BolusCare^{TM}: A Two Component Bolus

Bolus material is routinely used in radiation therapy for the treatment of superficially located tumors. However, the reproducible positioning of conventional bolus materials is often limited, creating a strong need for precise adaptation of the bolus to the patient's individual anatomy while minimizing air gaps at the tissue–bolus interface.

The dose build-up effect of both photon and electron beams presents a significant challenge in clinical practice, particularly for superficial tumors. The use of bolus materials can increase the skin dose and thereby achieve the desired therapeutic outcome, such as improved local tumor control. However, various studies have shown that bolus positioning, reproducibility, and the resulting air gap between the bolus and the tissue can alter the delivered skin dose. Consequently, these factors may reduce treatment effectiveness and, in some cases, compromise or even prevent therapeutic success[1][2].

1 Problem Statement

Typical clinical applications of boluses with varying thicknesses include chest wall irradiation following mastectomy, as well as the treatment of head and neck cancers and skin tumors. Boluses are also commonly used for superficial sarcomas of the extremities and for scalp lesions with skin infiltration[3][4][5]. Particularly in these anatomical regions, the surface geometry is highly irregular and curved. Consequently, fitting a standard bolus using adhesive fixation methods often results in varying air pockets between the bolus and the skin, making reproducible positioning challenging.
As a result, the dose distribution delivered to the tumor may differ from the planned distribution during each treatment fraction. To address this issue,literature recommends the use of patient-specific 3D-printed boluses generated from planning CT data. However, 3D printing is associated with substantial costs and increased preparation time, and access to this technology is not available at radiation therapy clinic[3][1].

2 BolusCare^{TM} - A Moldable Bolus

An alternative approach to achieve the desired surface dose while compensating for anatomical irregularities is provided by the two-component bolus offered by BolusCare^{TM}. In this system, Components A and B are mixed in equal proportions and kneaded until a homogeneous color is achieved. The resulting material can then be molded directly to the desired anatomical surface within approximately one minute. Following application, the bolus fully cures and hardens within five minutes, creating a patient-specific fit.

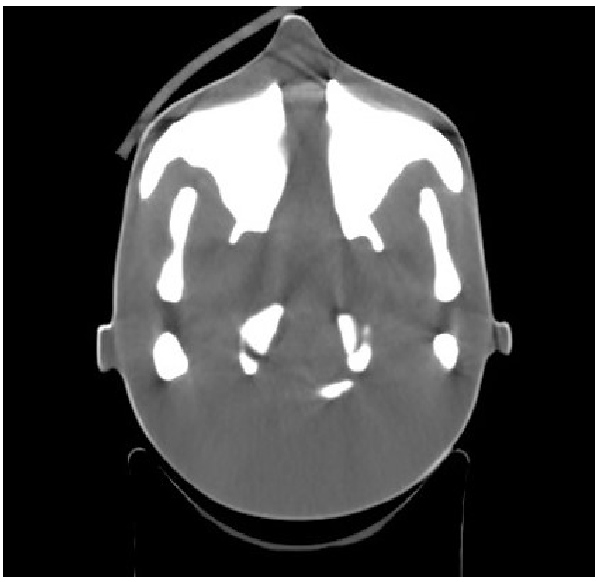

Figure 1: Prefabricated Bolus fixed with adhesive tape.

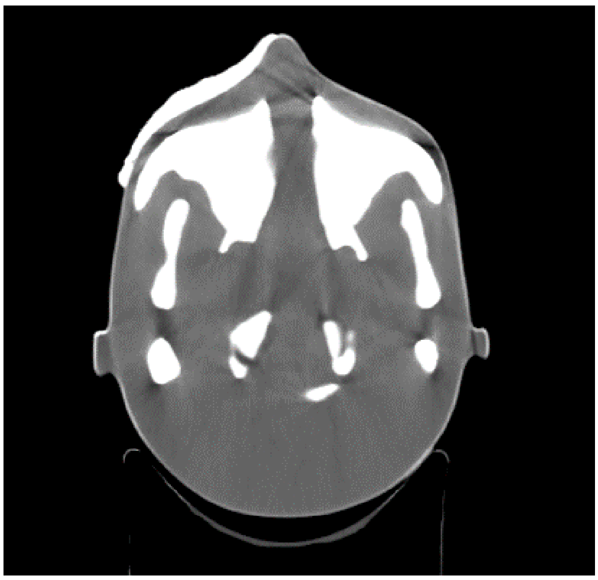

Figure 2: Exact fitting to patients anatomy mith the two component bolus.

A patient-specific bolus is thus molded to the target region, minimizing air inclusions. Due to the material properties, it maintains its shape and structural integrity consistently throughout the treatment period.
However, patient comfort and reproducibility of positioning are not the only aspects that are improved: by directly capturing the bolus in the planning CT and thus also incorporating it into the radiotherapy treatment planning, dose calculation becomes more accurate while simultaneously ensuring a reproducible surface dose (see Fig. 3 and 4).

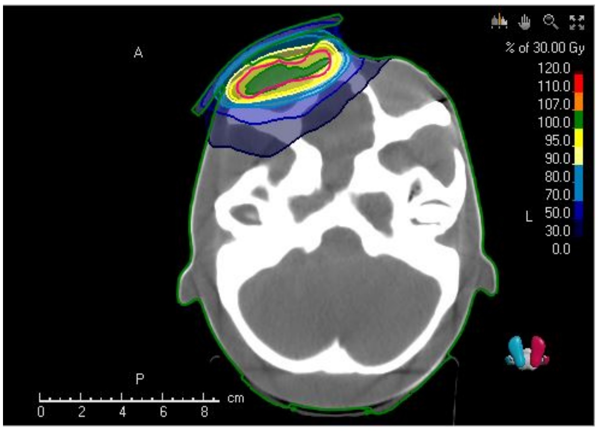

Figure 3: Dose distribution of a VMAT technique with prefabricated bolus.

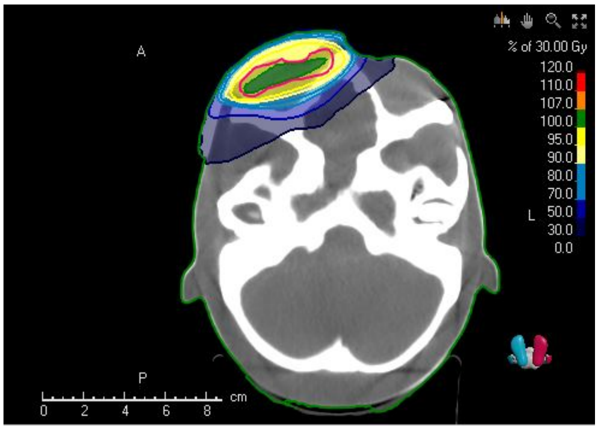

Figure 4: Dose distribution of a VMAT technique with molded bolus by BolusCare^{TM}.

Thus, the two-component bolus provides a robust, patient-specific alternative to 3D-printed boluses and moulages, while also representing a necessary advancement over prefabricated, flat-placed bolus materials. In addition, the use of moldable boluses can be extended to further indications, such as range adaptation in electron therapy for benign conditions like Dupuytren's disease (according to the S2e guideline of DEGRO [6]), or the patient-specific fabrication of a moulage in superficial brachytherapy. Accordingly, the wide range of applications, ease of handling, and improved safety and precision in patient treatment clearly support the integration of kneadable bolus materials into routine clinical practice.

References

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