

# **A multi-centre comparison of High Dose Rate Prostate Brachytherapy TRUS based treatment planning**

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# Overview

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- Aims and objectives
- Methods and materials
- Results
- Conclusions
- Future work

# Aims and objectives

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To assess differences in;

- contouring of the prostate and OAR,
- applicator reconstruction,
- treatment planning,

between observers for ultrasound based  
HDR prostate brachytherapy

# Methods and materials

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- Six centres contributed to the study
  - Offenbach
  - Oslo
  - Warsaw
  - Orebro
  - Manchester
  - Leeds
- Each centre provided two patient studies.
- Each patient study consisted of a virtual image set with no needles and a live image set with the needles in-situ.

# Methods and materials

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- This resulted in a sample consisting of image sets with different image qualities, prostate volumes and applicator types.
- The study was conducted in three distinct parts,
  - Contouring
  - Applicator reconstruction
  - Treatment planning

# Methods and materials

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## Contouring

- Six image sets were selected from the sample, 3 live and 3 virtual from 6 distinct patients.
- Each observer was asked to contour the prostate and OAR according to their centre's own protocol.
- Results were analysed by comparing prostate volumes, length, shape and sectional areas.

# Methods and materials

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## Reconstruction

- Two further live image sets were selected from the sample with the virtual positions of the needles indicated.
- The centres were asked to reconstruct the applicator.
- Results were analysed by comparing the source coordinates and DVH parameters obtained using constant dwell times and positions.

# Methods and materials

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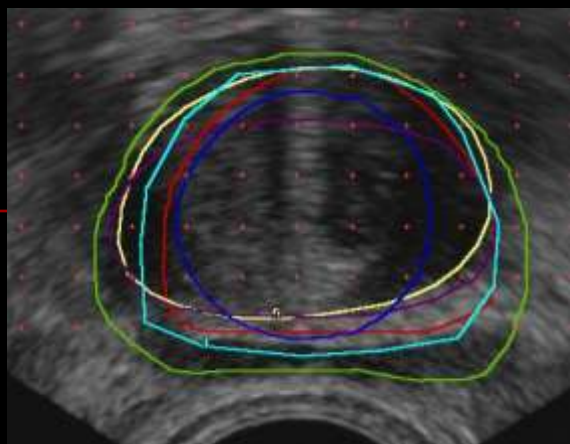
## Treatment planning

- The centres completed questionnaires detailing their planning methodologies.

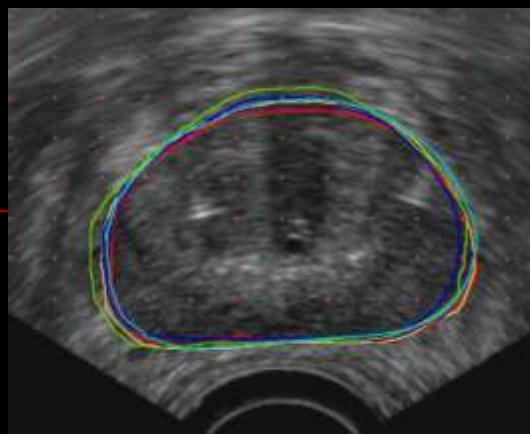
# Results

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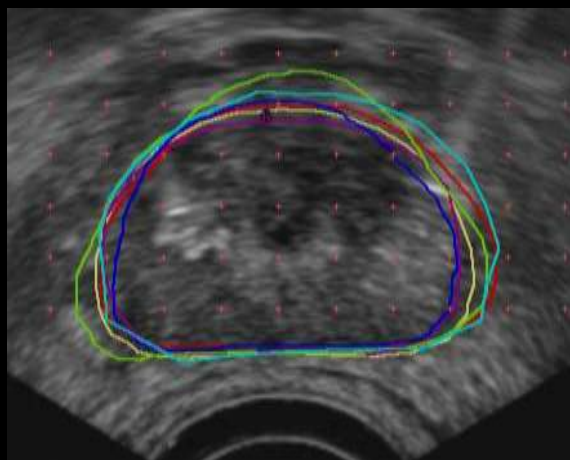
- There were significant variations in contouring between different observers resulting in differences in prostate volume, length, shape and sectional areas.
- The position of the base and apex varied between observers



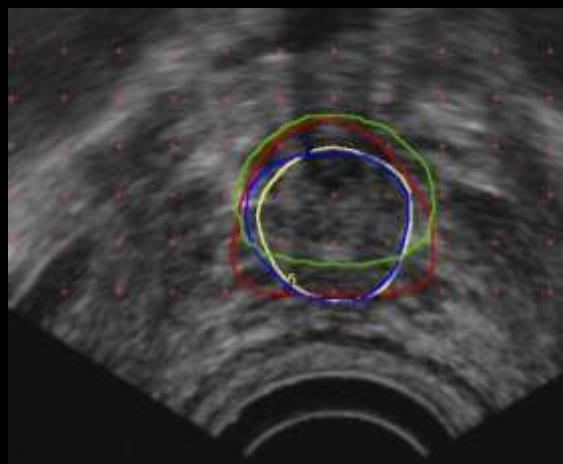
(a)



(b)

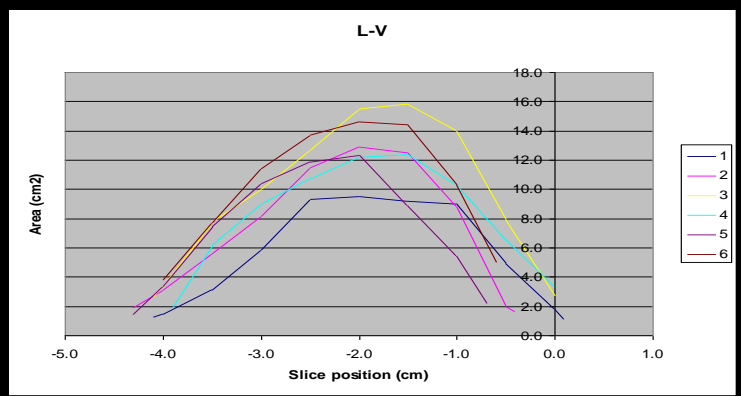
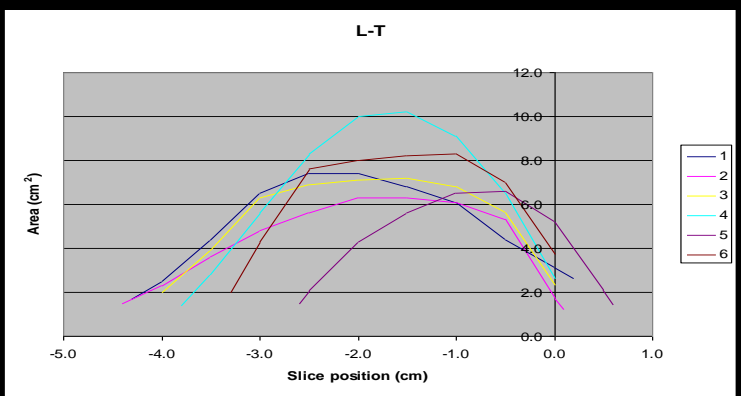
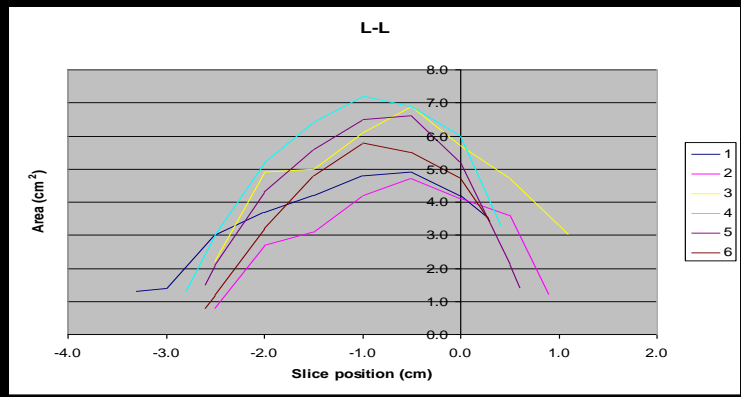
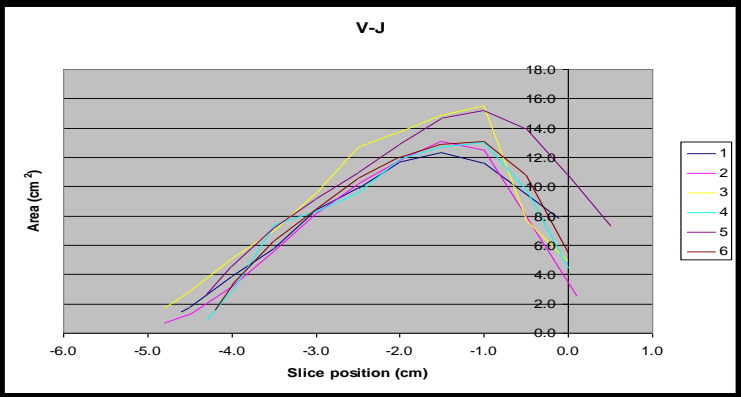
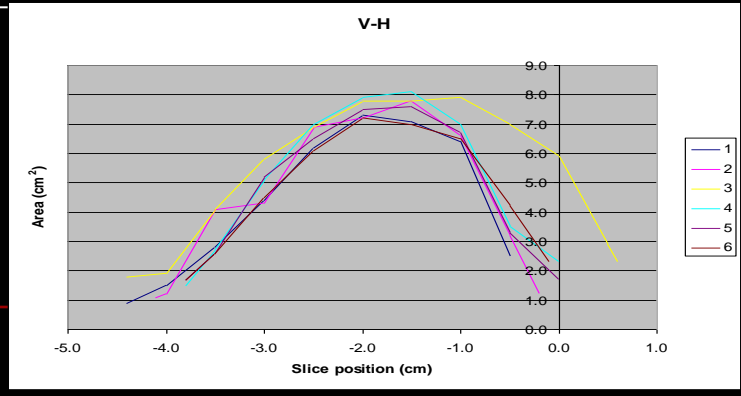
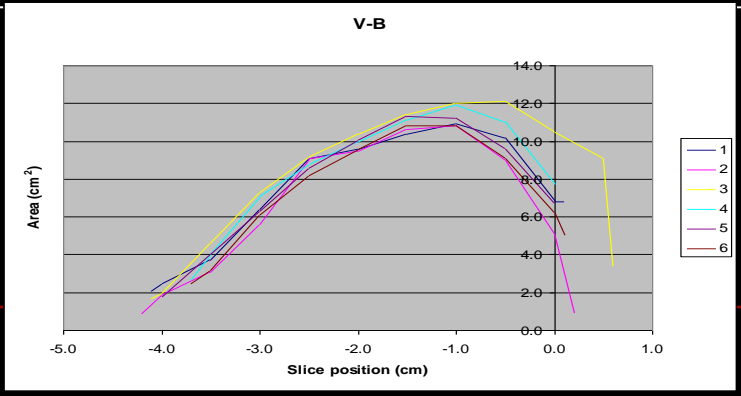


(c)



(d)

- Observer 1
- Observer 2
- Observer 3
- Observer 4
- Observer 5
- Observer 6



# Results

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- The differences in applicator reconstruction varied little in both source coordinates and the values of the DVH parameters.
- Planning methodologies were found to vary considerably between centres.

# Results

## Shift in coordinate (cm)

|                 | L-R  |      | L-W  |      |
|-----------------|------|------|------|------|
|                 | Mean | SD   | Mean | SD   |
| X               | 0.02 | 0.06 | 0.01 | 0.05 |
| Y               | 0.05 | 0.04 | 0.04 | 0.04 |
| Z               | 0.01 | 0.01 | 0.01 | 0.03 |
| <i>p</i> -value |      |      |      |      |
| X               | 0.99 |      | 0.99 |      |
| Y               | 0.99 |      | 0.99 |      |
| Z               | 0.99 |      | 0.99 |      |

# Results

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## DVH parameters

|                 | L-R   |     | L-W   |     |
|-----------------|-------|-----|-------|-----|
|                 | Mean  | SD  | Mean  | SD  |
| Prostate        |       |     |       |     |
| V100(%)         | 98.6  | 0.2 | 93.0  | 0.7 |
| D90(%)          | 111.8 | 0.4 | 103.7 | 0.9 |
| V150(%)         | 15.9  | 0.7 | 28.4  | 1.4 |
| V200(%)         | 2.4   | 0.1 | 7.1   | 0.2 |
| <i>p</i> -value | 0.99  |     | 0.99  |     |

# Conclusions

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- There were differences in contouring which resulted in different prostate dimensions.
- The variation in applicator reconstruction was small.
- The planning system requires knowledge of the free length.

# Conclusions

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- The free lengths were provided with the image sets and all observers used the same free lengths.
- This ensured consistency between observers.
- Different centres used different planning methodologies which could impact on dose distribution.

# Conclusions

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- Putting recommendations in place for contouring and applicator reconstruction could ensure a consistent approach to planning.

# Future work

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- Further investigations into planning
- Observers to plan according to their own protocol
- Observers to plan using a generic protocol
- Compare DVH values

# Future work

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- Centres asked to modify the plan by adding or removing a needle.
- Including more centres into the study.