

Introduction

This study aims to find out if the effect of modesty coverings over the treatment field for hypo fractionated breast plans has any effect on radiation beams during treatment. The hope is to determine if covering hypo fractionated (HFRT) breast cancer patients with modesty coverings in the treatment field has any dosimetric effects. HFRT administers larger doses per session over a shorter timeframe, often completing treatment in 3–4 weeks. The use of HFRT has been a breakthrough in breast cancer treatment, where whole-breast irradiation following breast-conserving surgery has become a standard approach. It is important to assess the dosimetric effect of modesty coverings affect the dose at the surface and at the isocenter because this could affect the patient's treatment daily and overall. By finding the results of how these modesty coverings affect the dose, it can be documented that patients should not be covered with any modesty coverings in the treatment field to ensure proper treatment of these patients. This study will help better understand whether these modesty coverings affect the dose at the surface and at the isocenter for hypo fractionated breast patient treatment plans.

Results

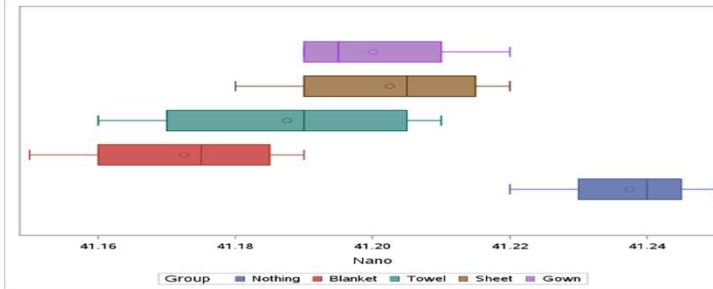


Fig 1 Two-Tailed t-test comparison of ion chamber readings of modesty coverings.

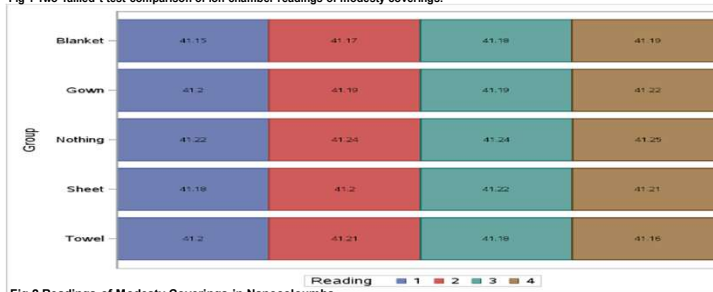


Fig 2 Readings of Modesty Coverings in Nanocoloumbs

Blanket versus Nothing					
Monte Carlo Estimates for the Exact Test					
Probability	Estimate	99% Confidence Limits		Samples	Seed
Pr >= S	0.015	0.011	0.018	10000	971249229
Pr >= S - Mean	0.029	0.025	0.034		
Nothing versus Gown					
Monte Carlo Estimates for the Exact Test					
Probability	Estimate	99% Confidence Limits		Samples	Seed
Pr >= S	0.027	0.023	0.031	10000	971333796
Pr >= S - Mean	0.057	0.051	0.063		
Sheet versus Nothing					
Monte Carlo Estimates for the Exact Test					
Probability	Estimate	99% Confidence Limits		Samples	Seed
Pr >= S	0.03	0.025	0.034	10000	971432551
Pr >= S - Mean	0.058	0.052	0.064		
Towel versus Nothing					
Monte Carlo Estimates for the Exact Test					
Probability	Estimate	99% Confidence Limits		Samples	Seed
Pr >= S	0.015	0.012	0.018	10000	971488954
Pr >= S - Mean	0.031	0.027	0.036		

Fig 3 Monte Carlo Estimates for the exact test

Methods and Materials

The researcher used a solid water phantom and an ion chamber on a linear accelerator to measure dose differences calculated in Varian Eclipse version 16.1. Each modesty covering (blanket, gown, sheet, towel) was contoured in Eclipse and included in separate treatment plans using the Acuros 13.5 algorithm. A custom bolus was applied to match each covering, with Hounsfield Units (HU) assigned based on CT scan readings where the coverings were placed over the phantom. Dose measurements were taken at the surface and isocenter in four locations on each plan. The study used an HFRT breast cancer regimen of 42.5 Gy in 16 fractions, 2.65 Gy per fraction. The phantom was set up with consistent SSD and laser alignment for each plan that was run. Each plan was run four times with a 6 MV photon beam, both with and without modesty coverings, to evaluate their dosimetric impact.

Results

The test results from the water phantom with the ion chamber show minimal difference from the effect of the modesty coverings over the patient for one fraction. The maximum difference in ion chamber reading between no covering and a blanket is 0.07 nC compared to the no covering value. The blanket has the most attenuation, the towel 2nd, and the gown and sheet were almost equal in comparison. The Monte Carlo exact test confirms the earlier interpretation: modesty coverings cause a small but statistically significant reduction in measured dose compared to nothing. For gowns and sheets the difference is small but still affects the dose. All coverings should be specifically positioned out of the radiation field to ensure accurate delivery of the radiation to the patient.

Conclusion

Modesty coverings (especially thicker ones like blankets and towels) slightly reduce the detected ion chamber signal, implying small but measurable attenuation of dose. The clinical impact is likely minimal in most cases but may be worth considering, especially in hypo fractionated regimens, where if you times this effect by 16, the difference between no covering and any of the modesty coverings is amplified. This data may support the recommendation to remove or minimize modesty coverings during beam-on if precise superficial dose delivery is a concern.

References

- Hankinson SE, Polyak K, Garber JE, et al. Breast cancer: Multiple, often complex, risk factors. In: Wild CP, Weiderpass E, Stewart BW, eds. *World Cancer Report: Cancer Research for Cancer Prevention*. Lyon, France: International Agency for Research on Cancer; 2020. Section 5.9. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK60650/>
- Polgár C, Kahán Z, Ivanov O, et al. Radiotherapy of Breast Cancer—Professional Guideline 1st Central-Eastern European Professional Consensus Statement on Breast Cancer. *Pathology and Oncology Research*. 2022;28. doi:<https://doi.org/10.3389/pore.2022.1610378>

Limitations

This study had a small sample size, and if we had more time to perform these tests to strengthen our data and show the differences could help with the findings. Further research is needed to see how the surface dose would be affected by testing with diodes. Blankets and towels should be avoided during beam-on time, especially in hypo fractionated treatments where precise dose delivery is critical.

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