

# Irregular vs. regular seed loading pattern in permanent prostate brachytherapy planning

Fröhlich Georgina, Major Tibor, Ágoston Péter,  
Polgár Csaba

National Institute of Oncology, Budapest, Hungary

**Purpose:** To evaluate the dosimetric differences between treatment plans using irregular seed loading pattern (ISLP) with loose seeds and regular seed loading pattern (RSLP) with stranded seeds in prostate brachytherapy.

**Material and methods:** Treatment plans of 9 implants using irregular and regular seed loading pattern were evaluated based on dose-volume histograms. The plans were created with SPOT PRO (Nucletron) treatment planning system applying IPSA optimization module followed by manual adjustment. 145 Gy dose was prescribed to the surface of the prostate and the dose coverage was aimed to be at least 95% and the D90 was at least 100%. For homogeneity the  $V150 \leq 50\%$  dose constraint was used. The maximal tolerance doses were:  $D10 \leq 150\%$  and  $D30 \leq 130\%$  for urethra and  $D2ccm \leq 145$  Gy and  $D0.1ccm \leq 200$  Gy for rectum. Dose-volume parameters for prostate (V90, V100, V150, V200, D90, D100), urethra (Dmax, D30, D10, D0.1ccm) and rectum (Dmax, D10, D0.1ccm, D2ccm), and quality indices (CI, DHI) were calculated and compared. Wilcoxon matched pairs test was performed between these parameters of treatment plans made by ISLP and RSLP.

**Results:** In plans using ISLP the mean number of seeds and the total activity were significantly higher than in plans with RSLP (51 vs. 47,  $p = 0.0041$  and 24.4 mCi vs. 22.8 mCi,  $p = 0.0042$ ). The mean needle numbers were practically the same (17 vs. 18,  $p = 0.1038$ ). There was no significant difference in the dose-volume parameters of V150 (54.1% vs. 58.2%,  $p = 0.0979$ ), V200 (26.2% vs. 25.5%,  $p = 0.6702$ ) and D90 (111% vs. 105.9%,  $p = 0.0642$ ). The target coverage (V100) was significantly higher with ISLP (95.5% vs. 92.7%,  $p = 0.0099$ ), the V90 were 98.1% vs. 96.3%,  $p = 0.0243$ , the D100 were 69.6% vs. 58.6%,  $p = 0.0177$ . The dose distributions were more homogeneous (DHI: 0.43 vs. 0.37, respectively,  $p = 0.0159$ ). Dose to the urethra was lower: Dmax were 135.5% vs. 171.6%,  $p = 0.0077$ , D30 were 118.2% vs. 137.3%,  $p = 0.0001$ , D10 were 123% vs. 147.9%,  $p = 0.0001$  and D0.1ccm were 123.2% vs. 150%,  $p = 0.0004$ . There was no significant difference in dose in Dmax and D10 for rectum (107.4% vs. 109.5%,  $p = 0.4772$  and 77.2% vs. 74.7%,  $p = 0.1986$ ), but dose to the most exposed 0.1 cm and 2 cm of rectum was higher with ISLP (128.8% vs. 87.2%,  $p < 0.001$  and 76.6% vs. 49%,  $p < 0.001$ ).

**Conclusions:** With the use of irregular seed loading pattern the dose coverage and homogeneity of the target