Study of dose modification in skin cancers induced by the kind of bolus used

Authors *: J. Camilleri, A. Laprie, A. Sors, P. Kerjean, JC. Kerjean, H.Gros Dagnac, E. Moyal, M. Delannes et X. Franceries.*

Introduction :

Carcinomas skin treatment can be performed with high energy electron beams with the use of equivalent tissue boluses. This technique allows to move up the maximum dose depth at skin surface and thus to treat the target volume with more efficiency.
Objectives of this study are twofold :

- **To propose** new treatment solutions with the use of bolus layers, by minimizing the presence of air-gap, between the silicone layer and skin surface.
- **To quantify** and evaluate dose modifications induced by these news methods.

Materials and Methods:

Studied lesion is a large basal cell skin carcinoma (*i.e. 2x0.8x0.6 cm³*) placed at the eye corner. Treatment is performed with the use of a bolus layer of 0.5 centimeters thickness during irradiation.

Many combinations were tested with an anthropomorphic head phantom:

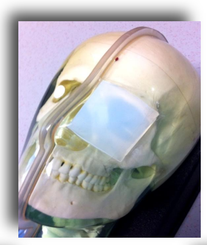
- *The use of a **single bolus layer of 0.5 centimeters thickness**.*
- *The use of **multiple superimposed thinner bolus layer cutted to conform lesion morphology**.*
- *The use of a **bolus layer attached to a thermoformable material (Boluformable ®)**.*

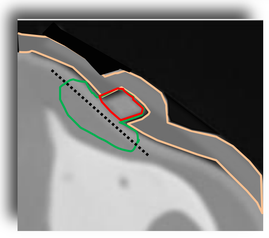
Brand's bolus layers used are Bolusil®. CT volumes were performed for each combinations described above in order to quantify the air volume, situated between the silicone layer and phantom surface. CT-DICOM acquisitions were transferred on a TPS (Eclipse®) in order to evaluate dose modification due to air-gap thickness variation for a prescription of 60 Gy delivered by an electron beam (6 MeV).

Results and Discussion:

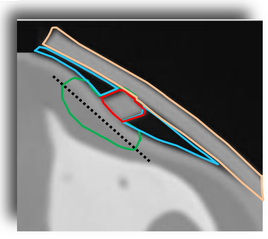
Classical use:

i.e. use a single bolus layer of 0.5 mm.





Virtual bolus defined by the TPS

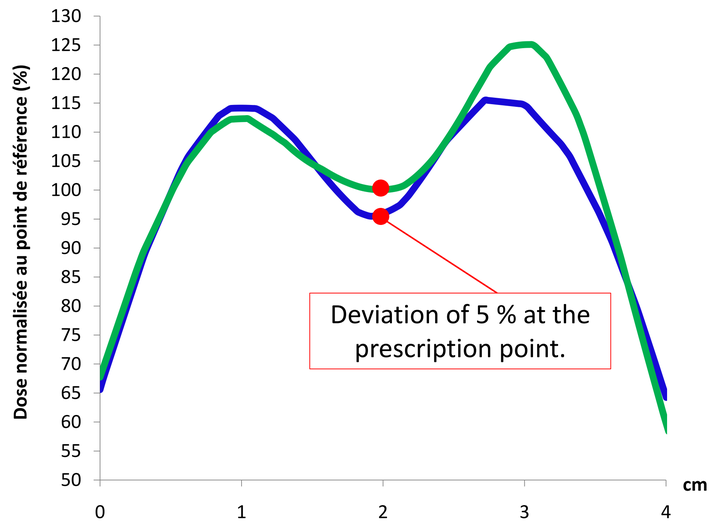


Real bolus of 0.5 cm

Virtual bolus: **283 UM**
Real bolus: **257 UM**

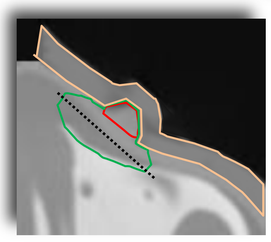
Deviation of 9,18 %

Dose profiles for 283 UM

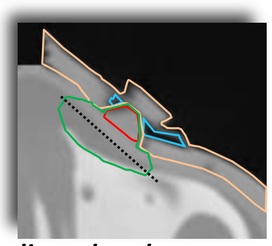


Adjust the bolus shape to the tumor :

i.e. thinner boluses layer adapted to morphology.



Virtual bolus defined by the TPS

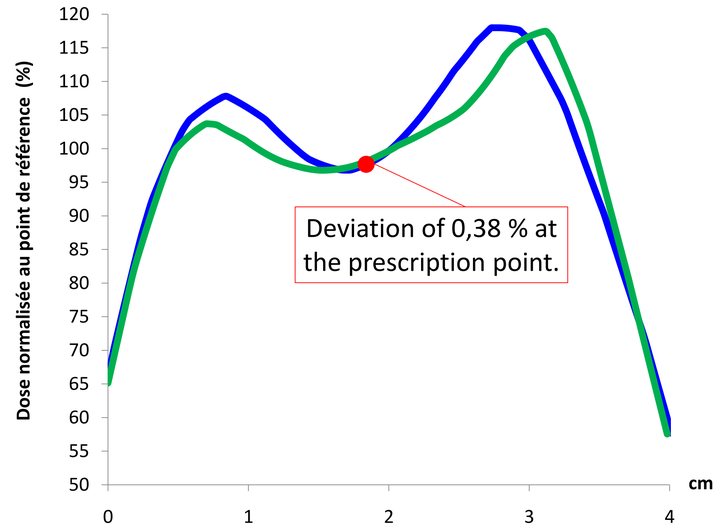


Bolus adjusted to the tumor shape

Virtual bolus: **243 UM**
Real bolus: **241 UM**

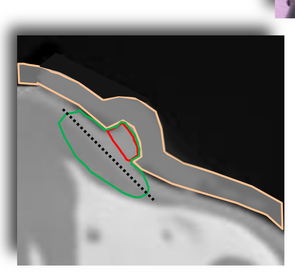
Deviation of 0,82 %

Dose profiles for 243 UM

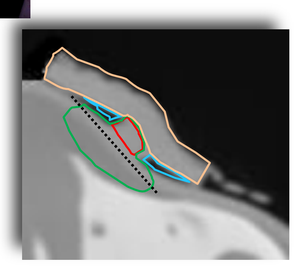


Use a thermoformable bolus:

i.e. equip a bolus layer with thermoformable material.



Virtual bolus defined by the TPS

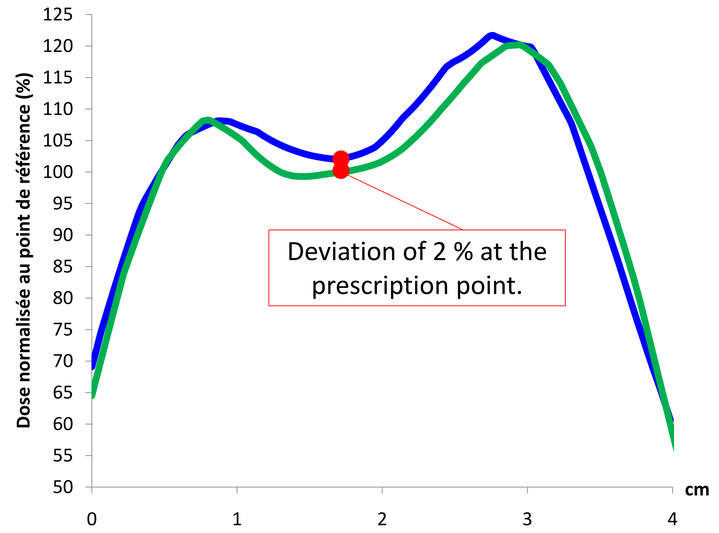


Real bolus thermoformable

Virtual bolus: **242 UM**
Real bolus: **237 UM**

Deviation of 2 %

Dose profiles for 242 UM



GTV **PTV** **Air** **Bolus** **Dose profile associated to the curves**

These results shows important dose modifications due to the presence of air. The use of a single bolus layer increasing this phenomenon (UM's numbers may vary of almost 10 % and we can also see differences dose in some PTV's region of **10%**).
When we adjust the shape of the bolus layer to the tumor, the presence of air is considerably depressed. The TPS forecasts are bitterly reproduced.
Finally, the use of a thermoformable bolus, improves dose accuracy and allows a better reproducibility of positioning.

Conclusion :

Both proposed techniques allow to decrease significantly the air gap from which the issue is originating, then matching more closely Eclipse's forecast and optimizing the dose delivered to the patient

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