

Treatment of an oropharyngeal tumor using Elekta PreciseBEAM™ IMRT

Institution:	The Royal Marsden Hospital, UK
Patient:	61-year-old
Diagnosis:	Squamous cell carcinoma of the oropharynx
Plan:	Seven-field IMRT
Treatment:	65Gy to primary PTV, 54Gy to nodal PTV



Treatment of an oropharyngeal tumor using Elekta PreciseBEAM™ IMRT

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Presentation

On examination a 1.5cm lymph node was found in the left level II which was slightly tender but no other palpable lymphadenopathy. The tumor in the oropharynx was extensive sub-mucosally arising from the anterior and posterior faucial pillars extending just onto the soft palate but extending into the tongue base and anteriorly into the posterior part of the oral tongue.



Diagnosis

Nasoendoscopy and biopsy confirmed findings.

Biopsy

Squamous cell carcinoma.

Primary tumor

Enlarged node

Figure 1: diagnostic CT scan

IMRT planning

The patient was immobilized in a shell encompassing the lower face, neck and shoulders. A planning CT scan was transferred to Philips Pinnacle3® for planning. Primary and nodal CTVs were outlined and grown by 3mm to create the PTVs. Edited versions of the PTVs were also created for planning purposes, excluding the region within 5mm of the skin surface.

A seven-field IMRT plan at 6MV was used, with gantry angles 160°, 100°, 50°, 0°, 310°, 257°, 200° – selected to avoid patient support structures and the patient's shoulders, whilst considering the position of the target volumes and organs-at-risk (OARs). The aim was to cover 99% of each target volume with the 90% isodose, and 95% of the volume with the 95% isodose. Dose was prescribed to give a mean dose of 65Gy to the primary PTV. The OARs were the spinal cord (max dose to be kept below 48Gy), brain stem (max <55Gy) and parotids (mean dose as low as possible).

Treatment

The patient was entered into the PARSPORT trial, which is a multi-centre randomized trial of parotid-sparing IMRT compared to conventional radiation therapy. The patient drew the IMRT arm of the trial.

Treatment consisted of two cycles of induction chemotherapy with cisplatin (80 mg/m²) day one and Fluorouracil (1000 mg/m²) days one to four, followed by radiation therapy using IMRT, delivering 65Gy in 30 fractions to the primary tumor and the involved nodes and 54Gy in 30 fractions to the uninvolved nodes.

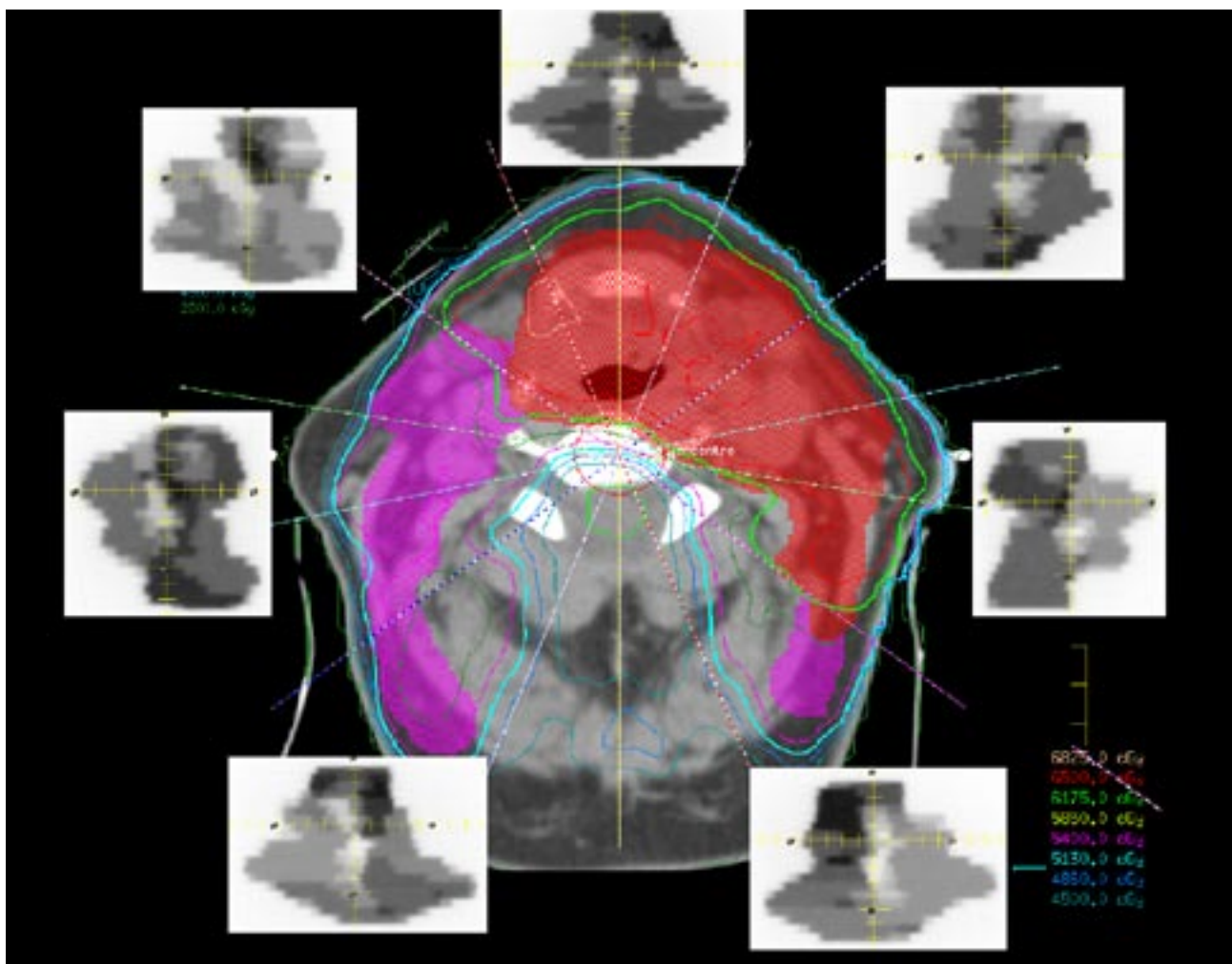


Figure 2: seven-field IMRT technique, showing fluence maps for each beam. The isodoses conform well to the primary PTV (red) and the nodal PTV (pink) whilst avoiding the spinal cord (green outline).

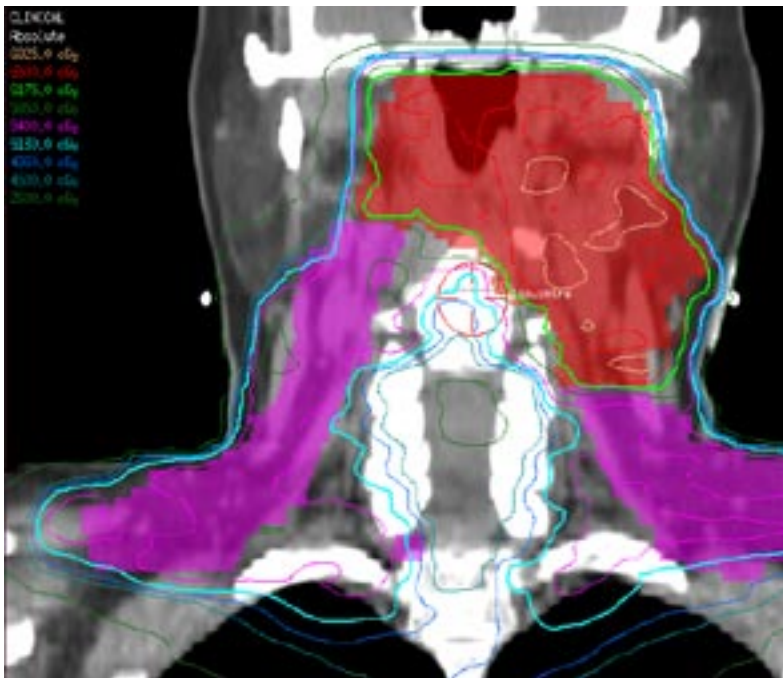
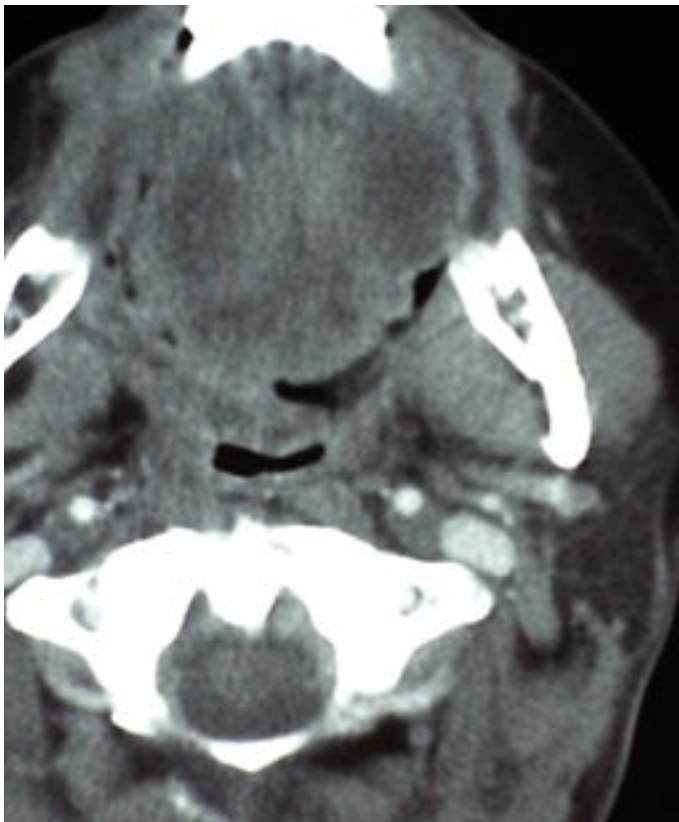


Figure 3: coronal isodose distribution – the isodoses conform tightly to the PTVs, avoiding the spinal cord and parotids.

Figures 2 and 3 show the dose distribution and figure 4 the dose volume histogram for the treatment plan. The plan had a total of 50 segments and took approximately 8 min to deliver on an Elekta Precise Treatment System™ linear accelerator. Plan verification was performed using film and ion chamber; Figure 5 shows a comparison between a coronal film measurement and the planning system prediction using Scanditronix-Wellhöfer OmniPro™ I'mRT. The ion chamber measurements were within 1%.



Positional verification was performed for the first three treatments and then weekly, using an open anterior and lateral field acquired using iView™ which was compared to DRRs generated from the planning CT scan.

Outcome

The patient had a clinical and radiological complete response to treatment and is disease free six months following treatment completion (figure 6).

Figure 6: CT scan showing radiological complete response

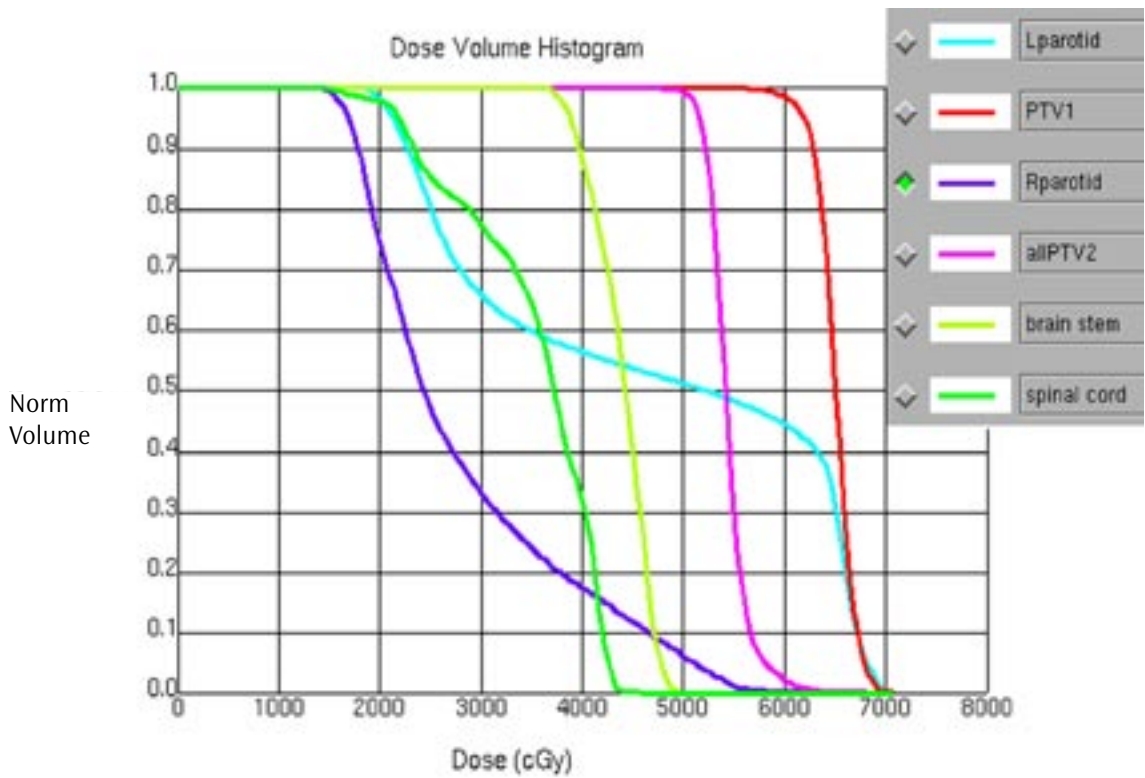


Figure 4: dose-volume histogram for IMRT plan – PTV, spinal cord and brain stem were all within the plan acceptance criteria. A large proportion of the left parotid lay within the primary PTV and hence could not be spared (mean dose 46.8Gy). The mean dose to the right parotid was 28.2Gy.

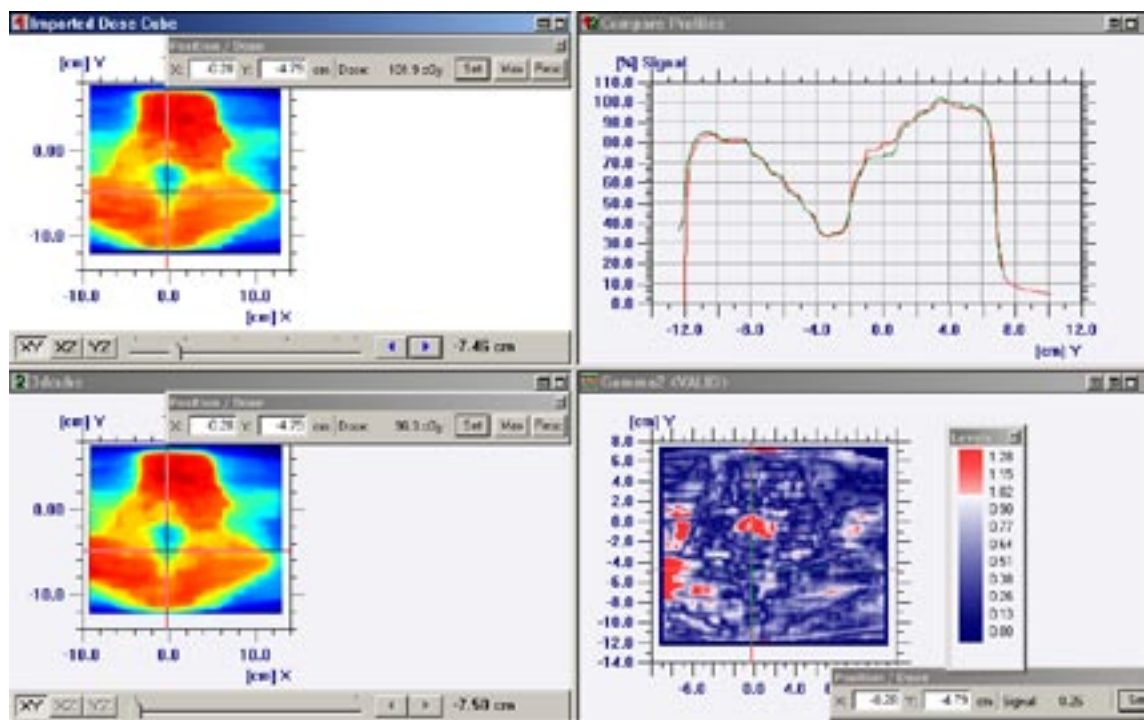


Figure 5: comparison between planning system (top left) and film (bottom left). The gamma map (bottom right) has been calculated using acceptance criteria of 3% and 3mm. The red areas indicate regions that do not fall within these criteria; this is due mainly to out-of-plane dose gradients.

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