Severe late toxicity involving the lungs, kidneys and thyroid was relatively low. The risk of second cancers was acceptable. Our study indicates that this approach is both safe and effective.

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A 3D OPTICAL SCANNER FOR IMAGE ACQUISITION IN 3D PRINTING- OPTIMIZING IMAGE ACCURACY THROUGH THE DEVELOPMENT OF AN IN-HOUSE DESIGNED GANTRY  
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Purpose: The use of 3D printing for medical use is well established and has been utilized in clinical practices ranging from surgical planning to individualized medical implants. Three-dimensional printing has been implemented at our institution to create customized treatment accessories such as shielding and medical implants. Three-dimensional printing has been implemented at our institution to create customized treatment accessories such as shielding and medical implants. Three-dimensional printing has been implemented at our institution to create customized treatment accessories such as shielding and medical implants. Three-dimensional printing has been implemented at our institution to create customized treatment accessories such as shielding and medical implants.

Results: An anthropomorphic head phantom was used to quantify the accuracy of the gantry-mounted 3D scanner. Meshes acquired using the 3D scanner were compared to a mesh generated from a high resolution CT scan, which was taken to be the gold standard. Optimal scan settings were identified and final accuracy of the gantry was quantified using the 3D scanner.

Conclusions: This work demonstrates that an in-house 3D scanner can be utilized to acquire accurate topographical information with near clinical accuracy. Further, this same scanner can be used to design custom shielding for 3D printing of shielding structures.

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CAN VMAT IMPROVE CONFORMALITY WHILE MAINTAINING KIDNEY DOSE FOR SEMINOMA PATIENTS  
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Purpose: To evaluate the use of VMAT planning techniques for para-aortic and ipsilateral pelvic irradiation in seminoma patients, driven by standard kidney contours and automatically generated concentric rings about the PTV.

Material and Methods: Ten seminoma patients with small volume retroperitoneal nodes (< 5 cm) were randomly selected. CTV2 included the gross tumour plus a 5 mm margin, and CTV1 was contoured based on an expansion of blood vessels. PTV was defined by addition of 5 mm margin around the corresponding CTV, with PTV1 extending from 2 cm below the top of kidney to the top of femoral head, and modified to exclude both kidneys. The prescription dose (in 20 fractions) was 25 and 35 Gy for PTV1 and PTV2 respectively. Abdominal and pelvic organs at risk (OAR) were contoured. For each patient, a conformal (AP-PA, 18 MV) and VMAT (two 360-degree coplanar arcs, six MV, 15-degree collimator twist) plans were created. Dose constraints for the VMAT optimization were set at < 50% and < 30% for the kidneys (D50% < 350 cGy, max EUD < 350 cGy); RingPTV2+2 cm (max dose = PTVmin). Normal tissue 4 cm beyond PTV (max dose < 1000 cGy, D50% < 150 cGy, D2% < 500 cGy). No other structures were included in the optimization. The maximum (D2%), mean (D50%) and minimum dose (D98%) for PTVs and OAR were obtained and compared between plans.

Results: There was no difference in the coverage of PTV2, while VMAT provided better PTV1 coverage: mean D98% was 24.2 Gy +/- 0.16 versus 23.9 Gy+/-.0.25 (p = 0.05). Use of VMAT reduced the volume of normal tissue receiving 95% of the prescribed dose from 11% to 2%, compared to the conformal AP-PA plans (p = 0.005). Kidney D2% was reduced by 6 Gy with VMAT (p = 0.03), while the kidney D50% was 1.3 Gy higher (p = 0.01). There was no significant difference in D2% or D50% for either heart or pancreas. VMAT reduced spinal cord dose: D2% (28.2 Gy +/- 2.2 versus 32.0 Gy +/- 4.4, p = 0.02) and D50% (12.6 Gy +/- 8.7 versus 19.8 Gy +/- 7.4, p = 0.01), and reduced the D2% for bone marrow (p = 0.01), large bowel (p = 0.05) and stomach (p = 0.05) but not for bladder or liver. Conversely, the conformal APPA resulted in higher D50% to bone marrow (p = 0.01), large bowel (p = 0.05), stomach (p = 0.01), bladder (p = 0.05) and liver (p = 0.05).

Conclusions: It is possible to generate organ-sparing VMAT plans with only the kidneys and automatically generated concentric PTV rings included in the optimization process. Use of VMAT for para-aortic/pelvic irradiation improves the conformity of the isodoses to the PTV and reduces the maximum dose to the surrounding OAR, but at the cost of an increase in the low dose region.

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USING OPTICAL SCANNER AND 3D PRINTER TECHNOLOGY TO CREATE LEAD SHIELDING FOR RADIOTHERAPY OF FACIAL SKIN CANCER WITH LOW ENERGY PHOTONS: AN EXCITING INNOVATION  
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Purpose: Treatment of non-melanoma skin cancers of the face using ortho-voltage radiotherapy may require lead shielding to protect vulnerable organs at risk (OAR). As the human face has many complex and intricate contours, creating a lead shield can be difficult. The process can include creating a plaster mould of a patient’s face to create the shield. It can be difficult or impossible for a patient who is claustrophobic or medically unable to lie flat to have a shield made by this technique. Other methods have their own shortcomings. We aimed to address some of these issues using an optical scanner and 3D printer technology.

Methods and Materials: The clinicians identified three patients with skin cancer involving the nose who required treatment with ortho-voltage radiotherapy using lead shielding to protect vulnerable organs at risk (OAR). Using non-melanoma skin cancers of the face as an example, we describe how to fabricate a lead shield using an optical scanner and 3D printer.

Results: We were able to fabricate a lead shield using an optical scanner to acquire the topographical information of the patient’s face. This information was then used to design and print a custom lead shield using a 3D printer. The lead shield was then fabricated from lead sheet material. The shield was contoured to fit the patient’s face and was secured using surgical tape. The shield was used during the course of radiotherapy.

Conclusions: Using optical scanner and 3D printer technology to create lead shielding is a feasible and cost-effective method to provide safe and effective radiation therapy for non-melanoma skin cancers of the face.