Radiotherapy Shielding Block Cutters: A Time-Proven Fit in a Technology Evolution

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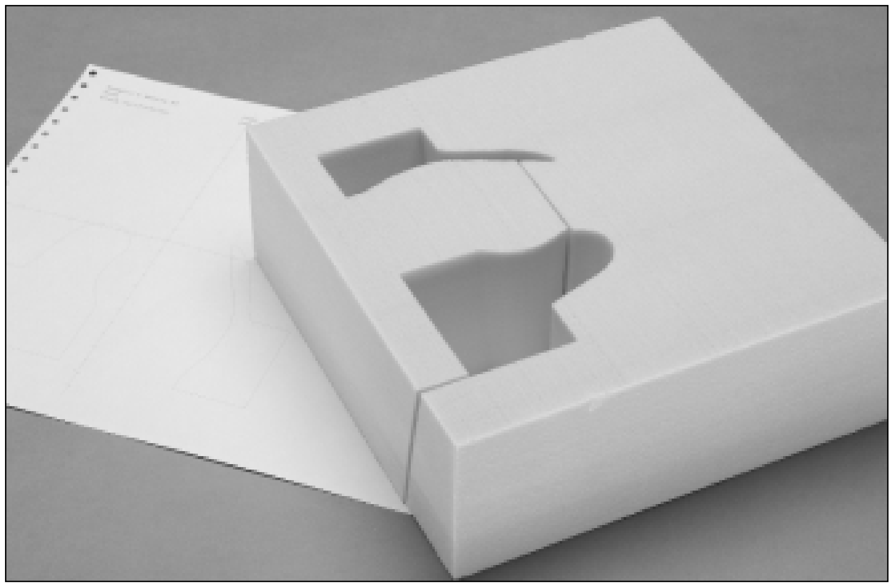
This paper will discuss radiotherapy shielding block cutters as a continuing, cost-effective component of radiation therapy. Cost-benefit analysis of various 3-D radiotherapy techniques is also presented.

Significant technological advances have been realized in radiotherapy in recent years with even greater evolutionary changes on the horizon. A new era of three-dimensional radiation therapy (3DRT) holds vast potential for 3-D volume representation and treatment planning and delivery systems that will re-define radiotherapy accuracy and repeatability. However, as with other significant and complicated technological changes, these advances will take time. In the wake of this technological evolution, block cutting continues to be a time-proven, staple component in radiation therapy.



Timely technological advances in radiotherapy are further hindered by their juxtapose position to socioeconomic changes related to the cost cutting efforts of managed care. These highly refined treatment techniques have many cost issues that are not easily resolved in current budgetary environments. More complicated treatment plans utilize more complicated and more expensive procedures. The advent and implementation of multi-leaf collimators (MLC) and beam intensity modulated radiation therapy (IMRT) techniques for precision shaping of dose distribution has much to offer. 3DRT will become faster, more accurate, and easier to use, but there is still much work to be done.

Current cost-benefit analysis is difficult at best, with many unforeseen variables. These advances require a considerable amount of time and funding for research and development, training, and implementation before they are perfected. These time-intensive, costly processes will require careful study and innovative budgeting before many facilities can absorb them as routine components of their radiotherapy program. With current economic conditions and reimbursement challenges, radiotherapy professionals must be able to strongly justify high-end equipment purchases to discerning administrative managers.

Many radiotherapy departments justify the use of MLC for use in IMRT. While IMRT is certainly a growth segment in the future of radiotherapy, there are many factors that still need to be addressed before it is implemented on a widespread, common scale. Advances in treatment planning, dose delivery, and treatment verification must be coordinated in a systems approach to radiation oncology in order take advantage of the power of IMRT. While the majority of radiotherapy departments realize the capabilities of IMRT, many are challenged by the complexity of its implementation.

MLC is also often justified for its potential increased throughput and subsequent economic advantages. While MLC does offer potential for increased throughput by eliminating the costs associated with pre-mounted trays, MLCs have significant additional costs of their own. These costs can be significant barriers to the implementation and maintenance of a MLC program in many facilities.

Capitalization costs for a new linear accelerator with an 80-leaf or 120-leaf MLC, treatment planning system, and additional bunker and shielding requirements, are beyond the reach of many radiotherapy departments. Additional service contract costs, connectivity issues, downtime, and planned replacement for MLC design obsolescence place this complicated technology well over the top for many budgets.

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Cost analysis comparing MLC and alloy shielding is not clear-cut. Billing between the two systems is not always differentiated in terms of complex or simple procedures, or the amount billed. Efficiency is also difficult to assess, since although therapist workload appears to decrease with the use of MLC, the number of therapists employed is not always reduced. The workload on the dosimetrist can actually be higher with MLC due to increased verification requirements.

Even with increased throughput potential, radiation oncologists must be willing to use MLC rather than custom blocks in most situations in order to take advantage of its efficiency. With distinct competencies in capitalization and maintenance costs, field size, and advantages with specific procedures such as mantle fields, block cutting will continue to play an active role as a strong compliment to MLC technology. Leaf-span limitations and physician objections can be additional barriers to the acceptance of MLC technology. MLC does not cover 100% of all procedures and applications. A combination of MLC and custom blocks can be used for the same field.

Radiotherapy departments have a high degree of familiarity with block cutting accuracy and reliability. Most computerized shielding block cutters utilize a highly accurate CNC cutting mechanism that drives a temperature-adjustable hot wire cutter. (Figure 1) An application program digitizes and stores files for reference or alterations, and has built-in checks to minimize operator error and consequently, remakes. Digitized block outlines can be easily transferred from treatment planning systems. This eliminates the need to input block outlines from radiographs, saving time and minimizing redundancy. The imported outlines from treatment planning systems can be cut immediately or stored for later use.

Many block cutters also feature a digitizing table with calibration lines for X-ray alignment. (Figure 2.) The operator traces the radiograph with a digitizing mouse which sends location data to the built-in software.

The outline is visible on the monitor and can be sent to the printer for examination of the printout or to the hot wire cutter for block cutting.

Figure 1.

FIgure 2.

The operator often has the opportunity to select any cut path to connect more than one block outline. Most block cutting systems also allow easy input of patient and block information and preset function keys that simplify multi-step operations. Contour data can be stored, inverted and easily edited. Data such as source-to film distance, source-to-axis distance and source-to tray distance can be programmed into the computer before block cutting.

Conclusion

Block cutting is a time-proven, well established component of radiotherapy that will continue to bridge the gap to emerging technologies in 3DRT. The cost-benefit factors of MLC and IMRT are not clear-cut. Radiotherapy administrators must weigh conflicting priorities in the acquisition and adaptation of new technologies. Advances in patient care and the desire to increase the level of competitive service must be balanced against budgetary constraints that can make expensive new technology difficult to justify. ■

John O'Flaherty has served as Advertising/Communications Manager for Huestis Medical, Bristol, RI, USA since joining the company in 1997. He is responsible for the marketing and advertising of Huestis Medical products for the radiotherapy and diagnostic imaging markets. He holds a degree in marketing from the University of Rhode Island.