User Guide for Prospera™
(MED3633) Palladium-103 Brachytherapy Sources

Introduction

Oncura recently announced a distribution arrangement for model Prospera (MED3633) Palladium-103 brachytherapy sources. This source will be supplied instead of TheraSeed (Model 200) Palladium-103 seeds to our prostate brachytherapy customers. This document details the subtle differences between these two sources, and provides the necessary information to allow a simple and straightforward transition between them. The MED3633 source meets all American Association of Physicists in Medicine (AAPM) requirements, and is listed in the joint AAPM/RPC seed registry (http://rpc.mdanderson.org/rpc/htm/Home_htm/Low-energy.htm). Seeds meeting this definition are required to comply with the recommendations published in the document "Dosimetric prerequisites for routine clinical use of new low energy photon interstitial brachytherapy sources", Williamson, et.al., Medical Physics **25** (12), 1998. The MED3633 source is traceable to the revised NIST air kerma strength standard effective April 23, 2001. Additional information including dosimetry data for the MED3633 seed is also included in the publication: "Update of AAPM Task Group 43 Report: A revised AAPM protocol for brachytherapy dose calculations", Rivard, et.al., Medical Physics **31** (3), March 2004.

Physical Geometry Comparison

Both seeds are essentially the same size, which should allow consistent needle loading and treatment planning. Although the internal active geometry is different, the dose distribution and anisotropy around the MED3633 source is essentially identical to the Theragenics model 200 source. An external difference is that the end weld caps on the model 200 source are concave or recessed, versus the typical convex rounded caps the majority of source manufacturers.

Task Group 43 Consensus Data for the MED3633 Palladium-103 Source

The consensus data from the updated Task Group 43 protocol is summarized below. The primary data included in this guide includes the dose rate constant, radial dose function, and the two-dimensional anisotropy function. Further information regarding the dosimetry data can be found in the Task Group 43 document, or in the enclosed references.

Dose Rate Constant

The published dose rate constant, Λ, for the MED3633 source is 0.688 cGy/hr/U. This value is nearly identical to the value of 0.686 for the model 200 sources.

Radial Dose Function

The data table below is derived from page 644 of the updated Task Group 43 report, and provides a comparison of the radial dose functions for the model 200 source (left columns) and the MED3633 source (right columns).

Consensus $g(r)$ values for two ^{103}Pd sources. Interpolated data are boldface, and italicized data are nonconsensus data obtained from candidate datasets.

	Line source approximation		Point source approximation	
	Model 200	MED3633		
r [cm]	L = 4.23 mm	L = 4.2 mm	Model 200	MED3633
0.10	0.911		0.494	
0.15	1.21		0.831	
0.25	1.37	*1.331*	1.154	*1.123*
0.30	1.38	*1.322*	1.220	*1.170*
0.40	1.36	*1.286*	1.269	*1.201*
0.50	1.30	1.243	1.248	1.194
0.75	**1.15**	1.125	**1.137**	1.113
1.00	1.000	1.000	1.000	1.000
1.50	0.749	0.770	0.755	0.776
2.00	0.555	0.583	0.561	0.589
2.50	0.410	0.438	0.415	0.443
3.00	0.302	0.325	0.306	0.329
3.50	**0.223**	0.241	**0.226**	0.244
4.00	0.163	0.177	0.165	0.179
5.00	0.0887	0.098	0.0900	0.099
6.00	0.0482	0.053	0.0489	0.054
7.00	**0.0262**	0.028	**0.0266**	0.028
10.00	0.00615		0.00624	

2D Anisotropy Function

The data table below is derived from page 647 of the updated Task Group 43 report, and details the 2D anisotropy function for the MED3633 source. The 1D anisotropy function, formerly known as the anisotropy constant, is also provided at the bottom of the table. (Please note however that use of the 1D anisotropy constant is discouraged by the Task Group 43 authors for all brachytherapy seed models.)

$F(r,\theta)$ for model MED3633.

Polar angle	r [cm]					
θ (degrees)	0.25	0.5	1	2	5	10
0	1.024	0.667	0.566	0.589	0.609	0.733
10	0.888	0.581	0.536	0.536	0.569	0.641
20	0.850	0.627	0.603	0.614	0.652	0.716
30	0.892	0.748	0.729	0.734	0.756	0.786
40	0.931	0.838	0.821	0.824	0.837	0.853
50	0.952	0.897	0.890	0.891	0.901	0.905
60	0.971	0.942	0.942	0.940	0.948	0.939
70	0.995	0.976	0.974	0.973	0.980	0.974
80	1.003	0.994	0.997	0.994	1.000	0.986
$\phi_{an}(r)$	1.257	0.962	0.903	0.895	0.898	0.917

Activity Information

The MED3633 Palladium-103 source will be available for the same range of clinically relevant air kerma strength and apparent activities previously offered for the model 200 sources. For all Palladium-103 brachytherapy sources, the accepted half-life is 16.99 days, and the conversion factor for air kerma strength to apparent activity is 1.293 U/mCi (reference 1).

References

1. Mark J. Rivard, *et. al.*, "Update of AAPM Task Group No. 43 Report: A revised AAPM protocol for brachytherapy dose calculations," Med. Phys. **31** (3), 633-674 (2004)
2. Robert E. Wallace, *et. al.*, "Dosimetric characterization of a new design ^{103}palladium brachytherapy source," Med. Phys. **26** (11), 2465-2470 (1999).
3. Zuofeng Li, *et. al.*, "Monte Carlo calculations and experimental measurements of dosimetry parameters of a new ^{103}Pd source," Med. Phys. **27** (5), 1108-1112 (2000).
4. Eli E. Furhang, *et. al.*, "Fitting and benchmarking of dosimetry data for new brachytherapy sources," Med. Phys. **27** (10), 2302-2306 (2000).
5. M. J. Rivard, "A discretized approach to determining TG-43 brachytherapy dosimetry parameters: case study using Monte Carlo calculations for the MED3633 ^{103}Pd source," Applied Radiation and Isotopes **55**, 775-782 (2001).