

# APBI Brachytherapy Device Stability and the Importance of Pre-fraction Device QA



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## ABSTRACT

### Purpose:

Recently, several new single-entry, intracavitary breast brachytherapy applicators have emerged with multiple catheters that allow dose modulation to spare normal tissue, such as skin, chestwall, and lung. However, since these catheters are differentially loaded with the HDR source, care must be taken to ensure there is no rotation, change in the device, or change in cavity conformance that could potentially alter the dose modulation from beneficial to detrimental. In this study, we retrospectively assess the rotational stability, strut symmetry, and cavity conformance of the SAVI device.

### Methods and Materials:

Fifty patients treated at UC San Diego with the SAVI device were retrospectively reviewed for the number of patients that needed re-planning as a function of rotation, strut asymmetry (splay), cavity conformance, or a combination of these factors. At our institution, the radiation oncologist surgically places the SAVI device followed immediately by a planning CT scan. A treatment plan is generated immediately after the surgical insertion.

### Results:

Of the 50 patients treated, 4 were re-planned for device rotation, 8 were re-planned due a change in strut symmetry, and 2 for cavity conformance; all within a 24 hour window following surgical insertion of the device. An additional 7 of the 50 (14.0%) were re-planned outside of the 24 hour window, making them unexpected re-plans, primarily due to rotation.

### Conclusion:

The interfraction stability of multicatheter, intracavitary breast devices is crucial for efficacy and patient safety. All cases were planned immediately after insertion since they were inserted by the treating radiation oncologist in the HDR suite. However, our recommendation is to allow 24 hours after device insertion for settling of the device, especially in the case of strut splay. Heeding this advice, 14 of 50 cases presented would not have needed re-planning. Obvious strut splay or air pockets necessitate planning to be delayed for 24 hours to allow stable conformance. In practice, with a 24 hour time window between insertion and planning only 14.0% of cases reviewed needed re-planning due to changes in the position or symmetry of the device. All of these cases were re-planned regardless of the amount of change; however, further analysis will evaluate the dosimetric relevance of the re-plan. This study also demonstrates that daily evaluation of the device before each fraction is essential to evaluate rotation, strut symmetry, and cavity conformance.

## INTRODUCTION

The SAVI (Strut-Adjusted Volume Implant) breast brachytherapy device by Cianna Medical is a multicatheter device used for partial breast irradiation. The device has an open, cage-like geometry with a central channel and either 6, 8, or 10 peripheral struts. The peripheral struts allow <sup>192</sup>Ir dwell positions adjacent to the lumpectomy cavity walls, which in turn allows for sculpting of the dose to a patient's individual anatomy. This has the advantage of no skin spacing or chestwall restrictions, but the disadvantage of careful QA to ensure no interfraction device changes. There are several changes that can occur over the course of a patient's treatment including device rotation, device deflation or collapse, strut asymmetry, or air gaps opening or closing. There are several new multichannel devices on the market for accelerated partial breast irradiation such as the SAVI, Contura, and new MammoSite device. All of these device require careful QA to ascertain any changes in the device or patient over the course of treatment and this study looks at the SAVI specifically.

## OBJECTIVES

The purpose of this study is assess the device and patient changes that can occur over the course of partial breast irradiation while using the SAVI device and the QA steps that can be taken to address any of these changes.

## METHODS

SAVI placement at UC San Diego is performed by the treating radiation oncologist. The radiation oncologist places the device under ultrasound guidance in the HDR suite and then the patient is taken for a CT scan for planning. Fifty patients treated at UC San Diego with the SAVI device were retrospectively assessed for the number of patients that needed re-planning as a function of rotation, strut asymmetry (splay), cavity conformance, or a combination of these factors.

## RESULTS

Of the 50 patients treated, 14 patients (28.0%) had changes all within a 24 hour window following surgical insertion of the device; 4 were re-planned for rotation, 8 were re-planned due a change in strut symmetry, and 2 for cavity conformance. An additional 7 of the 50 (14.0%) were re-planned outside of the 24 hour window, making them unexpected re-plans, primarily due to rotation.

## DISCUSSION

Since multichannel HDR devices can shape dose to a patient's anatomy, dose can be limited to normal tissue. However, due to the extreme dose modulation that can be achieved, device changes can lead to differences between the planned dose and received dose. Thus, care must be taken when using the multichannel devices to ensure consistency between the planned and treated device and patient geometries. At UC San Diego, the treating radiation oncologist inserts the intracavitary devices post-lumpectomy in the HDR suite. A CT scan is taken immediately after insertion for evaluation and planning. However, this is not the case at most institutions, as most patients will come for radiation treatment with the device in place for at least 24 hours. This is important as we have found that the majority of implant "settling" is done in the first 24 hours after the implant. From our date, scanning and planning less than 24 hours from insertion leads to a higher than normal incidence of re-scanning and re-planning due to changes in either the device or the patient tissue surrounding the implant (conformance). Fifty patients who were treated with the SAVI intracavitary device for accelerated partial breast irradiation were retrospectively analyzed. The data shows that in 28.0% of the patients, changes occurred within the first 24 hours following device implantation. Therefore, waiting 24 hours after the implant to scan the patient would have prevented 28.0% from needing a re-plan. There were 7 patients who had changes occur outside the first 24 hours. Five of the seven patients had device rotation which was found in orthogonal x-ray films (AP and Lat scout films). In the other two patients, one had a strut splay that corrected after 4 days and the other had an air gap (conformance) close at the tip of the device. Careful monitoring of patients with predisposition to device changes is crucial in the HDR QA program. The patients with a "predisposition to changes" are those with splayed struts, conformance problems, and other complicating factors. For example, one of the seven patients with a device rotation outside the 24 hours window came with a CED in place for over a week. This seemed to affect the lumpectomy cavity wall and allow the SAVI to rotated more freely inside the cavity. A good quality assurance program for the multichannel intracavitary devices needs to include assessment of in/out motion of the device, rotational motion of the device, and tissue conformance on an interfraction basis.

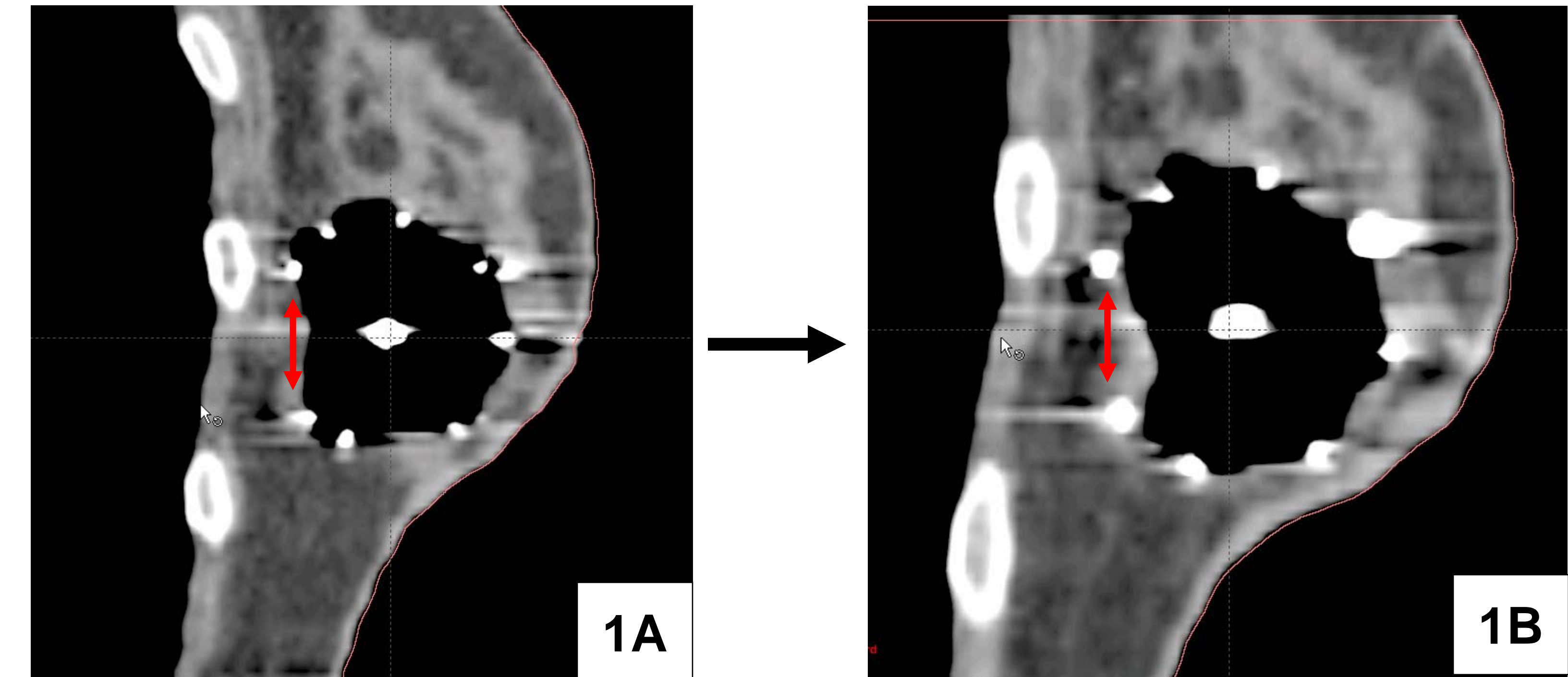


Figure 1A & 1B. Strut splay in a SAVI device (1A) and correction (1B). The struts against the chest wall have come closer together in 1B, 24 hours post-insertion.

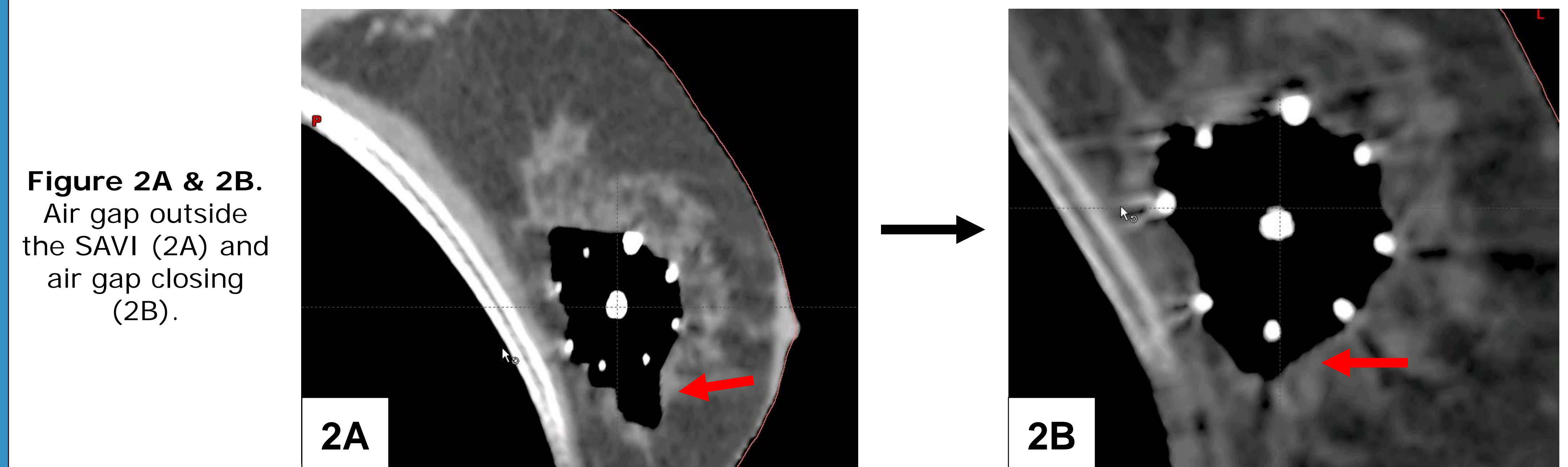


Figure 2A & 2B. Air gap outside the SAVI (2A) and air gap closing (2B).

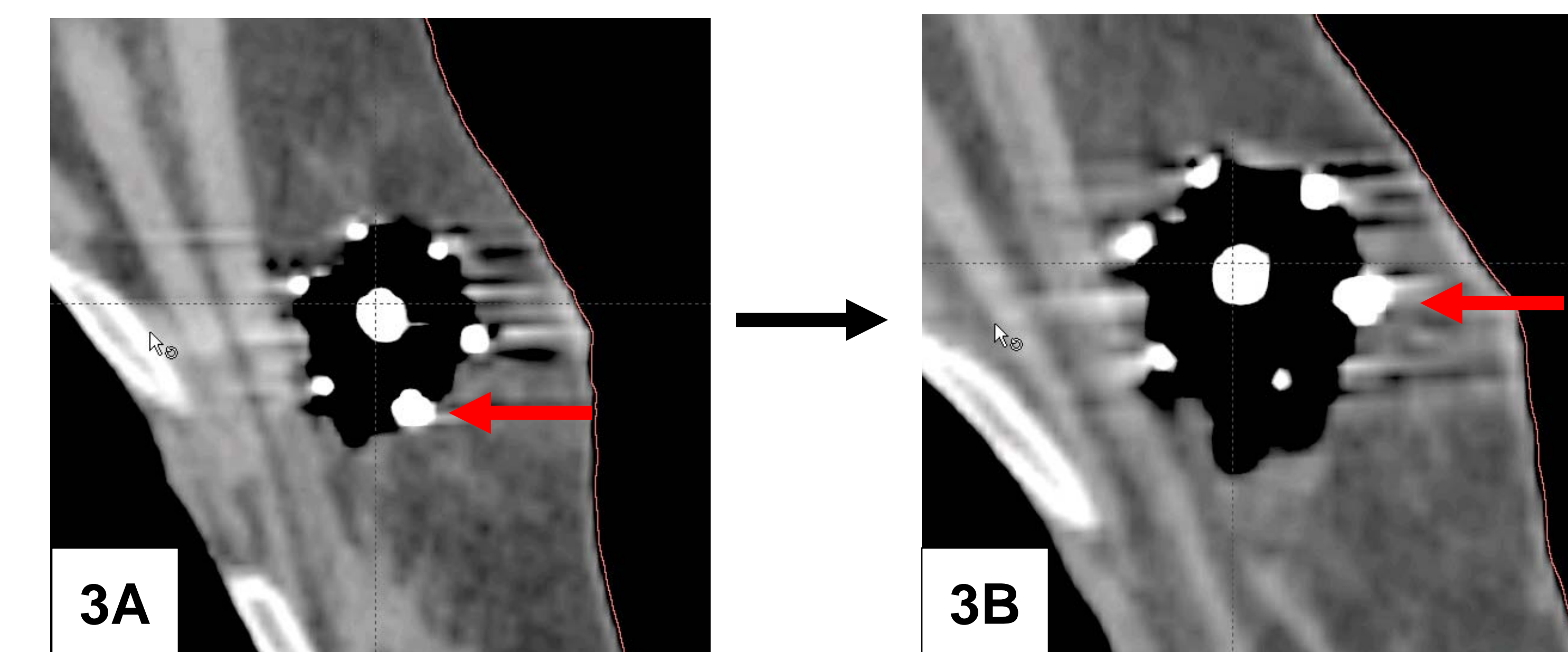


Figure 3A & 3B. SAVI device rotating in the cavity – 3A (before) and 3B (after) – counter-clockwise rotation shown. The red arrow points to catheter 4 which has gone from the 5 o'clock position in 3A to the 3 o'clock position in 3B.

## CONCLUSIONS

Fifty patients studied at UC San Diego suggest that the majority of device or patient changes occur within the first 24 hours after intracavitary implant. Therefore, waiting 24 hours after implant to perform the CT planning scan eliminates the majority of re-scans and plans. However, there are still a few groups of patients that need close monitoring during the implant duration to ensure the planning scan corresponds to the current geometry. Nevertheless, it is important to have a good quality assurance program implemented in a HDR program. Pre-fraction checks should be implemented to check for device motion or changes in device/patient geometry.