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Positioning of Patients for Pelvic Radiation: Variability Across Treatment

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PURPOSE

The purpose of this retrospective study was to determine the presence and degree of variation in sacral slope in 20 subjects receiving radiation therapy for oncological disease.

BACKGROUND

Pelvic radiation therapy is a standard of treatment for urogenital and anal cancers (1). Proper positioning of patients throughout each fraction of treatment is essential to improve clinical outcomes and efficacy of treatment. It is important in pelvic cancers to achieve consistent patient setup due to the proximity of crucial organs such as the bladder, rectum, and bowel (2) and complex lymphatic drainage patterns (3).

Radiation therapy can cause late effects on the pelvic musculature and bones (4).

As such, proper positioning is important to accurately localize and plan for lymph nodes during simulation imaging in order to deliver proper dosage to the nodes in question and to limit radiation dosage to normal surrounding tissue.

METHODS

A retrospective review was performed of 20 subjects with an oncologic diagnosis treated with pelvic radiation therapy at UMass Memorial Medical Center.

All subjects received between 20 and 25 fractions of external beam radiation treatment to the pelvis.

The sacral slope was measured manually and independently by two readers from the patient's lateral digitally reconstructed radiograph (DRR) based off of the simulation CT and from each of the lateral port films taken prior to daily treatment using ARIA Oncology Image Software (Varian Medical Systems, Palo Alto, CA).

The absolute difference between baseline and individual treatment visits was calculated and averaged across all subjects.

RESULTS

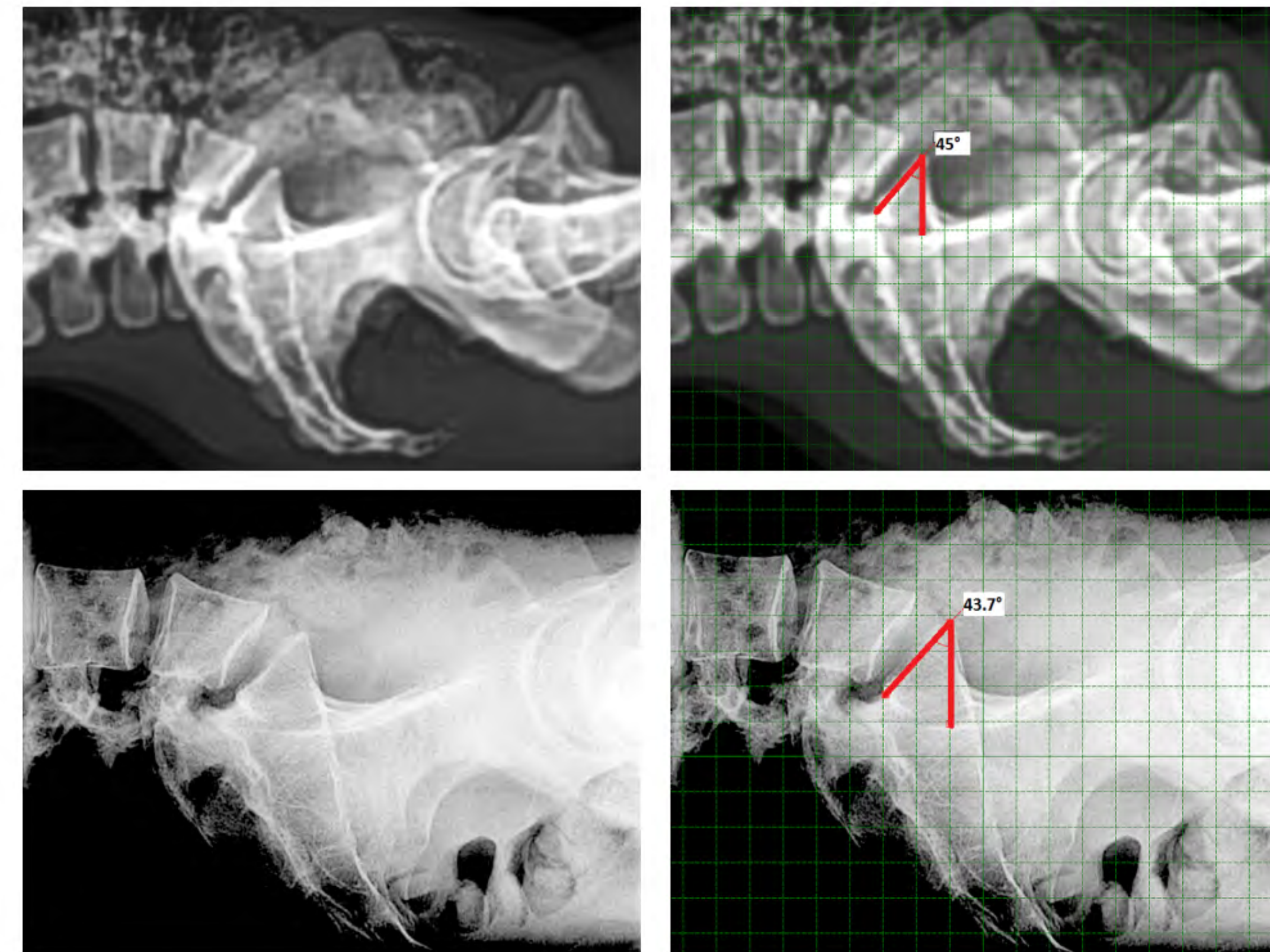


Image 1: Subject N simulation CT DRR (top row) and treatment 8 port film images (bottom row) with and without angle measurements.

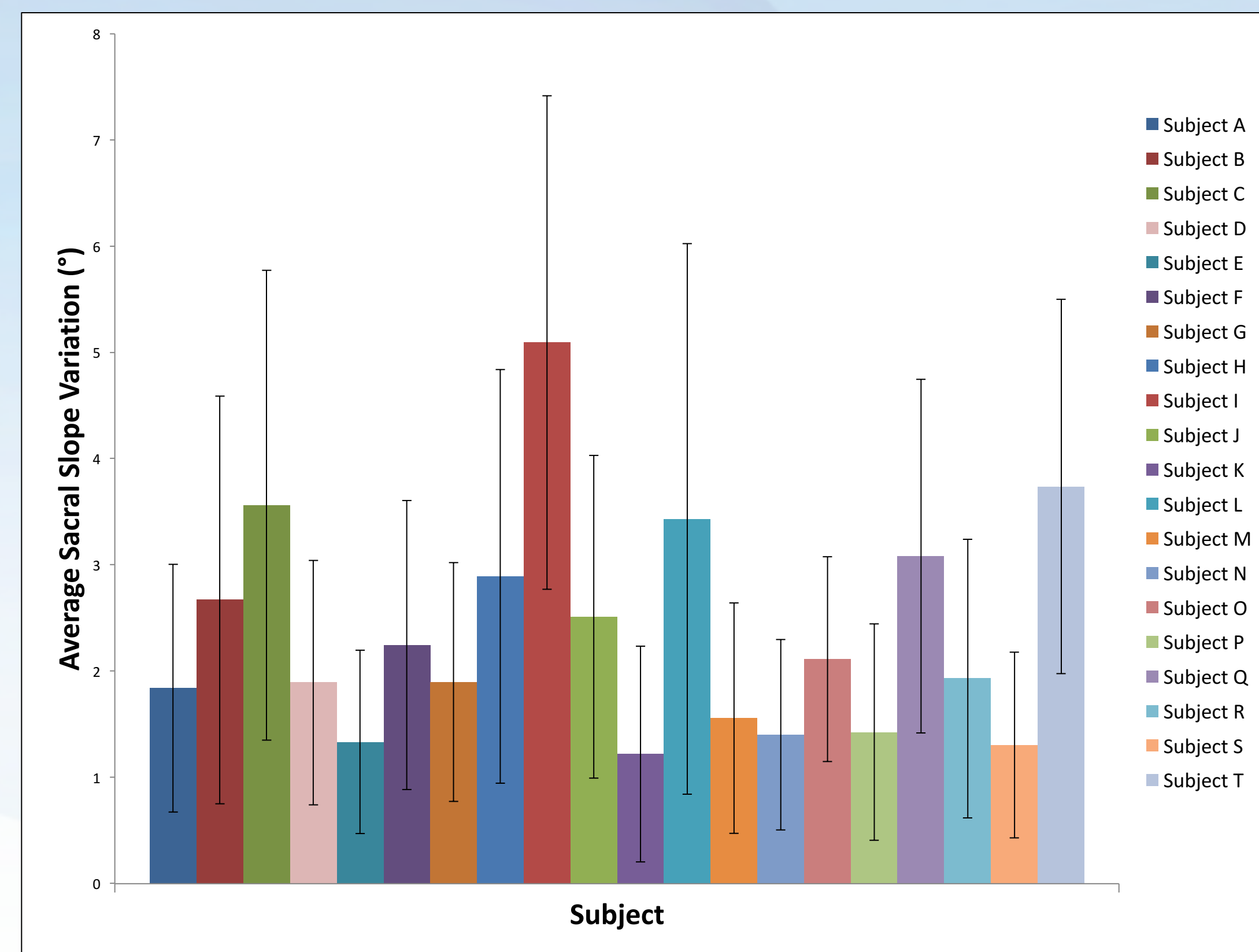


Figure 1: Overall variation in sacral slope from daily treatment port films compared to baseline simulation CT for each patient over entire treatment duration.

DISCUSSION

- ❖ In this study, we report variation in sacral slope measurements across 20 subjects receiving pelvic radiation therapy, indicating a difference in pelvic tilt and overall positioning throughout daily radiation treatment.
- ❖ Daily measurement of sacral slope showed demonstrable variation within and across the 20 subjects. Average sacral slope angle variation across all 20 subjects was 2.27° ($\pm 1.43^\circ$), and average variation among all subjects ranged from 1.22°-5.09°.
- ❖ The weekly averages for each patient were also assessed. The weekly variation in sacral slope across all subjects showed a significant difference between early and late weeks of treatment. The first week had a significantly smaller variation compared to both the fourth and fifth weeks of treatment. The second week of treatment had a significantly smaller variation in sacral slope compared to the fifth week of treatment.
- ❖ This study demonstrates that after corrections for patient setup there still exists variability in sacral slope angle between treatment days and compared to initial baseline imaging off of which a treatment plan is developed.
- ❖ Future studies should be considered to address and attempt to reduce this variation.

ACKNOWLEDGEMENTS

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