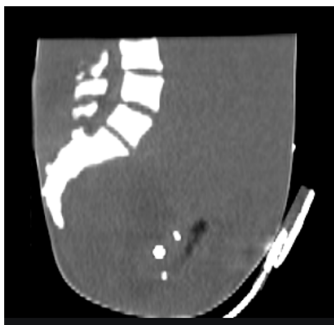


Physical Assessment of BolusCare

CT-based geometry capture, treatment planning and dosimetric measurements

Patient-specific geometry and planning CT

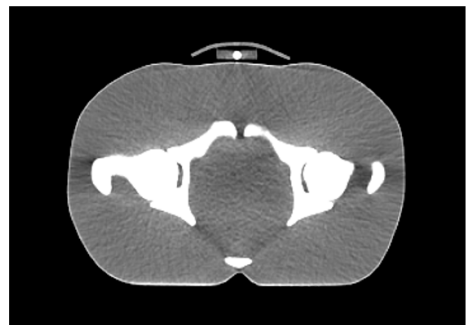
When molding the bolus to the patient-specific anatomy, individual bolus configurations are created, with varying thicknesses depending on the surface characteristics as well as the tumor location and entity. If BolusCare is positioned on the patient already during acquisition of the planning CT, the actual patient-specific geometry, including the local bolus thickness, is captured in the CT dataset and can therefore be taken into account during the subsequent treatment planning process. The manufacturer specifies a material density of approximately 1.6 g/cm^3 for BolusCare. In the treatment planning system used, a density of approximately 1.7 g/cm^3 was assigned.



Sagittal view with ionization chamber



Axial view with ionization chamber and patient-specific bolus



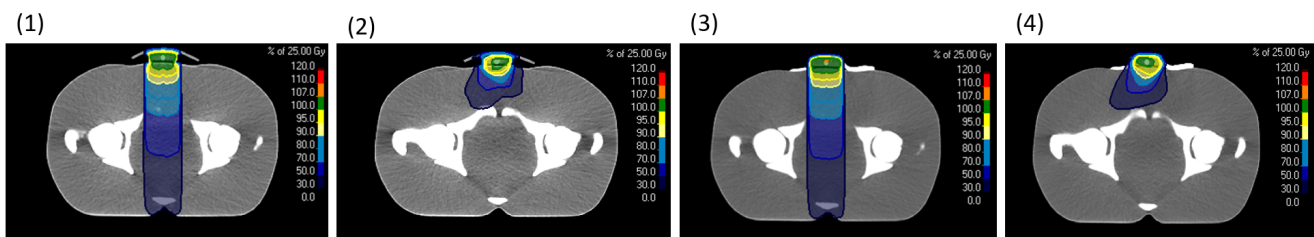
Axial view with ionization chamber and attachable secure with adhesive tape

CT images: ionization chamber, patient-specific moldable bolus and conventional bolus secured with tape.

Dosimetric measurements and comparison

In dosimetric measurements of both an intensity-modulated and a 3D-conformal treatment plan, using both BolusCare material and a conventional bolus, even smaller deviations were observed for the moldable bolus. For this purpose, an ionization chamber was placed inside a plastic chamber, which was then fixed to a pelvic phantom together with the respective bolus (see Figure). For the VMAT point-dose measurement, the deviation from the calculated dose was 0.23%, while for the static-field treatment plan, the deviation was only 0.094%. In comparison, the treatment plans using the conventional bolus showed deviations of 0.48% for VMAT and 0.66% for the static-field plan.

Treatment plan	BolusCare	Conventional bolus
VMAT	0.23%	0.48%
Static field	0.094%	0.66%



Dose distribution using conventional bolus with (1) static-field and (2) VMAT techniques, and using the moldable BolusCare bolus with (3) static-field and (4) VMAT techniques.

Dose distributions: conventional bolus (1) static field, (2) VMAT; BolusCare (3) static field, (4) VMAT.

Conclusion

For all investigated phantom configurations and treatment plans, very good agreement was observed between the dose calculated by the treatment planning system and the measured dose. The results demonstrate that BolusCare could be adequately accounted for within the investigated CT-based treatment planning and dose calculation workflow. However, if a virtual bolus is used after acquisition of the planning CT, the local bolus thickness should be assessed separately.

M.Sc. Pauline Riethmüller | Medical Physicist