectively. There were different treatment planners for the original 3D FiF plan versus the EZFluence replans which leaves room to introduce planning bias.

Post replanning, an educated, subjective distinction had to be made to determine which parameters were statistically significant, clinically significant, or both.

References

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