CyberKnife®

ACCURAY®

versatile simple intelligent

VSI™

*With the ability to offer a full range of treatment options, from radiosurgery to high precision radiation therapy, the **versatile** CyberKnife® VSI™ System provides the flexibility to optimize treatments for the unique needs of each patient*

*A comprehensive set of tools to manage every aspect of patient treatment, ready integration into existing institution infrastructure and a logical workflow make the use of the CyberKnife VSI System **simple** and convenient in daily clinical practice*

*Using **intelligent** capabilities to not only enable expert-level treatments with an intuitive planning process, but also to adapt treatment delivery to the distinct characteristics of each patient with continual image guidance, the CyberKnife VSI System instills confidence that the plan created is the plan delivered*

Prostate Treatment with the CyberKnife® System

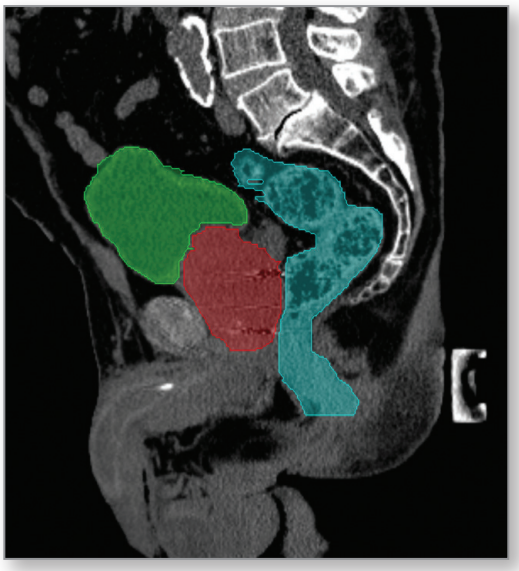
There is a growing demand for treatments that are tailored to the specific needs of patients. By being sensitive to these needs and attentive to developments in prostate radiation oncology, Accuray researchers and engineers have evolved the CyberKnife® System into a radiation delivery system that is maximally flexible, to allow clinicians to choose the very best treatment for each individual patient.

Prostate Treatment Challenge

Safely and accurately delivering radiation to the prostate, knowing that intrafraction prostate motion is random and unpredictable,[1] presents a challenge for any external beam radiation delivery system.

Conventional IGRT technologies provide image guidance for pre-treatment setup and can be used during treatment delivery to detect intrafraction organ motion. However, the ability to detect intrafraction organ motion alone is not enough. Treatment accuracy is assured when the information acquired from the image guidance system is used to automatically correct beam delivery in real time.

The CyberKnife Robotic Radiosurgery System is the only radiation delivery system that combines continual image guidance with the intelligence of robotic mobility. This unique combination enables the system to automatically adapt the targeting of each beam to correct for patient and organ motion, thus ensuring sub-millimeter accuracy throughout each treatment fraction for each patient.



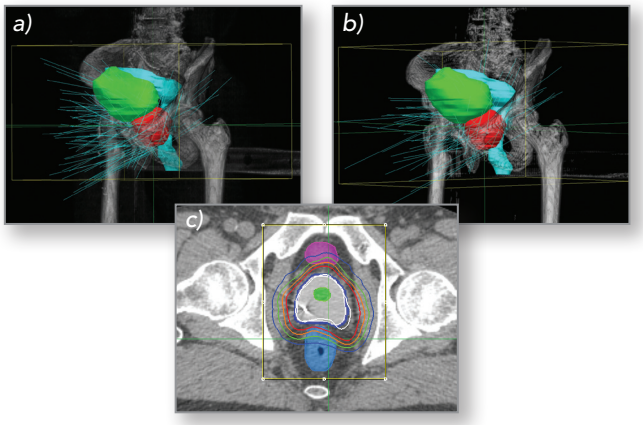
The close proximity of dose limiting critical structures such as the bladder (in green) and the rectum (in blue) make accurate treatment of the prostate a challenge for any radiation delivery system.

Prostate Treatment Capabilities

The robotic mobility of the CyberKnife System enables the automated delivery of a large number of non-isocentric, non-coplanar beams individually directed at unique points within the intended target. This automation eliminates the need to reposition the patient for each beam. Delivery of multiple non-coplanar beams enhances dose conformality and creates very steep dose gradients, reducing dose to surrounding critical structures. High dose conformality and steep dose gradients are particularly important when treating the prostate due to the close proximity of dose-limiting structures, such as the radiation-sensitive rectum and bladder.

Benefits

- Radiosurgical treatment accuracy is assured with the combination of continual image guidance and robotic mobility
- Corrections due to patient and organ motion are automated in the treatment delivery workflow, eliminating the need to stop the treatment to manually make corrections
- The non-coplanar treatment capability of the CyberKnife System results in treatment plans with superior conformality and exceptional normal tissue sparing



Whether delivering a radiosurgery treatment plan (a) or a Robotic IMRT treatment plan (b) to the prostate, the CyberKnife System has the ability to deliver the same high conformality and steep dose gradient (c).

Simple and Versatile Treatment Solutions

A number of prostate treatment options are available with the CyberKnife® System. Clinicians may choose a robotic radiosurgical approach, treating the prostate using accelerated hypofractionation (treatment in five or fewer fractions), or a Robotic IMRT™ approach, using conventional fractionation and dose schedules. Regardless of approach, the CyberKnife System's versatility and continual image guidance assures the delivery of every treatment beam with radiosurgical precision.

Prostate Radiosurgery

Many clinicians believe that the α/β ratio for prostate cancer is low, suggesting a favorable biological response to hypofractionated (high dose per fraction) treatments.[2] Studies of hypofractionated treatment using external beam delivery systems have yielded outcomes comparable to conventionally fractionated approaches without undue increases in toxicities.[3] Accelerated hypofractionation, as delivered with HDR brachytherapy, has had success in controlling prostate cancer,[4,5] yet the nature of the HDR procedure has left both providers and patients looking for less invasive and less complicated treatment alternatives.

The CyberKnife System allows clinicians to non-invasively deliver HDR-like dose distributions or uniform dose distributions to the prostate with sub-millimeter accuracy while minimizing dose to the rectal wall and bladder.[6] Used as monotherapy or as a boost following external beam treatment, prostate radiosurgery is typically delivered in five or fewer outpatient visits.[6,7]

Robotic IMRT for Prostate

The clinical benefits of IMRT to deliver conventionally fractionated treatment to the prostate are well documented and are supported by clinicians who suggest the α/β ratio for prostate cancer may not be as low as predicted.[8-10] Robotic IMRT combines the proven effectiveness of IMRT delivery with the robotic intelligence of the CyberKnife System — superior conformality, steep dose gradient and fully automated treatment delivery with continual image guidance — to deliver high precision radiation therapy to the prostate using a conventionally fractionated approach.

Robotic IMRT is a practical option in routine daily practice when delivered using the Iris™ Variable Aperture Collimator, which provides an array of variably sized beams to efficiently deliver a highly conformal treatment plan in a short treatment time.

Benefits

- Delivery of prostate radiosurgery using both HDR-like and uniform dose distributions is possible with the CyberKnife System
- Robotic IMRT enables the treatment of the prostate using conventional fractionation while maintaining radiosurgical accuracy throughout each treatment fraction
- The versatility and robotic mobility of the CyberKnife System offers clinicians the ability to treat patients with varying fractionation and dosing schemes without compromising accuracy

Prostate Treatment Planning

Consistent Quality Combined with Ease of Use

The Sequential Optimization feature of the MultiPlan® Treatment Planning System allows high quality, conformal treatment plans to be generated easily, quickly and intuitively for a wide variety of clinical objectives (e.g., HDR-like and uniform dose distributions) and fractionation schemes.

AutoSegmentation™

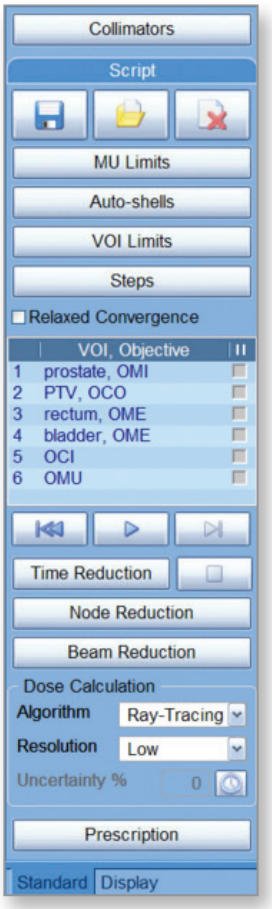
This feature enables accurate automatic delineation of prostate, rectum, bladder, seminal vesicles and femoral heads with minimal user input. This is a unique approach to automatic segmentation that leverages a model-based approach. AutoSegmentation™ provides accurate results in a matter of minutes. Both CT and MR data can be used (use of MR is not a requirement). Workflow in the clinic is improved and treatment planning time is reduced.

QuickPlan™

Automation of a number of steps in the treatment planning process greatly reduces the level of user interaction required during plan generation, freeing the physicist to perform other tasks while plan generation is in progress. QuickPlan™ automates the following planning tasks: fusion, AutoSegmentation, the setting of plan parameters, plan optimization and dose calculation. The end result is a complete high quality treatment plan for user review. Enhanced plan template functionality and the scriptable nature of Sequential Optimization ensure that QuickPlan will consistently produce high quality plans that meet the user's requirements.

Optimized & Predictable Treatment Times

A newly introduced feature in the Sequential Optimization option in the MultiPlan System is the ability to estimate and optimize the treatment time of any given plan. The amount of time it will take to deliver each fraction of treatment – including set up time, imaging time, linac motion time and beam-on time – is optimized by the clinician during the planning process. The result is consistently faster treatment times, regardless of the treatment approach.



Generate a treatment plan using a Sequential Optimization script, then use the Time Reduction feature to control the treatment delivery time.

Benefits

- A comprehensive set of tools for generating both radiosurgery and Robotic IMRT™ treatment plans are available in the MultiPlan Treatment Planning System
- Sequential Optimization enables the most complex planning objectives to be achieved easily
- The ability to predict treatment times results in greater efficiency and increased patient throughput

Prostate Treatment Delivery

InTempo™ Adaptive Imaging System

When delivering the high conformality and steep dose gradients required for either prostate radiosurgery or extended fractionation treatments, imaging at set-up alone is inadequate. Studies have shown that the prostate can move up to 12 mm in as little as eight minutes of treatment delivery.[11] Xie et al. noted significant (> 2 mm) prostate motion in a number of instances even when prostate position was assessed every 30 s, and the likelihood of extensive prostate motion increased as the interval between position checks increased.[1] The authors concluded that sub-millimeter accuracy for prostate treatment is only assured by frequent image-guided detection of and correction for prostate motion.[1,11] Only a system that maintains this level of targeting accuracy throughout the treatment can allow a clinician to minimize margins for inaccuracy and be truly confident that the plan created is the plan delivered.

The InTempo™ System automatically adapts the frequency at which prostate motion is assessed depending entirely upon the rate and extent of the observed motion. By minimizing the Image Age (the elapsed time between image acquisition and beam delivered), the InTempo System minimizes the uncertainty that exists with other target tracking techniques. By constantly adapting to patient specific motion, the InTempo System maximizes dose to the prostate while sparing surrounding normal tissue and critical structures.

Plan QA (Quality Assurance)

A comprehensive set of tools is available in the CyberKnife® System to perform the necessary task of patient-specific Plan QA. Perform Plan QA for both robotic radiosurgery treatment plans and Robotic IMRT™ treatment plans to assure the dose planned is the dose delivered.

The MultiPlan® Treatment Planning System provides a streamlined workflow to generate a QA Plan from an authorized Robotic IMRT or a radiosurgery treatment plan. Once the QA Plan is generated, it is delivered at the CyberKnife treatment delivery system and the dose delivered is measured. QA analysis software, provided with the CyberKnife System, is used to compare the measured dose to the planned dose. The Plan QA workflow is completed when the results of the dose comparison are documented in the CyberKnife data management system Plan Administration application.

Benefits

- The InTempo System provides the ability to reliably track and correct for both slow drift and sporadic prostate motion
- The InTempo System makes intelligent, adaptive treatment delivery tools available to the user in daily clinical practice
- The quality of CyberKnife System treatment plans can be assured using the simple and integrated plan-through-analysis Plan QA workflow

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CyberKnife® VSI™ System

Robotic Manipulator and Linear Accelerator – The compact, 1000 MU/min 6MV X-band linear accelerator is capable of being positioned in virtually any direction by a high precision robotic manipulator with repeatable sub-millimeter accuracy.

Imaging System – The low-energy X-ray sources and the flush mounted detectors create high-resolution anatomical images throughout the treatment, which are continually compared to previously generated DRR's to determine real-time patient positioning and target location.

Iris™ Variable Aperture Collimator – Rapidly manipulates beam geometry to deliver up to 12 beam sizes from each linac position with characteristics virtually identical to that of fixed circular collimators.

RoboCouch® Patient Positioning System – Robotically aligns patients precisely with six degrees of freedom, enabling faster patient setup. The Seated Load option enables simple and comfortable loading of mobility-limited patients.

Xchange® Robotic Collimator Changer – Automatically exchanges collimators robotically, enabling highly conformal treatments delivered with greater efficiency.

CyberKnife® Data Management System – Provides comprehensive storage and processing of the patient data that is generated as the patient progresses through the CyberKnife planning and treatment workflow.

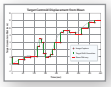
Report Administration – The ability to review stored patient and usage data is simple and straightforward with the easy availability of a variety of departmental reports.

Radiosurgery DICOM Interface – This interface utilizes the industry-standard DICOM protocol to export patient treatment plan and delivery information to an Oncology Information System.

Synchrony® Respiratory Tracking System – Continuously synchronizes beam delivery to the motion of the tumor, allowing clinicians to significantly reduce margins while eliminating the need for gating or breath-holding techniques.

Xsight® Lung Tracking System – Directly tracks the movement of lung tumors without fiducials while maintaining precision, reliability and self-adjusting repeatability.*

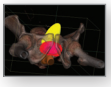
Xsight Spine Tracking System – Eliminates the need for surgical implantation of fiducials by using the bony anatomy of the spine to automatically locate and track tumors, making radiosurgery more precise and less invasive.



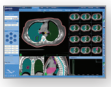
InTempo™ Adaptive Imaging System – Intelligent, adaptive imaging system designed from the ground up to address the unique challenges of prostate tracking resulting from random and excessive target motion.

Monte Carlo Dose Calculation – Often considered the gold standard when treating lung tumors, the CyberKnife System's Monte Carlo Dose Calculation produces results in minutes compared to what commonly requires hours or days with other systems.

Sequential Optimization – An intuitive and intelligent plan optimization algorithm for rapidly developing custom tailored treatment plans specific to the unique clinical objectives for each patient.



AutoSegmentation™ – Automatically generate accurate contours for prostate, rectum, bladder, seminal vesicles and femoral heads. Results can be generated using both CT and MR image information, and require minimal user input.



QuickPlan™ – A complete treatment plan is generated automatically, and the results presented to the user for review. The entire planning process, including the setting of planning parameters, optimization, and dose calculation, is automated. Plans are generated using the clinical objectives predefined by the user.

** Limited to specific tumor size and location*

For more information on the CyberKnife Robotic Radiosurgery System, please contact Accuray Incorporated.

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The CyberKnife System and CyberKnife options may not be available in some countries. Specifications, features and functionality subject to change without prior notification. For a complete list of CyberKnife Systems and options available, please contact Accuray at ***sales@accuray.com.***

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