

## EA2182: Immobilization and Bolus at Simulation

### 1. Overview

This document is meant to supplement Section 5.2.3: “Immobilization and Simulation” of the DECREASE protocol by adding pictures from case examples, along with additional descriptions.

A custom immobilization device is recommended to minimize set-up variability (see supine and prone setup descriptions below). If no immobilization devices are available, then the straight-leg position is more reproducible than the frog-leg position.

For patients who have disease confined to the anal canal, placement of a radiopaque marker at the anal verge is recommended. For patients who have tumor involvement of the perianal skin, wires or other radio-opaque material should be used to outline gross disease.

### 2. Supine Setup

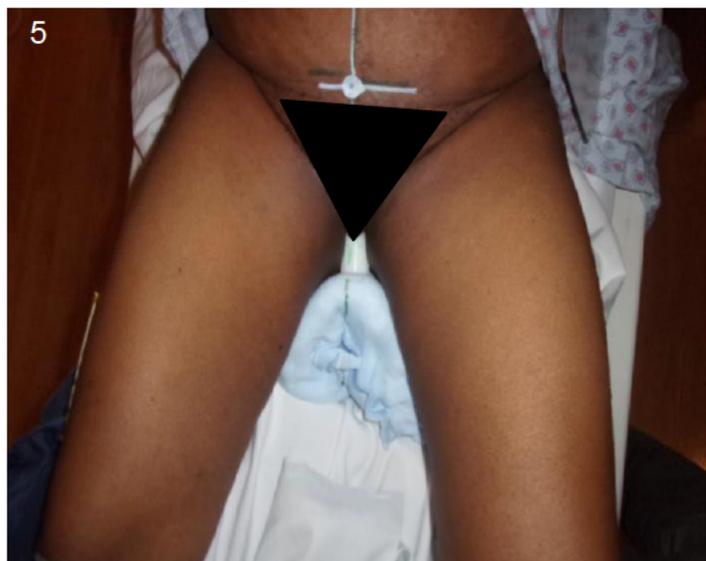
Supine setup in the “frog-leg” position is generally preferred for most patients to offer better setup reproducibility (compared to prone positioning),<sup>1,2</sup> as well as to separate skin folds in the upper inner thighs, groin and genitalia in order to reduce the risk of dermatitis in these areas. In addition, frog-leg position can allow for more accurate displacement of male genitalia away from the RT target volume and enable the use of vaginal dilators for female patients, which can be difficult to adjust in the prone position. In selected patients with difficulty moving into a frog-leg position, a more straight-leg position may be utilized, but ideally there would be separation between the thighs. It will be left to the investigator to decide whether he or she wishes to utilize the supine or prone position.

Custom immobilization of the lower extremities with an Alpha Cradle™ or VAC-LOCK™ for supine patients is required for patients treated in the frog leg position. At our institution, we utilize a wingboard to provide structure in order to build a foot stop and knee bend into the VAC-LOCK, while maintaining the pelvis flat on the table and taking care not to have the bag touch the perineum (Pictures 1-2). A large VAC-LOCK bag is needed to have enough material to support the bend of the knee and leg position. It is helpful to take measurements in order to reproduce the longitudinal distance between reference marks (indicated by red arrows in Picture 3) on the patient’s pelvis and the VAC-LOCK bag. This measurement can help to reproduce the degree of bend in the knee. It can be helpful to measure the widest dimension of the legs plus the VAC-LOCK bag and the highest dimension between the table and the top of the legs plus VAC-LOCK bag in order avoid collision between the patient lying their immobilization device and the head of the LINAC at the time of treatment. Since every LINAC can accommodate different dimensions, it is helpful to place the patient in their immobilization device on the treatment table in advance to be sure there is no collision at the planned treatment isocenter.





For women who will utilize a silicone vaginal dilator during RT delivery, the setup position must be supine in the frog-leg position with creation of backstop to prevent expulsion of the dilator during treatment (Pictures 4-5). It is helpful to mark the dilator at the vaginal introitus to reproduce the depth of insertion (red arrow points to the green pen mark in Picture 4). We have found it helpful to utilize an AccuCushion® moldable form (typically used as head and neck support) placed in between the perineum and VAC-LOCK cradle as a backstop for the dilator as in Pictures 4-5. It is helpful to build the AccuCushion backstop to fit within the VAC-LOCK bag as in Picture 5. We recommend using a dilator with dimensions of ~ 3 cm in diameter and 11 cm in length (Soul Source Enterprises, Portland, OR), or otherwise the maximal dilator diameter that is comfortably tolerated by the patient.3



To reduce dose to male genitalia, it is helpful to utilize a scrotal sling (Picture 6) or shelf (Picture 7) to elevate and displace the genitalia anteriorly, away from the perineum and therefore the high-dose RT field. At the same time, the genitalia should be kept midline so as to not extend superiorly or laterally towards either inguinal RT field. A rolled-up pillowcase placed just

underneath the scrotum (but not pulled tight towards the inguinal radiation target volume) and taped to the lower abdomen on either end can be effective (Picture 6). Alternatively, a shelf can be utilized to achieve this effect and can be integrated into the VAC-LOCK bag (Picture 7).<sup>4</sup>



### 3. Prone Setup

Prone setup is not the preferred treatment position for most patients because there is increased rotational setup variability compared to supine positioning, which in most cases negates the potential benefit of using a bowel displacement device like a belly board due to the requirement for a larger PTV margin. This has been found to be the case for both rectal and gynecologic cancer patients undergoing IMRT with daily image-guided RT.<sup>2,5</sup> However, patients with a significant degree of tumor extension into the perianal skin may benefit from prone positioning in order to ensure accurate bolus positioning. We recommend utilizing a VAC-LOCK™ bag to abut the lower edge of the belly board to ensure accurate immobilization of the lower extremities and provide separation between the thighs (Pictures 8-9). In Picture 9, rolled towels were utilized to provide separation between the thighs to reduce skin reaction from radiation. In the prone position, care must be taken to ensure that male genitalia are directed inferiorly towards the patient's feet and does not get pushed superiorly or laterally in the direction of the inguinal or perianal RT target volumes. A knee cushion can be built into the VAC-LOCK bag (Picture 10).





#### 4. Use of Bolus

It is recommended that bolus be utilized if the primary tumor involves the anal margin, perianal skin, or if it protrudes through the anal canal. In some cases with very minimal tumor involvement at the anal verge, there is sufficient normal buttock tissue to cover the tumor (with 1.5-2 cm or more of normal soft tissue) and thereby provide buildup of radiation dose in order to not require bolus. Bolus over the groins is not recommended as this can increase dermatitis reaction and all patients enrolled in this protocol have clinically uninvolved inguinal lymph nodes.

Bolus should be carefully tailored to cover only the specific areas of concern, such as gross tumor involving the perianal skin. It is recommended that bolus be utilized if there is less than 1.5-2 cm between GTV in the perianal skin and the end of the buttock tissue (free air). This is because it will be necessary to cover GTV with margins of 1.5-2 cm (which will vary depending on the PTV margin selected) with the full prescription dose.

If bolus is necessary as described above, it is highly recommended that bolus be placed at the time of the CT simulation scan. Alternatively, virtual bolus can also be added at the time of RT planning and used to guide actual bolus placement at the time of treatment.

We prefer using 5 – 10 mm of tissue-equivalent bolus (Superflab or equivalent) to provide adequate density for buildup over the skin surface with or without either wet gauze or petroleum jelly underneath to fill in airgaps within underlying cavities (such as the perineum and/or gluteal cleft). Saran wrap can be used to envelop wet gauze and/or petroleum jelly to hold moisture in place and allow for ease of removal, as was done in Pictures 11-13. The goal is to minimize air gaps between the skin and bolus material in order to improve radiation dosimetry.

Prone Positioning with Bolus: For patients with tumor involving the perianal skin, it can sometimes be easier to manage the bolus material with the patient in the prone position (Pictures 11-13). The bolus can be secured flat against the body by tucking it between the folds of the buttocks, using a towel to keep it flush against the body, and/or using tape (Pictures 9 & 13).



**Supine Positioning with Bolus:** For women with tumor extending anteriorly into the perineal body, it can be useful to utilize the supine, frog-leg position with a strip of Superflab placed underneath the buttocks, extending anteriorly to cover the width of the perineum/vulva and secured with tape to the lower abdomen (Picture 14). In Picture 14, please note that a rolled towel was additionally used to separate the abdominal pannus from the inguinal region to minimize skin reaction from radiation.



## 5. Simulation Imaging

Simulation will be done with the patient in the supine "arms up" or prone "arms up" position using a CT-simulator with a slice thickness  $\leq 3$  mm. The scan regions should be extended at least 4 cm above and below the target volumes, from the L3 vertebral body to 5cm below the ischial tuberosities. Comfortable and reproducible bladder filling is encouraged for simulation and treatment, such as instructing patients to void and then drink 250-300 cc of water approximately 1-2 hours prior to scanning and daily treatment.<sup>2,5</sup> Comfortable and reproducible bladder filling is encouraged for simulation and treatment. IV CT contrast is required in order to define the lymph node target regions, unless the patient has a documented reason for not being able to receive contrast. Placement of an anal marker at the verge or at the inferior extent of the tumor is recommended. If the rectum is distended at the time of simulation (i.e.  $> 4$  cm in diameter), it is recommended that simulation be repeated after further bowel preparation.<sup>6</sup> If rectal contrast is utilized, it is recommended that it be done after the non-contrasted CT scan used for planning so as to not distend the target volume.

## 6. Isocenter Placement

To enable visualization of the entire target volume on CBCT, it is recommended that the isocenter be placed along the patient's midline about halfway between the anticipated superior border of the RT target volume (at L5-S1 for patients assigned to Arm A or the bottom of the sacro-iliac joint for patients assigned to Arm B) and the inferior border at the bottom of the perianal skin/lesser trochanter. This halfway point will often fall near the top of the pubic

symphysis. However, in some cases, it may not be possible to image the entire length of the treatment volume all within one CBCT scan. In this case, it is important to prioritize visualization of the lower half of the treatment field to be sure that the primary anal canal/margin tumor is well aligned on a daily basis. A second CBCT scan of the upper aspect of the treatment field should also be obtained on a regular basis (if not daily) to be sure there are no issues with positioning and alignment.

## References

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