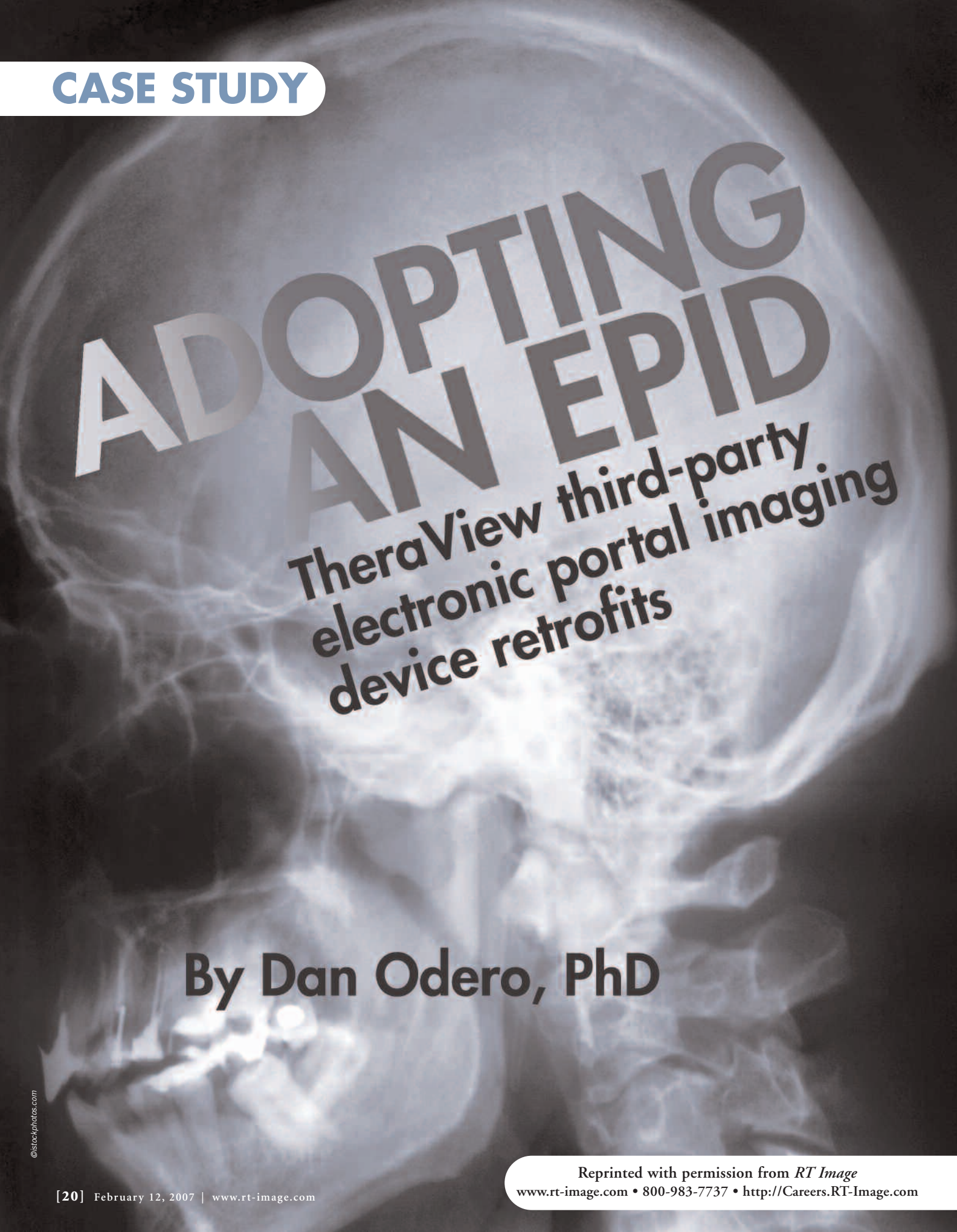
CASE STUDY

ADOPTING AN EPID

TheraView third-party electronic portal imaging device retrofits

By Dan Odero, PhD



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CASE STUDY

The aim of external beam radiotherapy is to deliver a sufficient dose of radiation to the targeted tumor while delivering as small of a dose as possible to the surrounding normal tissues. Accurate and reproducible placement of treatment fields is necessary to achieve this goal. In addition, portal images allow visualization of the anatomical structures within the radiation field.

Verification of proper positioning and setup of the patient has historically been performed by using X-rays to produce an image on film; this permits the physician to verify the positioning of the patient. Ideally, films should be performed every day before the treatment.

To do this, a radiation therapist must load a film into a X-ray cassette, carry the cassette to the treatment room, insert the cassette into the X-ray table or freestanding cassette holder, position the patient, take the X-ray, develop the film and check the processed film for any problems to ensure that the film is suitable for radiation treatment set up decision. This process can take several minutes, during which the patient has to remain immobilized on the treatment table.

An increase in the frequency of portal films usage, however laborious, has been shown to reduce the error in missing the region of treatment to improve the radiation therapy treatment outcome. At the facility where I work, Raleigh Regional Cancer Center, there was a need for a more efficient method to obtain portal films using advanced technology.

Financial Considerations

The aforementioned considerations engage the treatment and the X-ray development rooms, as well as department personnel. Our timed studies indicated each portal film took an average of eight minutes from acquisition, processing and acceptance. Our departmental annual report indicated an average of 3,212 billable portal films per year per treatment machine. However, this number excluded rejected or repeated portal films.

The total machine time spent on acceptable portal films alone per year was 417.6 hours. With three therapists per machine, this gave us a total of 1,252.37 man-hours per year with an average annual cost of $32,570 towards portal films. The cost to maintain the film processor was $3,086 per year and the expenses toward purchasing the X-ray films were $3,500 per year. The total average cost of using portal films per year was $39,155.70; our portal film reimbursements were about $42,020. Thus, the net annual income from portal films was $2,864.30.

As a result of using an electronic portal imaging device (EPID), our calculations indicated that the treatment machine created an additional 1.04 hours per day; this would be enough to treat four more patients. The estimated additional reimbursement from the additional patients would be $162,807.80 per year.

Assuming the same level of usage of the EPID as that of portal films, the man-hour cost would be reduced to $9,092. The estimated annual income from portal imaging using EPID would then be $204, 827.

With minimal expenses toward the EPID in the first year, while the system is still under warranty, the net annual income would be $195,735. (Note: The above figures do not include increased income based on the new billable image-guided radiation therapy procedure code that can be performed using a complete portal imaging device.)

Choice of EPID

Adoption of EPID technology has posed problems for small radiation therapy cancer centers, since many of these centers either have machines that were manufactured before EPID became standard equipment or chose not to include EPID technology on more recently purchased LINACS. Furthermore, adding EPID to an existing accelerator is challenging for several reasons.

First, the cost of an add-on EPID system provided by the manufacturer of the accelerator is high, and can represent more than half of the cost of a new linear accelerator itself from some manufacturers. Second, there are always hardware and software compatibility issues with third-party products. Third, most add-on EPID systems do not come with complete portal image management software. Finally, there are inherent logistical issues with the new EPID and existing linear accelerator service maintenance contracts.

The resolution of these issues would be to install a reasonably priced, third-party EPID that offers more than just portal image acquisition and screen displays. In searching for an add-on system that would meet portal imaging needs, increase efficiency and keep the radiation therapy center competitive, it is necessary

to evaluate the initial purchase cost, quality of imaging and total cost of ownership of numerous systems.

The two principal electronic imaging options are amorphous silicon detectors and camera-based detectors. Although camera-based detectors are both cheaper and more reliable than amorphous silicon detectors, they have relatively lower image resolution. The aforementioned amortized financial calculations, based on the present portal imaging and target localization Medicare reimbursements, indicate that an add-on EPID should pay for itself within two years of ownership.

Additionally, the typical lifespan for amorphous silicon detectors is about five years and their replacement cost is very expensive – about 80 percent of the cost of a new purchase. On the other hand, the lifespan for water-cooled, camera-based detectors is longer than those of amorphous silicon and forced air-cooled, camera-based detectors when used under the same conditions.

Moreover, the replacement cost would be less – about 7.5 percent of the cost of the new camera-based system. For an add-on, it is desirable to use a system with a lifespan comparable to the remaining years of service of the linear accelerator. Thus, comparable camera-based systems would be more appealing.

At the time of the implementation of this project, we found a lack of third-party EPID manufactures.

Likewise, it is important to consider the quality of technical service offered by the manufacturer. We had no experience dealing with EPID service technicians. And, there was very limited information on other third-party manufacturers.

Finally, the purchase price for the TheraView system package was within our budget, compared to the other systems that we considered.

Enter: TheraView

The TheraView imaging system from Cablon Medical BV is manufactured in the Netherlands and is distributed in the United States through Acceletronics Inc., Exton, Pa. Acceletronics also installs and offers services, refurbished oncology systems, parts and accessories for Theraview and radiotherapy equipment.

Being an overseas-based product with different power ratings than the U.S., it was not easy for the institution to reach a purchasing decision on the product. However, a teleconference with an experienced user overseas resolved the impasse and the purchasing process went very smoothly and the delivery was within the promised timeframe.

The TheraView installation process took approximately a day-and-a-half and could be accomplished over a weekend. The team was comprised of four individuals: two factory-based engineers – one who actually built the video camera and the detector and another who assembled the electronics of the system before the shipment – and two local technicians – one an expert on the Siemens Medical Solutions' Primus linear accelerator and the other the local TheraView systems imaging engineer who later provided maintenance services.

In addition, after the system was connected to our local area network, the software engineers at the factory in the Netherlands were able to offer remote troubleshooting and guidance services to the team through the "tunnel." There was no need for local information technology personnel, since the only information required was IP addresses for the computers communicating with the TheraView system.

The hardware mounts easily at the bottom of the Siemens Primus. Then, the pendant cord passes through the existing conduit connecting the Linac and the modulator. It has a small remote hand pendant, which can be mounted anywhere within the treatment room. It weighs about 195 pounds and does not provide major hardware or electronic interference with the existing Siemens Primus linear accelerator; this weight is light enough not to cause gantry lag during rotational treatments. It is also mounted in the same location where the proprietary Siemens Primus EPID is usually mounted.

The training for all the users took two days immediately after the installation. The trainer performed the first few procedures with the staff and additional help was always available over the phone.

Reaping the Benefits

The TheraView electronic portal imaging system integrates well with existing equipment. It offers a complete imaging system that has eliminated the need for separate software for portal image viewing, interpretation, analysis, archiving, image-guided radiation therapy and other image management applications. Also, it has secure Internet access through the "tunnel" that allows for remote troubleshooting by factory personnel.

In addition to remote diagnosis, authorized personnel can access the database remotely via the Internet. Physicians can access the portal images and approve/disapprove remotely, provided that their computer can connect with the TheraView computer via VPN.

We are able to obtain portal images electronically, which keeps us competitive with other regional cancer centers using advanced imaging technology. The system has saved us a tremendous amount of time providing additional time to treat more patients.

We are now able to add more than four patients as previously projected. The therapists are satisfied with the TheraView portal imaging system and are able to effectively use all its features. The personnel are no longer overwhelmed with the portal imaging process.

Unlike other products capable of only providing images for computer screen reviews, TheraView comes with a complete image management system, saving us money from purchasing additional software.

Finally, the system allows us to perform radio-opaque or anatomical landmarks-based, image-guided radiation therapy, with additional allowed reimbursements from the 3-D external beam radiation therapy and intensity-modulated radiation therapy patients.

Dan Odero, PhD, is the chief of medical physics at Raleigh Regional Cancer Center, Beckley, W.Va. His interests are in clinical implementation of new radiation therapy cancer treatment methodologies and techniques, radiation therapy imaging and development of treatment quality assurance procedures. Questions and comments can be directed to editorial@rt-image.com.

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