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Review

Intensity-modulated radiotherapy in head and neck cancer — an update for oral and maxillofacial surgeons

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Abstract

Intensity-modulated radiation therapy (IMRT), a relatively new method of delivering radiotherapy, can precisely target a point within a specific tumour and reduce the dose to nearby anatomical structures. This is particularly important in the head and neck where radiotherapy can easily and irreparably damage the salivary glands, spinal cord, and eyes, and where, with increasingly better outcomes and survival, late complications of conventional radiotherapy (including osteoradionecrosis of the cervical spine) can be difficult to manage. IMRT has the potential advantage of reducing side effects including xerostomia and myelopathy of the cervical spinal cord. Several clinical trials have recently been published, and in this update we give an overview of IMRT for oral and maxillofacial surgeons, and discuss what the future may hold for radiotherapy.

Keywords: Review; intensity-modulated radiotherapy; head and neck cancer; oral cancer; complications; xerostomia

Introduction

Intensity-modulated radiation therapy (IMRT), which has been available for the last 15 years, is a highly-targeted, computer-planned treatment that is delivered by a linear accelerator to a solid tumour.[1] Unlike conventional 3-dimensional conformal radiotherapy, the dose can be matched precisely to a complex 3-dimensional treatment volume that incorporates concavities (Figs. 1–3). Typically, the summation of seven beams, each with "intensity modulation" (variation of the strength of the beam in different parts of it)[1] gives a mathematical solution to the 3-dimensional problem of how to deliver different doses to different parts of a tumour.

In volumetric modulated arc therapy (VMAT), a variant of IMRT, a beam rotates in an arc around the patient while its shape and intensity are varied. IMRT delivers a therapeutic dose to the tumour and protects nearby dose-limiting structures such as the parotid glands,[2] eyes and orbital regions,[3] and cervical spinal cord.[4] Since these normal structures are relatively spared, it has been reported to be associated with fewer side effects such as xerostomia and cervical myelopathy, and it now appears in several head and neck cancer guidelines (including the UK National Guidelines and those of the National Comprehensive Cancer Network) because of the possibility of reducing the toxicity of treatment.

Sparing of these dose-limiting structures however, comes at the cost of a low "dose bath" of radiation to other normal tissues. For example, the anterior mouth has little or no exposure to radiation with conventional radiotherapy, whereas doses of around 25 Gy may be seen with IMRT.

Better matching of the therapeutic dose to a target volume risks the under-treatment of areas that might contain microscopic tumour spread. It is therefore vital to delineate the target volume accurately, and this relies on close cooperation between the radiation oncologist, radiologist, and

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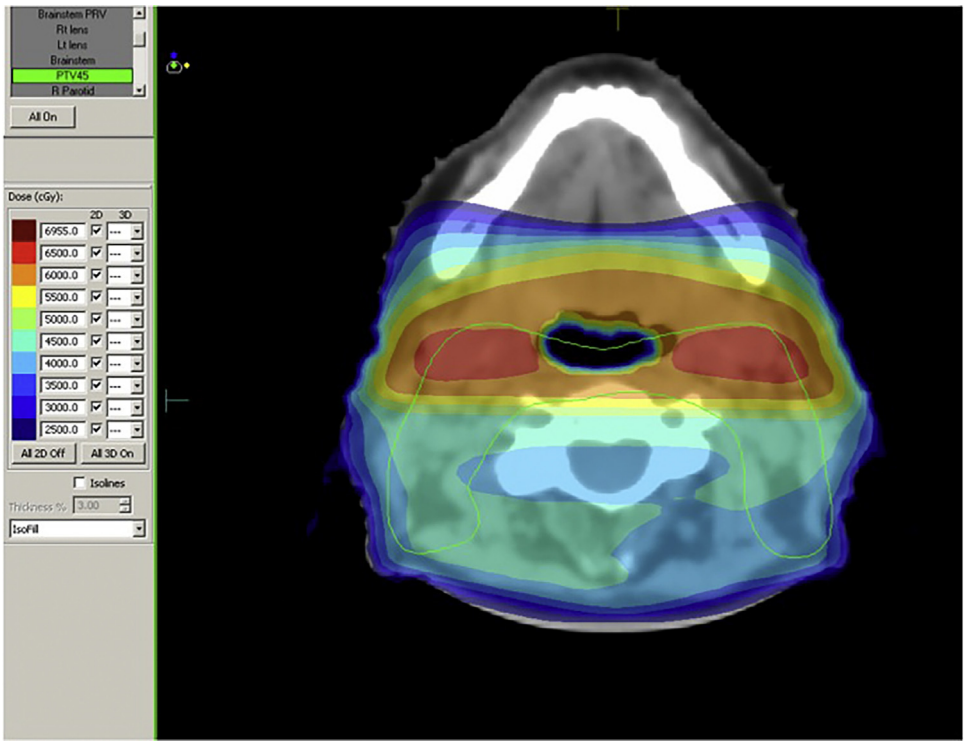

Fig. 1. Conventional radiotherapy for an unknown primary oropharyngeal carcinoma showing sparing of the anterior mouth.

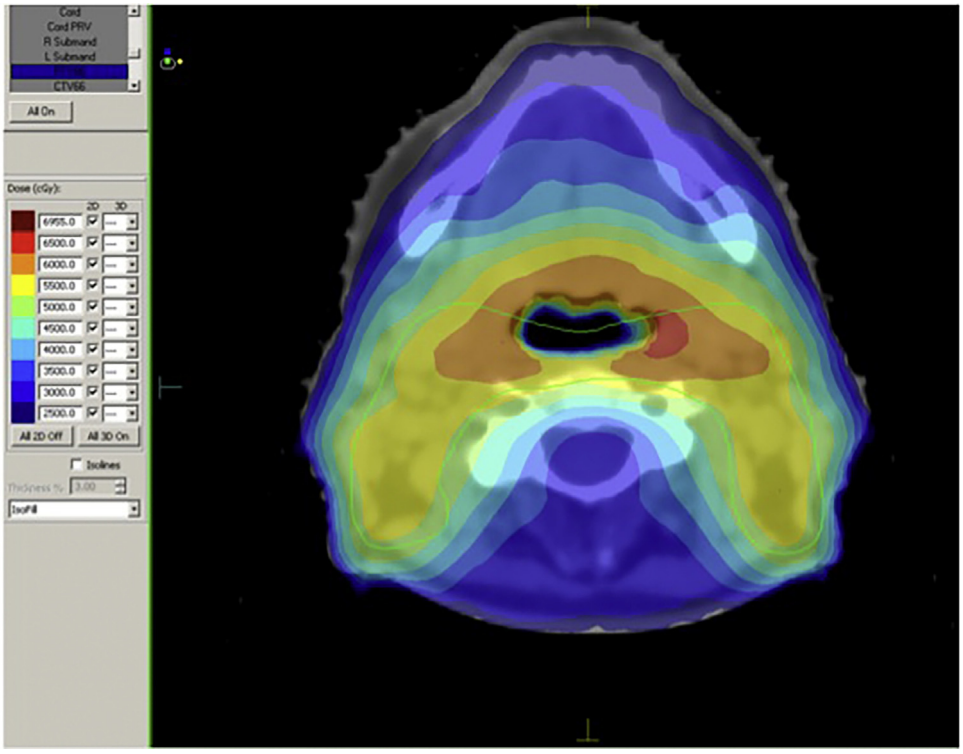

Fig. 2. IMRT in the same patient showing the low "dose bath" affecting the anterior mouth, but much better shaping of the dose to the target volume (outlined with a faint green line) while sparing the spinal cord.

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