



INTRODUCTION

- CivaSheet is a planar brachytherapy source array comprised of a flexible sheet with an embedded grid of CivaDots.
- CivaDot is a disk-shaped Pd-103 LDR source that is shielded on one side with a gold disk, providing a unidirectional dose distribution.
- CivaDot was modeled in BrachyVision and VariSeed treatment planning systems.
- The two treatment planning systems were investigated for their applicability, suitability, and convenience for treating with CivaSheet.
- Both of these systems involve meticulously placing seeds and/or individually rotating them.
- An automated procedure to perform this process would improve clinical efficiency and contribute to an ideal workflow.

METHOD

- The CivaDot was modeled in both BrachyVision and VariSeed.
- The dose distribution differences were investigated for a source strength of 100 U.
- Calculations from each treatment planning system for a single source of strength 100 U were recorded and compared at different angles and distances from the source.
 - Angles included 0°, 45°, 90°, and 180°.
 - Distances ranged from 0.25 to 4.5 cm.
- An optimal workflow using a combination of treatment planning systems was investigated.

RESULTS

- Calculated dose differences between BrachyVision and VariSeed varied from about 1% at a 1 cm distance from the source to 47% at 4.5cm from the source.

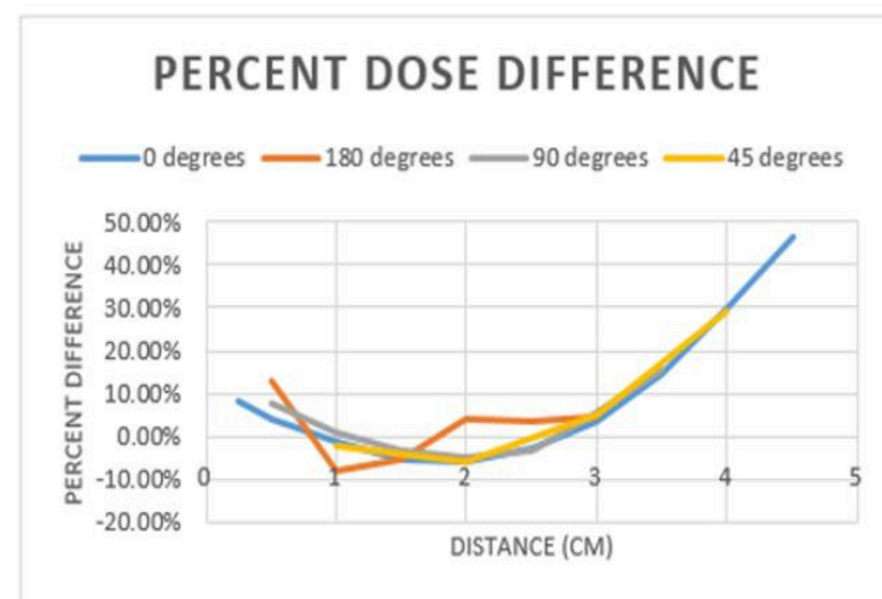


Figure 1. Percent Dose Difference between BrachyVision and VariSeed calculated doses.

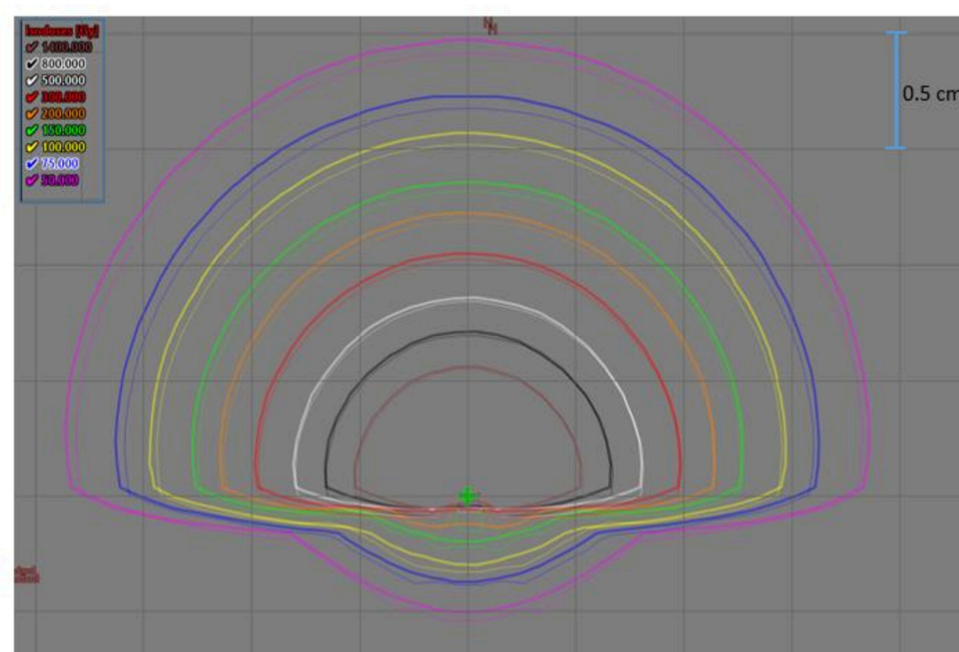


Figure 2. Isodose Lines for BrachyVision (thin line) and VariSeed (thick line) calculated doses.

- At shorter distances, the dose difference increases due to limitations in geometric modeling within BrachyVision.
 - Dose differences of up to 8.3% were found at distances of less than 1 cm from the source.
- The highest percent differences are in low dose regions. For a prescription dose of 10 Gy at 1 cm, the dose difference at 4.5 cm is about 5 cGy.
- CivaTech quotes the active length of the source to be 0.001cm
- The minimum active source length accepted for input by BrachyVision is 0.01cm.
- Due to this limitation, the source was modeled in VariSeed with a 0.001cm active length, while in BrachyVision, the source was modeled with a 0.01cm active length.
- This difference leads to different values for the geometry factor in the TG-43 dose calculation used by the two treatment planning systems, and is likely the reason for the discrepancy between the two treatment planning systems at small depths.

r (cm)	Θ	BrachyVision	VariSeed	% Difference	Absolute difference (Gy)
		Dose (Gy)	Dose(Gy)		
0.25	0	8993.252	8246.646	8.30%	746.606
0.5	0	1885.964	1807.428	4.16%	78.536
1	0	334.926	339.065	-1.24%	4.139
1.5	0	107.771	113.449	-5.27%	5.678
2	0	45.047	47.858	-6.24%	2.811
2.5	0	22.088	22.659	-2.59%	0.571
3	0	12.156	11.706	3.70%	0.45
3.5	0	7.379	6.299	14.64%	1.08
4	0	4.965	3.485	29.81%	1.48
4.5	0	3.787	2.019	46.69%	1.768
0.5	180	56.579	49.279	12.90%	7.3
1	180	13.397	14.445	-7.82%	1.048
1.5	180	5.389	5.694	-5.66%	0.305
2	180	2.703	2.592	4.11%	0.111
2.5	180	1.325	1.279	3.47%	0.046
3	180	0.703	0.673	4.27%	0.03
0.5	90	1395.427	1284.964	7.92%	110.463
1	90	257.884	255.278	1.01%	2.606
1.5	90	82.982	85.943	-3.57%	2.961
2	90	34.236	35.928	-4.94%	1.692
2.5	90	15.903	16.398	-3.11%	0.495
3	90	8.631	8.166	5.39%	0.465
3.5	90	5.165	4.352	15.74%	0.813
1	45	323.008	329.653	-2.06%	6.645
2	45	44.333	46.942	-5.89%	2.609
3	45	11.816	11.189	5.31%	0.627
4	45	4.809	3.4	29.30%	1.409

Table 1. BrachyVision and VariSeed dose calculation comparison.

CONCLUSIONS

- Either VariSeed or BrachyVision would be suitable for determining the dose distribution from a CivaSheet treatment.
- Due to strengths and weaknesses of both systems, a combination of the two may be the best option in developing an automated treatment planning process.
- Developing an automated procedure for the clinical treatment planning process will decrease planning time and increase clinical efficiency.

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