



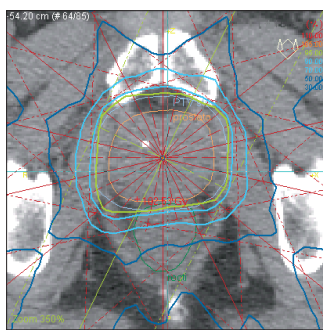
Decreased dose to the rectum during photon boost therapy of the prostate

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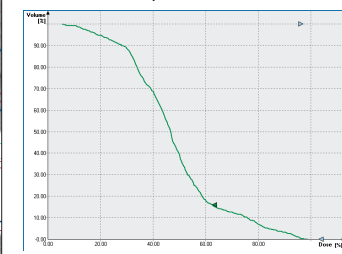
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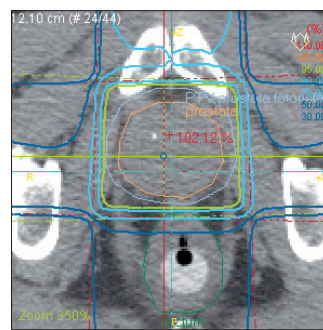
Conclusion: Withdrawal of the rectum from the prostate during 3D conformal radiotherapy decreases the volume receiving a dose of more than 70 Gy to rectum with 61 % compared to IMRT.



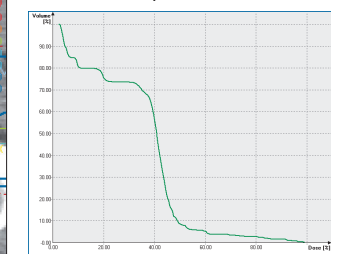
Prostate IMRT plan without rectal rod



Dose/volume histogram of the rectum without rectal rod



Prostate dose plan with rectal rod



Dose/volume histogram of the rectum with the rectal rod

Background: Curative treatment of localized prostate cancer with radiotherapy demands high doses. Dose escalation with IGRT is often used or a combination of 3D conformal radiotherapy with either brachy therapy or proton therapy. The proximity between the prostate and rectum often leads to a compromise between dose to target and organ at risk. The positioning of the prostate during radiotherapy is also a problem, since the prostate is known to be a movable organ. We have previously described a method where the distance between the prostate and rectum is increased during boost therapy with protons by withdrawal of the rectum in dorsal direction. The method included positioning of the prostate with small gold markers. The volume of rectum receiving more than 70 Gy was reduced with 77% when withdrawal of rectum was used. We have now developed the method for photon radiotherapy.

Purpose: Reduce the dose to the rectum by withdrawal of rectum during photon boost therapy.

Method: Nine patients with biopsy proven, localized adenocarcinoma of the prostate were studied. The patients received 2–3 gold markers, which were spread out in the prostate in order to ensure a satisfying 3D positioning. The patients were immobilized in a special fixation couch, and a cylindrical rod of Perspex was inserted into the rectum. This device is allowing the rectum to be retracted dorsally in order to maximize the separation between the prostate gland and the rectum wall.

Each day of the photon boost treatment, the prostate was positioned using anterior-posterior and lateral portal images visualising the gold markers in the prostate. The positioning was done with an accuracy better than 3 mm. Two comparative treatment plans were made. The first with 3D conformal photon radiotherapy to a dose of 50 Gy in 25 fractions of 2 Gy and with an additional photon boost of 20 Gy in four fractions of 5 Gy with retraction of the rectum. The other treatment plan was made with the same fractionation but planned with IMRT technique without retraction of the rectum. The IMRT plans were realised with seven beam directions and planned to be delivered with a step-and-shot technique. The total number of segments for all seven beams were between 50 and 60 segments for all nine patients.

Results: Analysis of the volume of the rectum receiving a dose exceeding 70 Gy (calculated in 2 Gy fractions) was made for the different plans. In the IMRT plans, the rectal volume was 12,7 cc (5,4–30 cc) compared to 4,9 cc (1,1–12,5) in the treatment plan with the rectal rod.

In summary, comparative treatment planning shows that the treatment plans with the rectal rod reduces the rectal volume receiving more than a dose corresponding to 70 Gy in 2 Gy fractions with 61% compared to the IMRT plans.