

The role of the radiotherapy technician during prostate radiation treatment _____

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Abstract

Introduction: Increasing positioning security is one of the main challenges of radiotherapy. The main movements of the prostate during radiotherapy are as a result of poor positioning of the patient, as well as by bladder and rectum volumes. These movements can be detected using various visualization techniques such as CBCT and radiographic images before each treatment session. **Purpose:** The purpose of this work is to highlight the role of radiotherapy technician in the management of the patient's movements during prostate treatment. **Methods:** 8 patients after customized positioning and immobilization performed the treatment with Varian TrueBeam HD linear accelerator. CBCT's were performed on different days during the course of treatment as well as radiographic images on other days to verify the position. These positions were compared with the positions planned by the simulation scanner and the daily movements of the patient and the prostate were corrected, thus creating a new isocenter. In cases where and with the new isocenter the prostate and seminal vesicles are located outside the planned PTV, it is performed a new simulation CT scan and a new treatment plan. **Results:** From 8 patients with primary prostate cancer, 42 CBCT controls and 207 MV-KV controls were considered. Patients required an

average movement of 0.27 cm in the vertical direction, 0.28 cm in the longitudinal direction, and a displacement of 0.17 cm in the lateral one. Regarding the rotation of the bed according to the X; Y; Z axes, we have an average Pitch of 1.32°, Roll of 0.5° and Rotation of 0.63°. **Conclusions:** 50% of these patients, needed a rescanning and replanning of treatment, and 12.5% more than one rescan.

Key words: Prostate cancer, Radiotherapy technician, Movement, CBCT, Radiographic imaging.

Introduction

Prostate cancer is the most common cancer in men and has a mortality rate of 14.6/100,000 in our country. It is a pathology, the risk of which increases with age, and for this reason, it is absolutely necessary that after the age of 50, all men regularly perform a PSA analysis, as it is one of the indicators for the possibility of prostate cancer.

Prostate cancer has 2 main methods of treatment, which are radiotherapy and surgery, as well as another auxiliary method of these two, which is hormone therapy, and chemotherapy which plays a role in the case of metastatic cancer, when the cancer does not respond to hormone therapy. Each of these techniques has its own benefits and risks.

According to the stage, if it is an early stage, an average stage or a locally advanced stage, it is decided how the patient will be treated, with surgery or radiotherapy. In some elderly patients, we are forced to treat only with radiotherapy, since the accompanying diseases do not make it possible to perform surgery. But even in patients who can afford surgery, must be made a balance between the positive effects of surgery and the negative ones.

The benefits of surgery are usually the treatment of the pathology and therefore the relief of symptoms. As far as the negative effects of it are that it remains an invasive treatment method accompanied by complications like any other intervention, the most frequent of which are urinary incontinence or impotence, which significantly reduce the patient's life quality. Also in moderately advanced stages the risk of seeding the disease increases, this is reflected in the metastases found in different organs in these patients, which are unusual for prostate cancer.

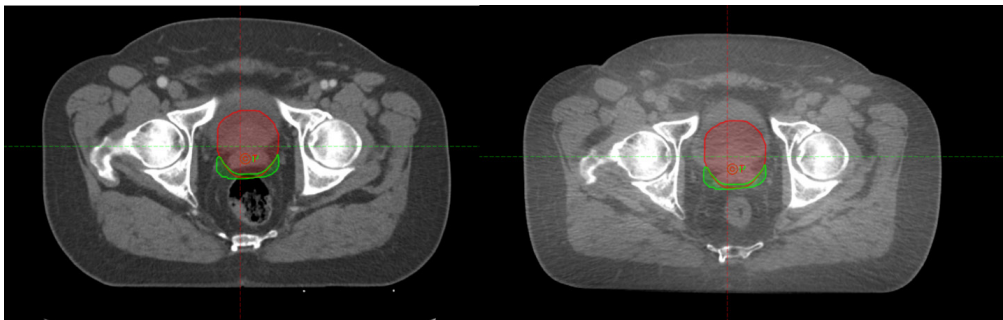
While the first and biggest advantage of radiotherapy is the fact that it is a non-invasive method. The risk of impotence and urinary incontinence is often lower than with surgery, but even if it happens, it is a short-term effect. As for the negative part or the side effects of radiotherapy is the duration of the treatment that goes up to 7 weeks, the exposure to radiation which consequently increases

the risk of developing a malignant pathology in the future, as well as diarrhea and inflammation of the rectum which are the most frequent short-term effects in this patients.



However, the achievement of this result and the maximum avoidance or minimization of these side effects of radiotherapy undoubtedly have their own challenges. One of the main challenges of radiotherapy, of course not only in the case of the prostate but in all radiotherapeutic treatments, is the safety in positioning, the minimization of geometric inaccuracies and the correction of these uncertainties during the treatment course. The main movements are a consequence of the poor positioning of the patient as well as the volume of the urinary bladder or rectum. These movements can be detected using various visualization techniques such as CBCT (cone-beam CT) and radiographic images before each treatment session which are performed from radiotherapy technologist. Recognizing and correcting these movements is essential in order not to have untreated parts from the planned area, as well as the maximum preservation of normal tissues around.

In this image we have illustrated 2 CT scans of the same patient performed on two different treatment days where is visible the different volume of the rectum which has also brought the seminal vesicles closer to the sides of the PTV.



To manage these interfractional movements of the prostate we must perform periodic checks of the patient's position every day before treatment using the images obtained through CBCT and the radiographic images obtained through MV-KV. These data will help us in the future to determine the PTV margin, thus giving us the assurance that the volume determined by the doctor will receive the determined dose.

Methods

In our study were included 8 patients who underwent radiotherapy treatment near the radio-oncology center of the Hygeia hospital. The inclusion criteria in the study were:

- Prostate CA diagnosis
- Not to have performed a prostatectomy
- Treatment period from June 2023

Of these cases, 75% (6) of them were stage III, which means that the cancer is locally advanced, more likely to spread to the lymphatic stations and surrounding tissues, and 25% (2) of them were stage IV, which means the pathology has spread outside the prostate (one case was with vesical infiltration and the other case with bone metastases). The treatment plan for these patients in the R.O.C was:

- Personalized positioning in supination Wing Step + Knee fix and 3 tattoos in the pelvis
- Preparation of 1 liter of water 1 hour before the treatment, to fill the urinary bladder
- The patient was treated with VMAT technique, with Varian TrueBeam HD linear accelerator,
- Prostate and seminal vesicles were treated with daily fractionation of 2.25Gy, up to a dose of 74.25Gy, pelvic lymphatic stations with daily fractionation of 1.64Gy, 5 times a week, up to 54.12Gy.

At the beginning of each treatment day, a control of the accelerator, which is in optimal condition, is performed by performing an MPC (machine performance check) to verify the geometric part of the device and the energetic one. Then for the patients of our study, such a positioning control protocol was followed:

- In the first week of treatment, CBCT was performed on the first 3 days of treatment, followed by MV-KV checks on the remaining days of the week.

- In the following weeks, the control of the patient's position and the prostate was followed by performing 1 CBCT per week and MV-KV images on the other days.

These positions were then compared with the positions planned by the simulation scanner and the daily movements of the patient and the prostate were corrected, thus creating a new isocenter. In cases where and with the new isocenter the prostate and seminal vesicles are located outside the planned PTV, rescanning and replanning of the patient's treatment is performed.

Results

From these 8 cases that were studied with primary prostate cancer, a total of 42 controls with CBCT and 207 controls with MV-KV were taken into consideration, where the data for each of them are presented in the tables below.

PATIENT 1

	Dita 1	Dita 2	Dita 3	Dita 4	Dita 5	Dita 6	Dita 7	Dita 8	Dita 9	Dita 10	Dita 11	Dita 12	Dita 13	Dita 14	Dita 15	Dita 16	Dita 17	Dita 18	Dita 19	Dita 20	Dita 21	Dita 22	Dita 23	Dita 24	Dita 25	Dita 26	Dita 27	Dita 28	Dita 29	Dita 30	Dita 31	Dita 32	Dita 33
VRT	0.58	0.79	0.58	0.28	0.44	0.31	0.47	0.43	0.80	0.32	0.45	0.69	0.19	0.36	0.67	0.56	0.32	0.38	0.44	0.39	0.55	0.58	0.47	0.47	0.36	0.34	0.50	0.57	0.32	0.04	0.53	0.38	0.61
ANG	0.32	0.30	0.29	0.23	0.57	0.31	0.45	0.22	0.37	0.38	0.46	0.38	0.44	0.47	0.39	0.41	0.40	0.35	0.32	0.33	0.41	0.43	0.34	0.52	0.55	0.39	0.36	0.39	0.42	0.23	0.31	0.43	0.35
LAT	0.49	0.23	0.19	0.49	0.31	0.03	0.03	0.04	0.23	0.05	0.04	0.27	0.16	0.19	0.03	0.06	0.03	0.14	0.13	0.25	0.13	0.03	0.21	0.02	0.39	0.24	0.01	0.05	0.08	0.04	0.21	0.13	0.01
PITCH	1.50	0.20	0.90	0.10	1.20	2.00	1.70	1.20	1.90	2.10	1.10	0.70	1.80	1.50	0.60	2.00	1.40	1.50	1.70	1.30	2.60	1.10	1.30	1.50	2.30	0.40	-	1.50	1.40	0.50	1.40	2.60	1.60
RROLL	0.80	0.10	0.50	1.70	1.00	1.40	0.20	1.00	0.60	0.20	0.70	0.80	0.30	0.40	1.00	0.70	0.20	0.30	0.20	0.30	0.80	1.20	0.40	1.10	0.80	-	0.90	0.20	0.10	-	0.20	0.40	0.90
RTN	1.70	0.80	1.70	1.70	2.10	0.90	2.20	1.40	1.60	2.20	1.90	1.80	2.60	0.30	0.50	0.30	1.60	1.50	1.10	0.90	0.80	1.00	1.70	0.50	2.20	0.80	0.80	1.20	2.30	1.40	1.60	1.90	1.70

PATIENT 2

MV-KV	Dita 1	Dita 2	Dita 3	Dita 4	Dita 5	Dita 6	Dita 7	Dita 8	Dita 9	Dita 10	Dita 11	Dita 12	Dita 13	Dita 14	Dita 15	Dita 16	Dita 17	Dita 18	Dita 19	Dita 20	Dita 21	Dita 22	Dita 23	Dita 24	Dita 25	Dita 26	Dita 27	Dita 28	Dita 29	Dita 30	Dita 31	Dita 32	Dita 33
VRT	0.13	0.19	0.25	0.11	0.19	0.20	0.42	0.07	0.04	0.16	0.40	0.07	0.40	0.33	0.17	0.18	0.11	0.15	0.30	0.32	0.20	0.43	0.56	0.02	0.06	0.18	0.02	0.01	0.06	0.15	0.06	0.04	0.05
ANG	0.30	0.23	0.41	0.18	0.28	0.12	0.05	0.13	0.11	0.26	0.17	0.21	0.11	0.23	0.18	0.35	0.15	0.38	0.34	0.02	0.19	0.01	0.38	0.28	0.26	0.15	0.08	0.26	0.34	0.36	0.11	0.07	0.13
LAT	0.10	0.16	0.18	0.07	0.02	0.15	0.18	0.03	0.14	0.31	0.17	0.09	0.03	0.03	0.26	0.03	0.02	0.14	0.08	0.12	0.05	0.19	0.01	0.09	0.03	0.28	0.13	0.17	0.08	0.14	0.30	0.01	0.09
PITCH	0.70	1.50	1.00	0.10	1.60	0.20	1.50	0.20	0.20	0.80	0.10	0.50	0.20	1.80	1.80	1.10	1.40	2.10	1.60	0.60	1.80	1.00	1.90	1.50	0.50	0.80	1.90	-	0.80	1.30	1.20	0.70	1.30
RROLL	0.20	1.00	0.30	0.10	0.80	0.70	0.60	0.60	0.80	0.70	0.50	0.50	1.20	1.30	0.90	0.70	0.70	0.50	0.80	0.50	0.60	0.50	1.70	0.50	0.70	0.80	0.70	1.00	0.40	0.80	1.30	0.40	0.40
RTN	0.10	0.90	0.50	1.20	0.10	0.40	0.10	0.10	0.40	0.10	0.30	0.40	0.70	0.60	0.90	0.90	0.50	0.60	0.10	0.10	0.50	0.10	0.80	0.30	0.70	0.70	0.70	-	0.10	0.50	1.60	-	0.10

PATIENT 3

	Dita 1	Dita 2	Dita 3	Dita 4	Dita 5	Dita 6	Dita 7	Dita 8	Dita 9	Dita 10	Dita 11	Dita 12	Dita 13	Dita 14	Dita 15	Dita 16	Dita 17	Dita 18	Dita 19	Dita 20	Dita 21	Dita 22	Dita 23	Dita 24	Dita 25	Dita 26	Dita 27	Dita 28	Dita 29	Dita 30	Dita 31	Dita 32	Dita 33
VRT	0.05	0.09	0.12	0.16	0.05	0.41	0.08	-	0.07	0.03	0.13	0.21	0.02	0.21	0.24	0.29	0.28	0.29	0.08	0.33	0.18	0.13	0.26	0.11	0.22	0.17	0.19	0.23	0.40	0.11	0.13	0.11	0.14
ANG	0.09	0.33	0.15	0.30	0.29	0.41	0.26	0.33	0.39	-	0.12	0.05	0.07	0.24	0.12	0.19	0.31	0.21	0.28	0.34	0.09	0.16	0.27	0.21	0.32	0.19	0.29	0.23	0.24	0.19	0.22	0.22	0.34
LAT	0.16	0.16	0.03	0.07	0.08	0.41	0.13	0.43	-	0.01	0.17	0.10	0.40	0.19	0.09	0.24	0.20	0.22	0.35	0.17	-	0.17	0.21	0.05	0.17	0.12	0.07	0.02	0.09	0.04	0.07	0.07	0.08
PITCH	0.70	0.10	0.40	0.90	0.50	0.20	0.70	0.30	0.70	0.40	0.20	1.50	0.90	0.70	0.30	0.10	0.10	0.60	0.10	1.80	0.80	0.70	0.20	0.50	0.40	0.10	0.50	0.60	0.70	0.70	0.60	0.40	0.30
RROLL	0.10	0.20	0.40	0.20	-	0.80	0.30	0.30	0.60	0.20	-	0.10	0.30	0.10	0.30	0.10	0.10	0.20	0.50	-	-	0.60	-	0.10	0.10	-	0.10	0.30	0.20	0.20	-	0.30	
RTN	0.10	0.10	0.40	0.10	0.20	0.60	0.10	-	0.30	0.60	0.20	0.60	0.10	0.30	0.60	0.40	0.30	0.20	0.30	-	0.50	0.20	0.10	0.10	0.20	0.60	0.10	0.40	0.20	0.10	0.30	0.10	0.40

PATIENT 4

	Dita 1	Dita 2	Dita 3	Dita 4	Dita 5	Dita 6	Dita 7	Dita 8	Dita 9	Dita 10	Dita 11	Dita 12	Dita 13	Dita 14	Dita 15	Dita 16	Dita 17	Dita 18	Dita 19	Dita 20	Dita 21	Dita 22	Dita 23	Dita 24	Dita 25	Dita 26	Dita 27	Dita 28	Dita 29	Dita 30	Dita 31	Dita 32	Dita 33	Dita 34	Dita 35	Dita 36	Dita 37	Dita 38
VRT	0.04	0.11	0.19	0.19	0.29	0.10	0.11	0.18	0.13	0.20	0.44	0.28	0.18	0.56	0.32	0.22	0.40	0.30	0.19	0.19	0.23	0.01	0.14	0.44	0.04	0.03	0.16	0.29	0.23	0.22	0.17	0.31	0.27	0.34	1.27	0.13	0.14	0.16
LNg	0.54	0.28	0.54	0.47	0.39	0.42	0.28	0.31	0.57	0.35	0.66	0.29	0.03	0.75	0.59	0.41	0.62	0.48	0.25	0.41	0.52	0.56	0.70	0.48	0.38	0.49	0.48	0.47	0.29	0.16	0.42	0.46	0.50	0.17	0.43	0.36	0.70	0.48
LAT	0.08	0.10	0.48	0.01	0.03	0.17	0.24	0.19	0.10	0.14	0.31	0.14	0.02	0.38	0.19	0.03	0.22	0.26	0.16	0.07	0.07	0.21	0.28	0.16	0.16	0.01	0.19	0.02	0.26	0.27	0.37	0.18	0.40	0.38	0.68	0.67	0.28	0.19
PITCH	0.40	-	1.20	1.00	-	1.20	0.40	1.80	0.30	0.80	1.50	1.60	1.40	0.10	0.50	0.10	0.40	0.60	0.10	0.30	0.50	0.10	0.60	1.10	-	0.70	0.30	0.60	1.20	2.70	1.80	1.30	0.10	0.80	3.00	3.00	0.60	0.30
RROLL	1.20	0.80	0.10	0.10	0.40	0.10	0.20	0.20	0.50	0.30	0.40	0.20	1.00	0.80	0.10	0.50	0.20	0.70	0.70	0.30	0.50	0.60	0.30	0.10	0.40	0.70	0.50	0.20	0.40	0.60	0.20	0.60	0.80	0.40	1.30	2.50	0.30	0.50
RTN	0.20	0.10	0.90	0.40	-	1.40	1.10	1.30	0.70	1.00	1.40	1.40	0.19	1.60	0.20	0.90	1.40	1.00	0.80	0.80	0.30	0.20	0.70	1.00	0.80	0.40	0.90	0.90	0.10	0.70	0.20	0.40	0.10	1.10	0.10	1.30	0.70	0.90

PATIENT 5

	Dita 1	Dita 2	Dita 3	Dita 4	Dita 5	Dita 6	Dita 7	Dita 8	Dita 9	Dita 10	Dita 11	Dita 12	Dita 13	Dita 14	Dita 15	Dita 16	Dita 17	Dita 18	Dita 19	Dita 20	Dita 21	Dita 22	Dita 23	Dita 24	Dita 25	Dita 26	Dita 27	Dita 28	Dita 29	Dita 30	Dita 31	Dita 32	Dita 33
VRT	0.04	0.05	0.16	0.09	0.03	0.29	0.11	0.02	0.44	0.11	0.31	0.38	0.27	0.25	0.17	0.32	0.15	0.05	0.09	0.43	0.17	0.08	0.28	0.30	0.19	0.24	0.34	0.19	0.28	0.25	0.21	0.32	0.45
LNg	0.38	0.44	0.28	0.35	0.40	0.40	0.48	0.41	0.43	0.26	0.27	0.19	0.04	0.35	0.29	0.21	0.16	0.45	0.41	0.25	0.23	0.35	0.35	0.30	0.37	0.29	0.38	0.29	0.58	0.15	0.26	0.34	0.36
LAT	0.09	0.06	0.08	0.17	0.07	0.21	0.27	0.37	0.22	0.26	0.24	0.10	0.12	0.16	0.07	0.06	0.05	0.10	0.20	0.07	0.17	0.18	0.02	0.17	0.06	0.03	0.04	0.03	0.15	0.09	0.05	0.06	0.03
PITCH	0.70	0.20	-	0.60	0.50	0.30	0.40	1.10	1.60	0.20	3.00	2.10	0.20	0.40	1.40	0.10	-	0.10	0.60	0.70	0.80	0.40	0.80	0.70	0.20	0.50	0.10	0.20	0.40	0.05	0.10	0.10	0.70
RROLL	0.50	-	0.20	0.40	-	0.50	0.40	0.70	0.60	0.40	-	0.40	0.20	0.20	0.90	0.60	0.60	0.10	0.80	0.80	0.50	0.30	0.30	1.20	0.20	0.60	-	0.50	0.50	0.60	0.60	0.70	0.20
RTN	0.30	0.10	0.20	0.20	0.10	0.40	0.50	1.20	0.10	0.40	0.70	0.50	1.50	0.40	0.20	0.70	0.10	0.40	0.80	0.60	-	0.30	1.00	0.70	0.30	0.90	0.50	0.80	0.60	1.30	0.90	0.40	0.40

PATIENT 6

	Dita 1	Dita 2	Dita 3	Dita 4	Dita 5	Dita 6	Dita 7	Dita 8	Dita 9	Dita 10	Dita 11	Dita 12	Dita 13	Dita 14	Dita 15	Dita 16	Dita 17	Dita 18	Dita 19	Dita 20	Dita 21	Dita 22	Dita 23	Dita 24	Dita 25	Dita 26	Dita 27	Dita 28	Dita 29	Dita 30	Dita 31	Dita 32	Dita 33		
VRT	0.56	0.40	0.19	0.66	0.48	0.40	0.46	0.47	0.40	0.55	0.07	0.45	0.46	0.19	0.34	0.52	0.24	0.28	0.26	0.32	0.39	0.11	0.30	0.49	0.31	0.29	0.29	0.61	0.37	0.36	0.30	0.03	0.33		
LNg	0.33	0.23	0.20	0.64	0.46	0.03	0.92	0.07	0.13	0.45	0.09	0.30	0.20	0.01	0.07	0.31	0.56	0.52	0.08	0.45	0.14	0.55	0.58	0.56	0.34	0.07	0.08	0.88	0.93	0.38	0.30	0.58	0.54		
LAT	0.03	0.09	0.27	0.41	0.14	0.11	0.44	0.19	0.22	0.38	-	0.43	0.02	0.28	0.13	0.02	0.03	0.51	0.25	0.01	0.14	0.11	0.18	0.39	0.03	0.05	0.31	0.34	0.24	0.23	0.01	0.16	0.57		
PITCH	3.00	3.00	3.00	3.00	3.00	2.30	3.00	0.90	3.00	3.00	1.80	3.00	3.00	3.00	3.00	3.00	1.70	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	1.50
RROLL	0.50	0.60	1.40	0.90	0.90	0.90	0.30	1.10	2.30	2.20	1.50	2.10	1.60	0.40	0.70	0.90	0.90	1.30	0.30	0.90	0.60	1.00	0.50	-	0.70	1.10	0.60	0.30	0.60	1.30	1.30	0.90	2.10		
RTN	0.30	0.10	0.60	2.40	1.60	0.20	0.90	0.40	0.50	0.60	1.50	0.60	0.40	0.40	0.20	0.30	0.10	1.50	0.70	0.50	0.70	0.60	0.80	0.90	-	0.40	0.60	2.20	2.20	0.70	-	0.50	1.50		

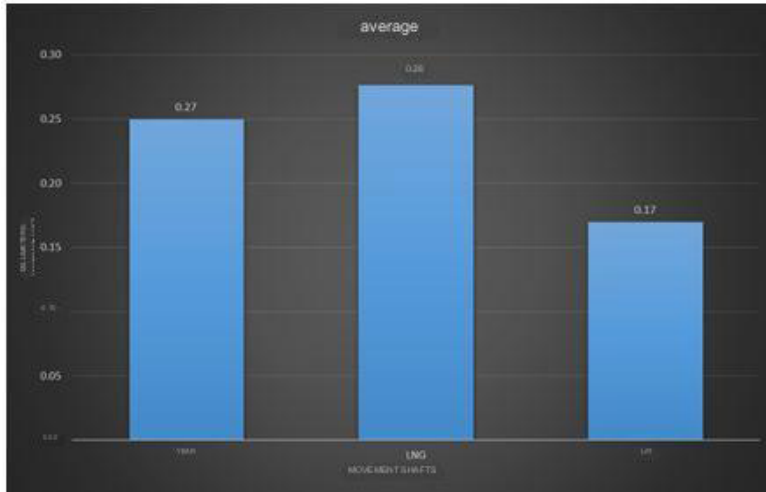
PATIENT 7

	Dita 1	Dita 2	Dita 3	Dita 4	Dita 5	Dita 6	Dita 7	Dita 8	Dita 9	Dita 10	Dita 11	Dita 12	Dita 13	Dita 14	Dita 15	Dita 16	Dita 17	Dita 18	Dita 19	Dita 20	Dita 21	Dita 22	Dita 23	Dita 24	Dita 25	Dita 26	Dita 27	Dita 28	Dita 29	Dita 30	Dita 31	Dita 32	Dita 33	
VRT	0.56	0.40	0.19	0.66	0.48	0.40	0.46	0.47	0.40	0.55	0.07	0.45	0.46	0.19	0.34	0.52	0.24	0.28	0.26	0.32	0.39	0.11	0.30	0.49	0.31	0.29	0.29	0.61	0.37	0.36	0.30	0.03	0.33	
LNg	0.33	0.23	0.20	0.64	0.46	0.03	0.92	0.07	0.13	0.45	0.09	0.30	0.20	0.01	0.07	0.31	0.56	0.52	0.08	0.45	0.14	0.55	0.58	0.56	0.34	0.07	0.08	0.88	0.93	0.38	0.30	0.58	0.54	
LAT	0.03	0.09	0.27	0.41	0.14	0.11	0.44	0.19	0.22	0.38	-	0.43	0.02	0.28	0.13	0.02	0.03	0.51	0.25	0.01	0.14	0.11	0.18	0.39	0.03	0.05	0.31	0.34	0.24	0.23	0.01	0.16	0.57	
PITCH	3.00	3.00	3.00	3.00	3.00	2.30	3.00	0.90	3.00	3.00	1.80	3.00	3.00	3.00	3.00	3.00	1.70	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	1.50
RROLL	0.50	0.60	1.40	0.90	0.90	0.90	0.30	1.10	2.30	2.20	1.50	2.10	1.60	0.40	0.70	0.90	0.90	1.30	0.30	0.90	0.60	1.00	0.50	-	0.70	1.10	0.60	0.30	0.60	1.30	1.30	0.90	2.10	
RTN	0.30	0.10	0.60	2.40	1.60	0.20	0.90	0.40	0.50	0.60	1.50	0.60	0.40	0.40	0.20	0.30	0.10	1.50	0.70	0.50	0.70	0.60	0.80	0.90	-	0.40	0.60	2.20	2.20	0.70	-	0.50	1.50	

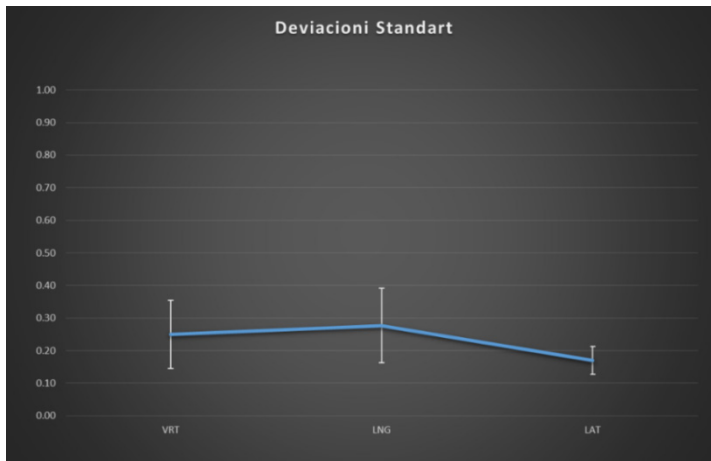
PATIENT 8

	Dita 1	Dita 2	Dita 3	Dita 4	Dita 5	Dita 6	Dita 7	Dita 8	Dita 9	Dita 10	Dita 11	Dita 12	Dita 13	Dita 14	Dita 15	Dita 16	Dita 17	Dita 18	Dita 19	Dita 20	Dita 21	Dita 22	Dita 23	Dita 24	Dita 25	Dita 26	Dita 27	Dita 28	Dita 29	Dita 30	Dita 31	Dita 32	Dita 33	
VRT	0.06	0.08	0.22	0.12	0.21	0.13	0.41	0.34	0.03	0.11	0.14	0.14	0.36	0.06	0.08	0.41	0.34	0.12	0.13	0.22	0.03	0.21	0.14	0.36	0.11	0.14	0.08	0.06	0.12	0.21	0.34	0.03	0.14	0.41
LNg	0.23	0.13	0.13	0.16	0.19	0.15	0.14	0.09	0.23	0.09	0.19	0.20	0.19	0.23	0.13	0.14	0.09	0.16	0.15	0.13	0.23	0.19	0.20	0.19	0.09	0.19	0.13	0.23	0.16	0.19	0.09	0.23	0.20	0.14
LAT	0.10	0.01	0.25	0.19	0.19	0.05	0.34	0.38	0.18	0.55	0.02	0.38	0.10	0.10	0.01	0.34	0.38	0.19	0.05	0.25	0.18	0.19	0.38	0.10	0.55	0.02	0.01	0.10	0.19	0.19	0.38	0.18	0.38	0.34
PITCH	2.10	1.20	2.50	2.20	1.80	1.30	3.00	2.50	2.40	1.00	0.70	2.70	2.90	2.10	1.20	3.00	2.50	2.20	1.30	2.50	2.40	1.80	2.70	2.90	1.00	0.70	1.20	2.10	2.20	1.80	2.50	2.40	2.70	3.00
RROLL	0.30	0.40	0.60	0.50	0.50	0.90	0.50	0.70	0.10	0.40	1.20	1.10	0.70	0.30	0.40	0.50	0.70	0.50	0.90	0.60	0.10	0.50	1.10	0.70	0.40	1.20	0.40	0.30	0.50	0.50	0.70	1.10	1.10	0.50
RTN	0.70	0.20	0.60	0.70	0.80	0.40	1.10	0.80	0.10	1.50	1.10	1.10	0.50	0.70	0.20	1.10	0.80	0.70	0.40	0.60	0.10	0.80	1.10	0.50	1.50	1.10	0.20	0.70	0.70	0.80	0.80	0.10	1.10	1.10

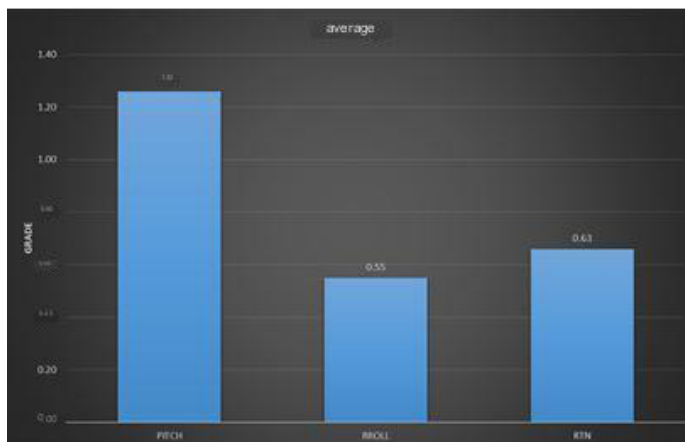
From these examinations it was found that the patients required an average movement of 0.27 cm in the vertical direction (anterior-posterior), 0.28 cm in the longitudinal direction (superior-inferior) and a displacement of 0.17 cm in the lateral direction (left-right). So the inaccuracy in the positioning regarding the geometry from the analysis of this data is less than 3mm.



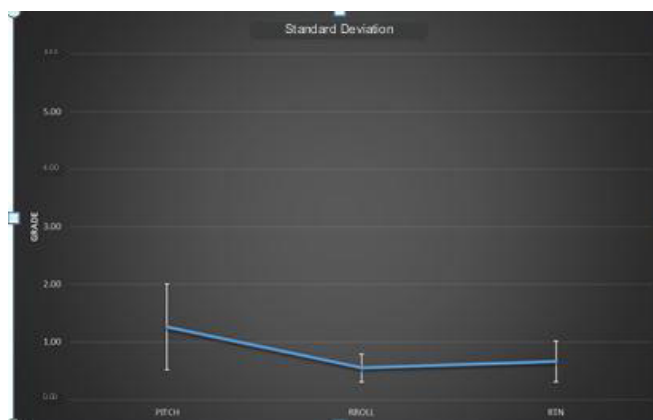
Standard deviation for X; Y; Z directions is 0.11; 0.11; 0.04 respectively



Regarding the rotation of the bed according to the X; Y; Z axes, we have an average Pitch of 1.32°, Roll of 0.5° and Rotation of 0.63°).



Standard deviation for PITCH; ROLL; ROTATION is 0.75; 0.24; 0.35 respectively.



In addition to these data, 50% of these patients needed a rescan and replanning of treatment, and 12.5% for more than one rescan and replan.

Discussion

The process of day-to-day implementation of the treatment plan is often neglected, but is of vital importance in ensuring accurate, safe and effective radiotherapy treatment, along with verification of the patient's position. The main duties of a radiotherapist technician during treatment are as following:

- a) The radiotherapy technician is responsible for determining the position of the patient with the relevant immobilizing accessories with the aim of

accurately reproducing this position every day of treatment, and therefore the exact localization of the treatment volume, just like in the planning scanner.

- b) The radiotherapy technician is responsible for preparing the patient for prostate treatment.
- c) The radiotherapy technician is responsible for the verification through imaging techniques of the volume of the rectum, of the urinary bladder, as well as the inclusion within the PTV of the prostate and seminal vesicles,
- d) The radiotherapy technician is responsible for providing the treatment and daily assessment of the patient's radiation tolerance, and the general medical condition.

Based on these duties and responsibilities of the radiotherapist technician, his role in the treatment of prostate cancer is essential in providing the most effective care and treatment to the patient. With his expertise and contribution to the treatment process, every day in every department, he can improve the quality of life of the patient and his family.

Conclusions

Since the radiotherapy technician is the one who practically implements the treatment plan created by the doctor and physicists, as well as deals with the management of every patient's daily needs his role is vital in ensuring an accurate and effective treatment, along with verifying the patient's position before each session.

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