JULY 12–16 2020 VIRTUAL JOINT AAPM | COMP MEETING
EASTERN TIME [GMT-4]

Dosimetric assessment of transparent polymer-gel type bolus for commonly used breast treatment delivery techniques

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INTRODUCTION

To increase radiation dose close to the skin for postmestectomy radiation treatment, tissue-equivalent superflab bolus is normally placed on the skin of the treatment area. However, while superflab is elastic, it is not flexible enough to fully conform against an irregularly shaped chestwall surface or a prominent surface shape such as those due to either a breast expander or implant. Also, superflab is too opaque to clearly see skin marks, tattoos, or scars underneath.

Two different types of bolus have been introduced to the clinic with the purpose of improving on these limitations of superflab:

- Brass mesh bolus (BMB), has better topographical conformality for patients with either breast implants or irregular chest wall contours
- A recently introduced clear polymer-gel bolus (PGB), which is characterized by its transparency and flexibility

AIM

To investigate skin dose enhancements of brass mesh bolus (BMB) and a recently developed transparent polymer-gel bolus (PGB) for clinically relevant breast treatment delivery techniques. The dose enhancement of the breast skin with BMB and PGB are compared to that of superflab bolus.

RESULTS

Skin measurements relative to 180cGy fractional dose:

- Dose with no bolus between all plan types ranged from 51.2% to 64.2% as measured with EBT3 film
- Dose as calculated in Eclipse with no bolus ranged from 48.7% to 60.6%

	Eclipse	EBT3 Film
FiF - Step & Shoot	54.60±11.1%	64.17±2.8%
Electronic Compensator - Sliding Window	60.60±11.7%	63.69±3.0%
VMAT - Arc Therapy	48.70±10.2%	51.25±2.7%

TABLE 1: Mean values from the center ROI of EBT3 film with no bolus relative to the prescription dose of 180 cGy, delivered from each plan type, and as calculated in Eclipse for FiF plan, EC 3DCRT plan and for the VMAT plan. Standard deviation included and accounts for ROI from EBT3 film for all three readings; Eclipse TPS reports standard deviation of dose within structures automatically.

Skin measurements with Bolus relative to 180cGy fractional dose, averaged over three measurements:

- All treatment techniques with addition of any bolus type brought skin dose between 88.4% to 107.4%
- Measured skin dose agreed with 3.0% for superflab and PGB
  - Standard deviation of 2.5% to 5.7% across these data
- Measured skin dose agreed with 6.0% for superflab and BMB
  - Standard deviation of 3.3% to 6.5% across BMB data
- Least enhancement seen with 1 layer BMB to 88.4% when VMAT delivery was utilized
- Greatest enhancement observed with 10mm equivalent PGB to 107.4% when VMAT delivery was utilized
- Variation in skin dose measurements were with 11% across all bolus types and techniques with respect to repeated measurement values over 3 deliveries

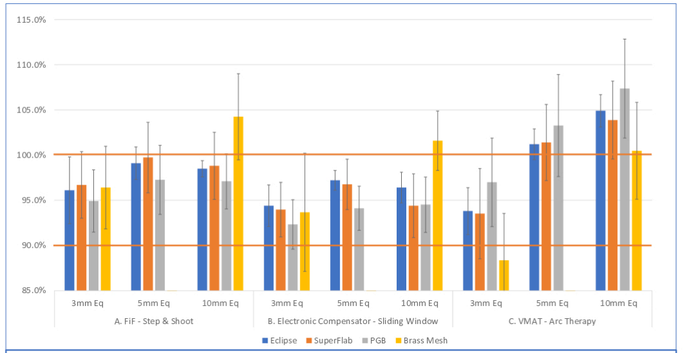

Figure 3. Mean values from the center ROI of EBT3 film under bolus relative to the prescription dose of 180 cGy, delivered from each plan type, and as calculated in Eclipse for A. FiF 3DCRT plan, B. EC 3DCRT plan and for C. the VMAT plan. Standard deviation included and accounts for ROI from EBT3 film for all three readings ; Eclipse TPS reports standard deviation of dose within structures automatically.

METHOD

- Three breast treatment plans were generated using the CT scans of an anthropomorphic chest phantom:
  - Tangential step-and-shoot 3D conformal Field-In-Field (FiF)
  - Tangential sliding-window 3DCRT, electronic compensator (EC)
  - Volumetric modulated arc therapy (VMAT)
- Gafchromic EBT3 films, all calibrated from a single batch, were used to measure skin dose for different bolus types using 5x5cm squares.
- Each plan delivered without bolus, and with each specific bolus type, for a total of 9 deliveries per plan. This was repeated 2 more times per delivery, for a total of 27 beam deliveries.
- Skin dose calculations from eclipse were also obtained, using a structure at the location of the film, extending 2mm into phantom

Figure 1: Chest phantom with smoothed surface for EBT3 film placement, covered with PGB, highlighting transparency and conformality/surface adherence over phantom surface.

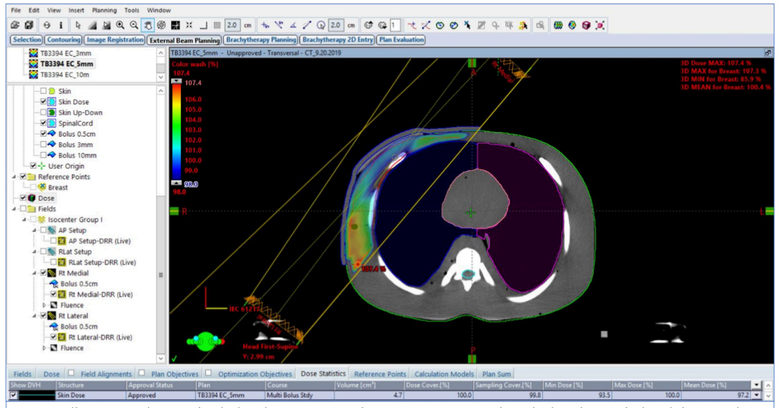

Figure 2:Illustration showing both the chosen tangent beam trajectories and a calculated 5mm bolus sliding window plan as generated in Eclipse TPS. Colorwash shown depicting 98% or greater dose values relative to chosen prescription dose.

CONCLUSIONS

Both BMB and PGB can be utilized accordingly instead of superflab when flexibility and transparency respectively is required:

- Complete dosimetric study of the BMB and PGB by measuring skin doses with three clinically relevant breast treatment techniques
- Dose enhancement with bolus shows that the skin dose of breast patients increases ≥ 88% of the prescription using any three types of bolus
- In particular, our study shows that PGB is a clinically equivalent bolus option for the 3, 5 and 10mm equivalent thicknesses available

CONTACT INFORMATION

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