

## Introduction

Surface-Guided Radiotherapy (SGRT) is a technique based on non-ionizing radiation to reproduce the 3D patient's surface in real time for patient positioning. This surface is compared with a reference 3D patient's surface, which originated from computed tomography of simulation, with submillimeter accuracy. The system provides the 6-Degree-of-Freedom (6-DoF) corrections that should be done so that the two surfaces are in agreement.

Moreover, monitoring of the patient's intrafraction motion is provided with automated beam holding when at least one of the 6-DoF parameters is out of the limit. The aim of this study is to compare patient positioning with tattoos and tattooless technique with SGRT. Additionally, PTV margins were calculated for each positioning technique.

## Objectives

- Set-up errors reduction.
- PTV margins reduction.
- Tattooless treatments.

## Materials and Methods

Twenty-pelvic radiation therapy (RT) patients are randomized in two groups of ten patients each. Group\_A comprises 286 fractions positioned according to the AlignRT Advance system. Group\_B comprises 316 fractions positioned according to the tattoos. Statistically significant differences in translational and rotational CBCT-based set-up errors were evaluated with Mann-Whitney U test, with significance level of <0.05.

The Root-Mean-Square (RMS) was calculated. PTV margins were calculated according to Van Herk's formula:

$$\text{PTV margins} = 2.5 \cdot \Sigma + 0.7 \cdot \sigma$$

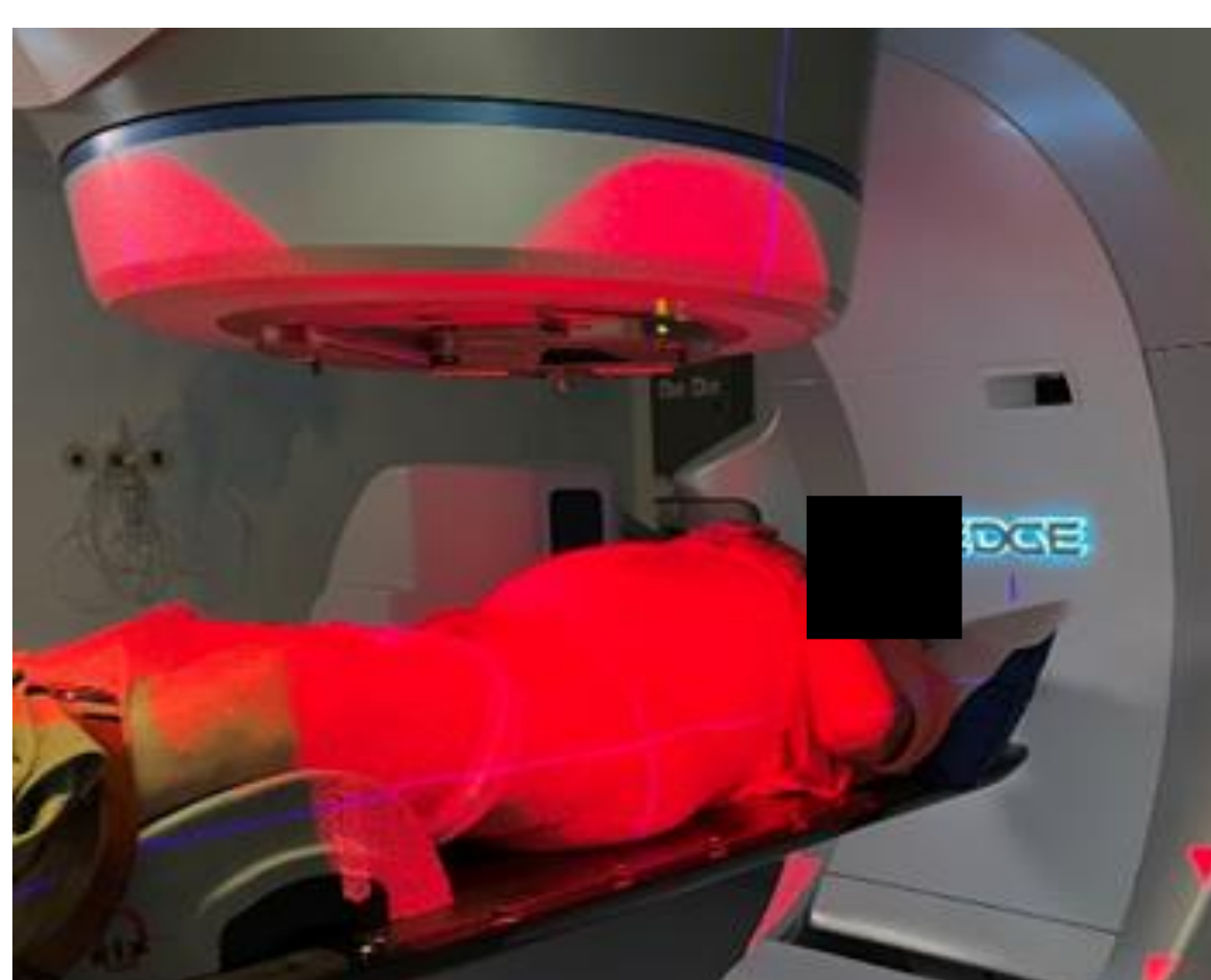


Image 1: Patient's set up according to AlignRT Advance



Image 2: Patient's set up according to tattoo

## Results

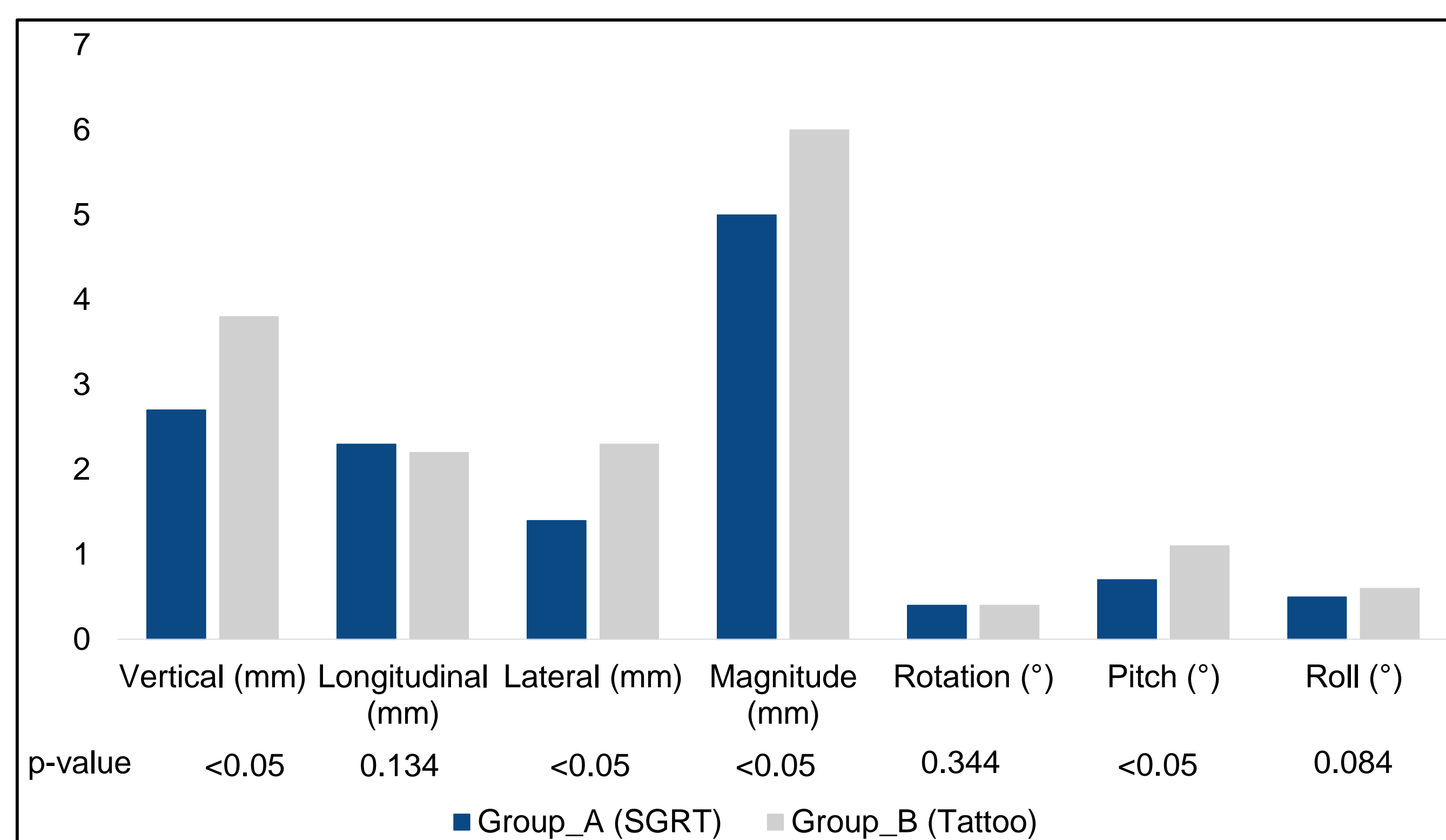


Figure 1: Median values of the set-up errors for two groups of patients

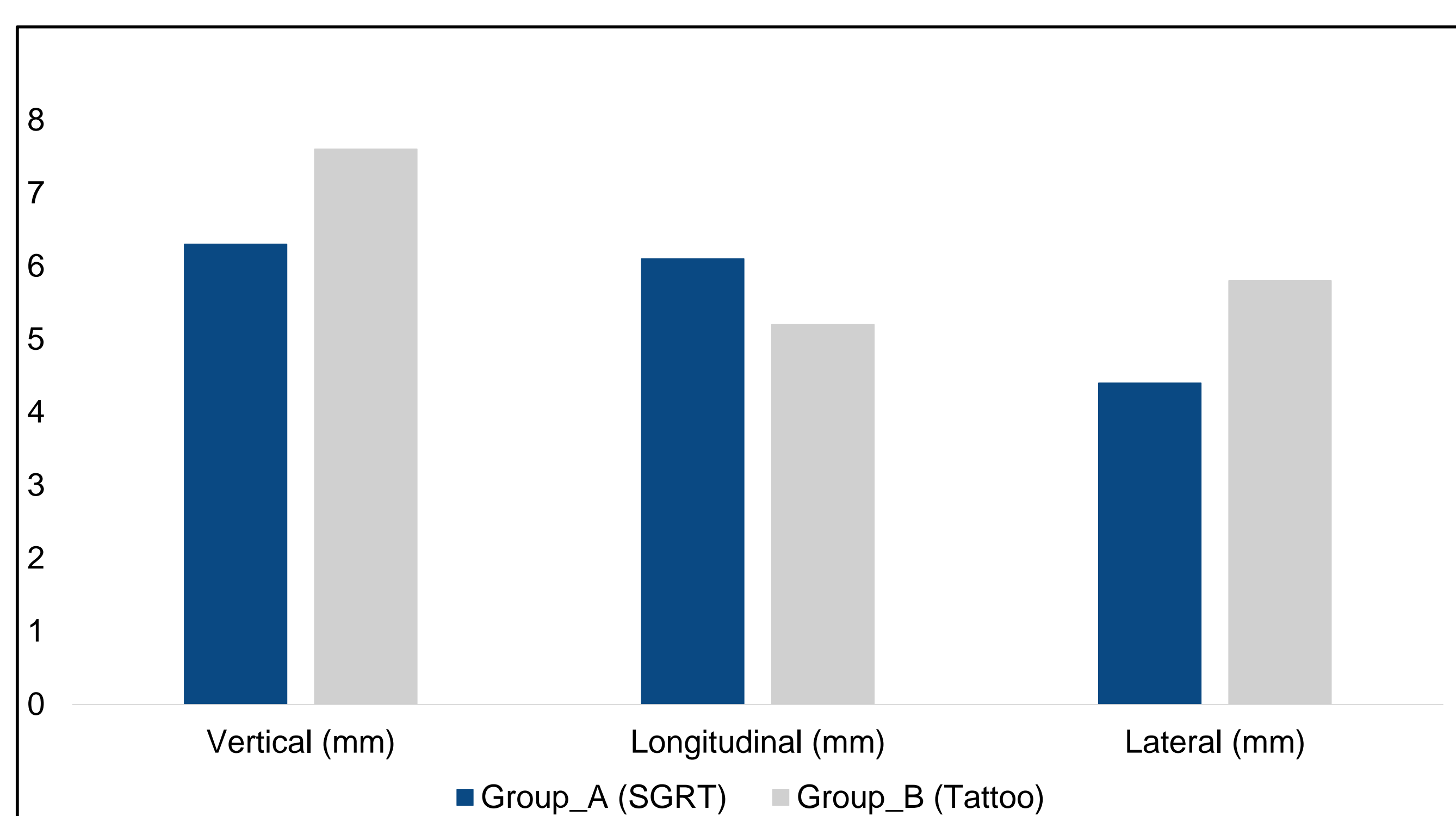


Figure 2: PTV Margins for two groups of patients

The median values for Group\_A were 2.7mm, 2.3mm, 1.4mm, 5mm, 0.4°, 0.7°, and 0.5° for vertical, longitudinal, lateral, RMS, yaw, pitch and roll, respectively. For Group\_B the median values were, accordingly, 3.8mm, 2.2mm, 2.3mm, 6mm, 0.4°, 1.1° and 0.6°. A statistically significant reduction of set-up errors in Vertical, Lateral, RMS and Pitch was found. A marginally statistically significant reduction was found for Roll (p-value=0.083<0.1). The PTV margins for Group\_A were 6.3mm, 6.1mm and 4.4mm for vertical, longitudinal and lateral directions, respectively. For Group\_B, margins were 7.6mm, 5.2mm and 5.8mm

## Conclusion

SGRT contribution seems to improve the patient positioning for pelvic RT patients. Furthermore, PTV margins could be reduced by the implementation of SGRT, leading to lower doses to adjacent healthy tissues. Subsequently, the conventional positioning technique of 3-point markers could be replaced by SGRT of the thousand points.

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