



A Comparison of Novalis Tx™ and CyberKnife

Feature	CyberKnife	Novalis Tx™	Added benefits of Novalis Tx
Immobilization	Frameless ¹	Frameless and Frame-Based ^A	<ul style="list-style-type: none"> Decide which treatment is best – Frameless or Frame-Based
Treatment Planning	MultiPlan treatment planning system with SRS ²	iPlan treatment planning with SRS ^B and IMRS & IMRT and Conformal Arcs and Dynamic Conformal and IGRT and Eclipse treatment planning system with RapidArc ^C treatment	<ul style="list-style-type: none"> Plan for radiosurgery with cone planning or MLC planning Do IMRT, 3D conformal, IGRT and other standard techniques when the machine is not doing SRS or SBRT Have the power to do RapidArc™ radiotherapy technology treatments for radiosurgery or IGRT
Setup Localization	Room-based stereo x-ray with 2D KV-KV match ^{1,4}	Room-based stereo x-ray with 2D-3D KV match ^H and machine-based imaging ^D and cone-beam CT ^D (CBCT) 3D imaging and MV-BEV ^E (beam's eye-view) and True KV-fluoro ^D	<ul style="list-style-type: none"> Visualize soft tissue via cone-beam CT on a radiosurgical device Localize with image matching using 2D-KV, 2D-MV, 3D-KV or KV-fluoro
Treatment Delivery	<p>6 MV 800^{3,4} MU at 80 cm</p> <p>12 Cones⁴ + “variable” iris collimator with 12 fixed apertures⁵</p> <p>Fixed Beam Positions⁴</p> <p>Anterior Beam Delivery⁴ [severely limited (22°) posterior beams⁴]</p>	<p>6 MV and HighX (10 – 20 MV) 1000 MU at 100 cm^A</p> <p>Cones and HD120 MLC^{F,G} with Shaped Beam Radiosurgery</p> <p>Fixed Beam Positions^A and Continuous arc delivery with RapidArc^A</p> <p>Anterior Beam Delivery^A and full 180° posterior beams</p>	<ul style="list-style-type: none"> Have a powerful linear accelerator Have up to 3 energies, including high X, to penetrate deeper into tissues more efficiently Use cones for SRS or shaped beams that conform to complex shapes of tumors from all beam angles Continuously and optimally modulate the beam power, gantry speed, and HD120 MLC leaf shape Design the treatment to deliver dose and spare tissue from any direction
Intra-Fraction Motion Management	<p>Room-Based x-ray shots⁴ (brain and body)</p> <p>Optical tracking via infrared⁶ (body only)</p>	<p>Room-Based x-ray shots^H (brain and body)</p> <p>6D Optical Gating^I (brain and body) and Gated Marker Block^J and Machine-based MV-BEV^E</p>	<ul style="list-style-type: none"> Provides intra-fraction localization via Snap Verification Treat what you planned to treat with respiratory gating. With tracking you may treat structures you did not intend to treat See what you treat while you treat and minimize any doubt about “how much” and “where”
Information Systems	DICOM RT Image, Dose, Import-Export ²	DICOM RT Image, Dose, Import-Export Sophisticated data base ^K with record and verify	<ul style="list-style-type: none"> Provides a comprehensive DICOM-RT based information system with the ARIA oncology information Provides a sophisticated networked & wireless system for plan review with iPlan Net
Treatment Times	35 – 90 minute treatments typical ^{3, 7}	2 – 20 minute treatments typical ^{L,M,N,O}	<ul style="list-style-type: none"> Novalis Tx treats efficiently with shaped beams, RapidArc and high linac output

References

CyberKnife references

1. CyberKnife product brochure. 500070.A
2. MultiPlan Treatment Planning System brochure. 500079.A
3. CyberKnife Robotic Radiosurgery Sys – New System Configurations. 500359.A
4. CyberKnife Site Planning Guide, PN027264.A
5. IRIS Variable Aperture Collimator for the CyberKnife Robotic Radiosurgery System: Design, Beam, Properties, and Clinical Benefits. 50034.A
6. Synchrony Respiratory Tracking System brochure. 500071.A
7. 52 min average treatment time based on 11 published case studies: 500092.A – RCC brain metastasis, 500089.A – optic meningioma, 500100.A – grade 2 optic meningioma, 500287.A – anaplastic astrocytoma, 500101.A – multiple myeloma at clivus & C1, 500094.A – nasopharyngeal carcinoma, 500095.A – peripheral nerve sheath tumor at C5, 500101.A – T5 solitary breast metastasis, 500093.A – non-small cell lung cancer, 500097.A – low-risk, organ-confined prostate cancer

Note: All of the above documents were based on material obtained 11/07 to 5/08 time frame either at www.accuray.com or at trade shows.

Novalis Tx references

- A. Novalis Tx Spec Sheet, RAD 10011B
- B. iPlan RT Dose Flier, RT-F-E-iPlan Dose 1006 Q:3.000
- C. RapidArc Brochure, RAD 10008B
- D. On-Board Imager Spec Sheet, RAD 9502G and 4DITC Product Brief, RAD 2768
- E. PortalVision aS1000 Spec Sheet, RAD 2553B
- F. HD120 MLC Product Brief, RAD 9997B
- G. HD120 MLC Specifications, RAD 9998C
- H. ExacTrac X-Ray 6D Spec Sheet, ETX-TS-E-SYS Rev 11 - Oct 2007
- I. ExacTrac Infrared Tracking Platform 5.x Spec Sheet, ET-TS-E-SYS Rev 8 - Oct 2007
- J. RPM Respiratory Gating System, RAD 5616A
- K. ARIA Oncology Information System specification, RAD 2749E
- L. Andrews DW, Bednarz G, Evans JJ, Downes B. A review of 3 current radiosurgery systems. *Surg Neurol.* 2006 Dec;66(6):559-564.
- M. Pawlicki T, Kim GY, Hsu A, Cotrutz C, Boyer AL, Xing L, King CR, Luxton G. Investigation of linac-based image-guided hypofractionated prostate radiotherapy. *Med Dosim.* 2007 Summer; 32(2):71-79.
- N. Crocker IR, Waller A, Davis LW, Fox TH, Linac Radiosurgery: A Retrospective Analysis of Treatment Efficiency, proceedings of the 90th American Radium Society meeting, Dana Point, CA, May 2008
- O. Data on file, August 2008. Varian Medical Systems.

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