ACRO 2009

WAKE FOREST UNIVERSITY

SOLID MODULATED ACCELERATED RADIATION THERAPY (S.M.A.R.T.) FOR EARLY STAGE BREAST CANCER CONSERVATION

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BACKGROUND AND PURPOSE

Accelerated partial breast irradiation is being studied as an alternative to whole breast irradiation for early stage breast cancer. Presently there are three common methods utilized: Multi-catheter brachytherapy, single catheter brachytherapy, and external beam limited volume radiation. The purpose of the article is to introduce a modification to standard external beam techniques. We describe a regimen treating with intensity modulating radiation therapy (IMRT) that allows concurrent partial breast irradiation (seroma site boost) with conventional whole breast prophylaxis. This technique concurrently treats the whole breast and the lumpectomy seroma cavity with a shortened course using beam modulation.

MATERIALS AND METHODS

Patients with stage 0, 1, or early 2 breast cancers were planned for both conventional tangent to boost and intensity modulation radiation therapy. Patient plans that developed improved dose homogeneity were then treated with beam modulation. Patients without any advantage from IMRT were treated conventionally (half-beam blocked tangents fields follow by seroma boost). The populations were compared for treatment tolerance and outcome.

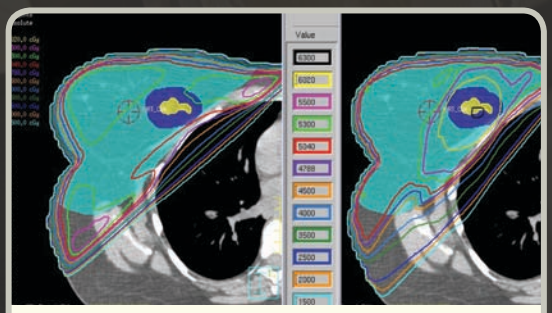
RESULTS

During 2.5 years of operation at a rural outreach radiation center 52 patients were treated for breast conservation. The beam modulation technique was introduced after the first year to offer IMRT as a treatment option. Subsequently 41 patients were evaluated and 22 were offered IMRT. 19 patients had no improvement in their plans and were treated conventionally. All 52 patients were judged for treatment tolerance and local control. To date, no patient has experienced a local or global failure. However, nearly 50% of patients treated with conventional tangent fields have treatable skin reactions while only one in the IMRT group developed such. Furthermore, no patient in the IMRT group developed breast edema or any cosmetic defect. Both groups had similar demographics, stage distributions, and prescribed doses. Beam modulation IMRT allowed a more uniform dose prescribing for that group.

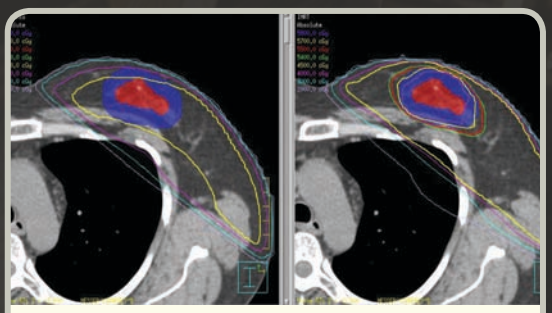
CONCLUSIONS

Solid Modulated Accelerated Radiation Therapy (SMART) is a useful form of IMRT delivery that yields similar tumor control probabilities. For larger volume patients it significantly enhances patient treatment tolerances and improves cosmetic outcomes. Thus far, it has proved to be a shortened-course, non-invasive alternative for low nodal risk early stage breast cancer patients.

Isodose Distribution

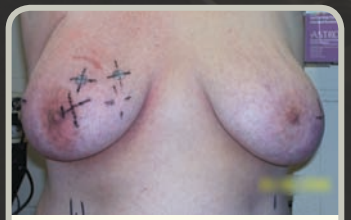


Tangent SMART treatment



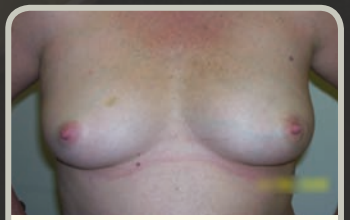
Tangent SMART treatment

Cosmetic Examples



Patient A: End of treatment

Patient B: One month out



Patient C: 18 months out

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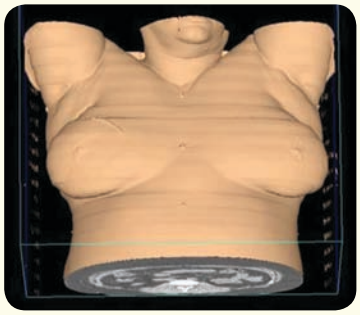
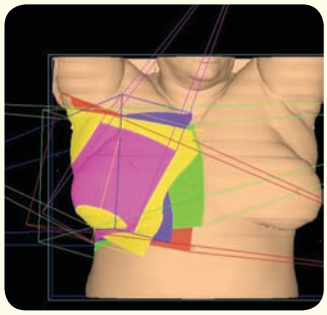
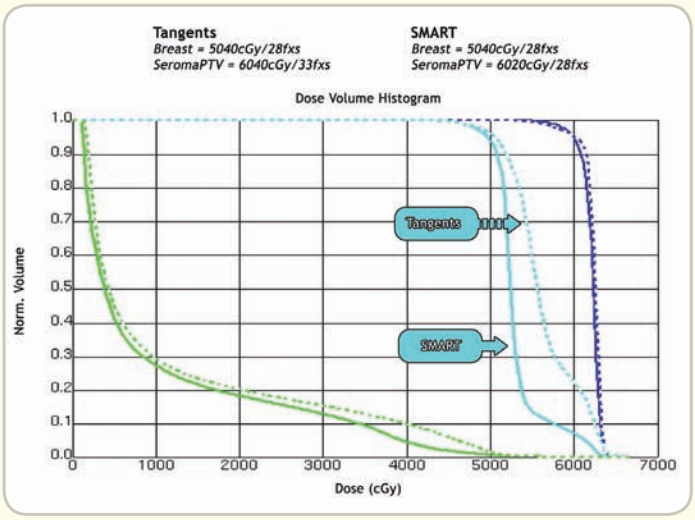
Technical Factors





DVH Comparison



References

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2. Kiricuta IC, et al. Target volume definition and target conformal irradiation technique for breast cancer patients, Acta Oncol 2000; 39: 429-436.

3. Baglan, et al. Accelerated partial breast irradiation using 3D conformal radiation therapy. Int. J. Radiation Oncology Biol. Phys. 2003; Vol. 55, No. 2; 302-311.

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Common Breast Treatment Schemes

Formula BED = nd x (1+d/alpha-beta ratio)

Seroma PTV Biologic Equivalent Dose Calculations:

Tumor response = Early responding tissues – a/b ratio = 3
Seroma volume: 28 fractions@ 2.15 Gy/day = BED 73.1 (Range 65.6 to 79.2)
Normal tissues = Late responding tissues – a/b ratio = 10
Seroma volume: 28 fractions@ 2.15 Gy/day = BED 103.3 (range 95.0 to 110.0)

Note:

Whole breast volume calculation is not demonstrated since it is standard dosing (1.8 Gy/day to 45 or 50.4 Gy) with a standard BED.

Summary

- 22 patients treated with SMART from February 2006 to February 2009
- Whole breast receives standard prophylactic dose (50.4 Gy at 180 cGy/fraction x 28)
- Seroma boost dose given concurrently (60.2 Gy at 2.15 Gy/ fraction x 28)
- Regimen is 5-10 days shorter
- 2 year results:
  - Local control: 100%
  - Cosmesis self score: 100%
  - Overall survival: 100%
  - Disease free survival: 100%

Photo courtesy of .decimal, Inc.

References

1. .decimal, Inc. in Sanford, Florida manufactures our three dimensional collimator mounted solid brass beam modulators used for daily treatments. They can be reached at 1.800.255.1613 or *www.dotdecimal.com*