

# Lateral isocenter deviations with source-to-skin distance variation in radiation treatments of pelvic cancer

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**Introduction:** The evolution of radiotherapy throughout the 20<sup>th</sup> century allowed it to become a therapeutic modality widely used. The accurate administration of radiation treatment to a patient, the setup and positioning are extremely important. The Source-to-Skin Distance (SSD) can be used as a verification of patient's correct positioning. Therefore, it is important to study its relationship with the obtained isocenter deviations.

**Objective:** To verify if the Source-Skin Distance (SSD) of lateral pelvic fields is directly related to the lateral (X) deviation of the isocenter position.

## Materials and Methods

### Sample definition

- Treatments between January and August of 2013;
- 37 patients treated in the pelvic region (prostate (8), rectal (12), gynecological (11), lymphoma (1) and bone metastasis (5));
- 665 imaging cases analysed regarding the variation of the lateral SSD value, in the anterior fields;
- Patients treated in supine position;
- Patients with treatment isocenter in a stable localization.

### Immobilization and positioning

- CIVCO® feet and knee accessories (combifix with KNEEFIX™2 and FEETFIX™2);
- CIVCO® Lock-bar (EXACT™);
- Regular pillow or CIVCO® headrest and arm support (POSIREST™-2).

### Treatment aspects

- After the planning CT, the patients were tattooed with 3 marks defining the zero plan, plus 2 alignment marks (midline);
- 3D conformal technique was used for all planned patients;
- Treatment was performed using a Varian Clinac 2100C/D® linear accelerator.

### Treatment positioning

- Patients were daily positioned using all tattoos;
- Deviations from zero plan to the isocenter were performed in the first session and marked in the patient skin.

### SSD measurement

- In the first session, SSD was observed with a lateral orthogonal field and compared with the planned SSD;
- This comparison was performed in a daily basis;
- The tolerance value was defined as 3 mm;
- When this comparison was less than 3mm, portal imaging was obtained during the treatment;
- If the comparison was more than 3mm, portal imaging was performed before treatment;
- Imaging analysis was made on Offline Review®;
- Portal images were obtained regarding the anterior field, to allow the analysis of the isocenter movement in the lateral (X axis) direction;
- Cases with deviation in the Y and Z axis were excluded from the study.

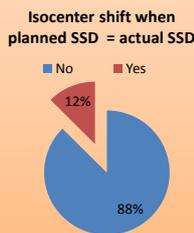
## Results

When deviations between the planned and actual SSD were within tolerance (up to 3 mm), 562 of the cases did show evidence of not having a lateral deviation (X axis) of the isocenter position. This refers to a percentage of 88%.

**Table 1.** Frequency and percentage table of cases with no SSD difference verified.

	Frequency		Total	Total with deviation (%)	Total without deviation (%)	Total (%)
	With deviation	Without deviation				
Deviations with no SSD difference	70	492	562	12%	88%	100%

**Graph 1.** Graph with the percentage of deviation verified with no SSD difference.

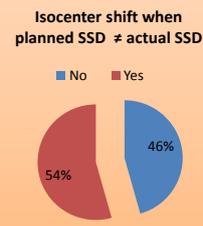


Additionally, when significant deviations (greater than 3 mm) were registered, 54% of the cases justify those values, presenting a lateral deviation of the isocenter.

**Table 2.** Frequency and percentage table of cases with deviation verified when SSD is different.

	Frequency		Total	Total with deviation (%)	Total without deviation (%)	Total (%)
	With deviation	Without deviation				
Deviations with SSD difference	56	47	103	54%	46%	100%

**Graph 2.** Graph with the percentage of deviation verified with SSD difference.



## Discussion

Although there were 12% cases registered showing an isocenter deviation in the lateral direction when the SSD value was kept under 3 mm, this is not statistically significant when compared to those values demonstrating an agreement between the planned and actual value of SSD (88%) and not having a deviation on the isocenter lateral axis. Therefore, the lateral deviation of the isocenter can be related to the SSD value observed in the lateral pelvic fields, in a daily basis.

Regarding the 54% cases in which the SSD value observed was greater than 3 mm, and the isocenter lateral deviation was kept within the tolerance limits, this result did not respond to the expectation. Rather that, it is significantly higher than expected. However, even not totally supporting the study, the result does not compromise the relationship between the SSD value and the lateral deviation of the isocenter.

## Conclusion

This study demonstrates an existing relationship between the SSD in the lateral pelvic fields and the lateral deviation of the isocenter position. Therefore, this parameter should be verified daily to avoid setup deviations in the lateral direction of the isocenter.

A better treatment reproducibility regarding isocenter location for patients treating the pelvic region can be achieved, improving the positioning technique with this new tested method.

### References:

1. Steel, G., et al., *Basic Clinical Radiobiology*, 2nd edition, Arnold, 1997.
2. Giordani, A., et al., *Accuracy in the reproducibility of daily patients' setup in 3D conformal radiotherapy for prostate cancer*, Radiol. Bras, 2010.

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