Radiotherapy remains integral part of treatment of Head and neck malignancies, in curative, post operative and palliative set ups.

Aim:
- Highest possible locoregional control
- Preservation of function
- Good Cosmetic results
- Good quality of life
SPECIFIC OBJECTIVES

- To identify
  1) Differences between 2D-RT and 3D-CRT
  2) Chain of processes in 3D-CRT
  3) Transiting from 2D-RT to 3D-CRT
  4) Impact of IMRT
  5) Ultimate goal – Adaptive RT
Radiotherapy Timeline

1895
- 100-400 keV X-Rays
- Rotation Therapy

1950
- Co-60
- Low Energy Linacs
- Betatrons

1965

1980
- Computerized 2-D Planning
- High Energy Linacs
- Simulators

1995
- CT Scanners
- 3-D Planning
- Accurate Dosimetry

1995
- MRI, PET, PET-CT
- MLCs, Optimization, and IMRT
- Image-Guided Radiotherapy
CONVENTIONAL 2D-RT - 1960S

- Simple treatment delivers uniform doses from 2-4 beam angles.
- Beam shape is either rectangular or square.
- Beam hits healthy tissue as well as tumor tissues.
- Doses have to be kept low to minimize harm to normal tissue.
STEPS FOR 2D PLANNING

Positioning

- Supine position (usual)
- Head - extended
- Immobilization-custom-made thermoplastic cast
TWO-DIMENSIONAL (2D) RT FOR HEAD-NECK CANCERS

Treatment area - drawn on orthogonal simulator films.

Field - Bilateral or antero lateral Wedge pair portals

- Matching third low anterior neck field-added sometimes
- Treatment planning with isodose plans on 1-3 planes
2D-RT (CONVENTIONAL OPEN FIELDS)
2.5D-RT (CONVENTIONAL SHAPED FIELDS)
2D Radiation Treatment Planning
Conventional 2D Planning
BENEFITS OF 2D PLAN

- Optimal field margins
- Large enough to prevent regrowth of the tumour
- Limited enough to prevent excessive irradiation to normal tissue
- Optimal dose distribution
CHALLENGES IN OPTIMAL DELIVERY OF CONVENTIONAL RADIOTherapy FOR HEAD-NECK CANCERS

- Close proximity of tumour to organs at risk.
- Tolerance of normal tissues limits the delivery of optimum high dose.
- Contour variation and tissue inhomogenity.
- Set up uncertainties.
Tumour volume and critical structures are drawn slice by slice on CT/MR Images
BEV (Beam’s eye view) are created
Complex set of 4-6 beams with precise immobilization
Tight margins are used
RATIONALE OF CONFORMAL RADIOTHERAPY

- Achievement of Dose Escalation
  - To improve loco-regional control
  - To improve disease-free and overall survival

- Reduction in normal tissue complications
  - To improve quality of life
BEAM MODIFICATION IN CONFORMAL RT

- Multiple fields including oblique and non co-planar beams.
- Varying weightage and wedges.
- Multi-leaf collimators
- Shaped blocks- Cerrobend blocks or MLC
MULTI-LEAF COLLIMATOR (MLC): TRUE ENABLER OF CONFORMAL RADIOTHERAPY

3D-CRT

1/ Radiation intensity is uniform within each beam

2/ Modulation conferred only by wedges.
2-DIMENSIONAL CONFORMAL RADIOTHERAPY TO 3 - DIMENSIONAL CONFORMAL RADIOTHERAPY

2D RT

3D CRT
TYPES OF ERRORS

- Discrepancy in intended and actual treatment position
- Systemic positioning errors
- Target delineation errors
- Recurring errors
- Treatment plan transcription errors
Patient immobilization is the most important step for all types of conformal therapy.
CT-Simulation: Imaging for Conformal Planning

- High Resolution Diagnostic images
- 3-D Reconstruction capabilities
- 3-D Tumour / OAR localisation
- Networked to Treatment Planning
GTV = Visible/palpable tumor
CTV = microscopic extension
ITV = CTV + Internal margin (IM)
PTV = ITV + Set up margin (SM)
The arrow illustrates the influence of the organs at risk on delineation of the PTV (thick, full line).

- **Red**: Gross Tumor Volume (GTV)
- **Pink**: Subclinical Involvement
- **Green**: Internal Margin (IM)
- **Light Green**: Set Up Margin (SM)
BEV PROJECTION FROM DIFFERENT ANGLES
PLAN APPROVAL & TRANSFER

- Final plan
- MU setting
- Final MU calculations
PLAN EVALUATION

- Dose Uniformity
- DVH
- Beam Weights
Port film or EPID to verify Isocentre placement as well as beam shape determination, prior to start of treatment.
DISADVANTAGE OF CONFORMALITY

- Nature of the photon beam is the biggest impediment
  - Has an entrance dose.
  - Has an exit dose.
  - Follows the inverse square law.
LIMITATIONS OF CONFORMAL RADIOTHERAPY

- Sophisticated Treatment and set up.
- Good understanding of cross sectional anatomy
- Stringent QA procedures
- High integral dose

Highly susceptible to motion and treatment related errors – Achilles heel of Conformal RT.
# Differences Between 2D and 3DCRT

<table>
<thead>
<tr>
<th>Key Steps</th>
<th>Typical Procedures</th>
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<tr>
<td></td>
<td><strong>2DRT</strong></td>
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<tr>
<td>Patient assessment &amp; decision to treat with curative radiation therapy</td>
<td>• Clinical procedures</td>
</tr>
<tr>
<td>Patient positioning &amp; Immobilization</td>
<td>• Establish treatment position</td>
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<tr>
<td></td>
<td>• Construct patient immobilization device</td>
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<tr>
<td>Image acquisition</td>
<td>• Fluoroscopy</td>
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<tr>
<td></td>
<td>• Single CT slice in treatment position</td>
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<tr>
<td>Target &amp; organ contouring</td>
<td>• Concept non-existant</td>
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<tr>
<td>Dose prescription</td>
<td>• Prescription in midplane or at isocentre</td>
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3D-CRT PROCESS & WORKFLOW SUMMARY

- Immobilization
- Planning Imaging
- CT/MR/PET
- Contour Target Volume and Normal Structure
- Select Beam Geometry and Energy
- Forward Planning & Optimization
- Plan Evaluation & Approval
- Patient set up verification & Treatment
- Machine QA
3D-CRT PROCESS & WORKFLOW SUMMARY
EVOLUTION FROM 2D TO IMRT
IMRT

THE SEARCH FOR CONFORMALITY
IMRT (INTENSITY MODULATED RADIOTHERAPY)

- An advanced form of 3DCRT.
- It is a radiation therapy technique where non-uniform fluence is delivered, using computer aided optimization.
- Types: Forward
  Inverse
RATIONALE OF IMRT

- More conformal than 3DCRT
- Dose more homogenous within PTV
- Sharp fall off beyond PTV boundary
- Less dose to OAR- lesser complications
## IMRT

<table>
<thead>
<tr>
<th>Forward Planning</th>
<th>Inverse Planning</th>
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</thead>
<tbody>
<tr>
<td>Beam parameters (beam orientation,</td>
<td>3D dose distribution</td>
</tr>
<tr>
<td>shape, modifier, beam weights, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beams Fluence Profile</td>
</tr>
<tr>
<td>3D dose distribution.</td>
<td></td>
</tr>
<tr>
<td>If not satisfactory, then modify the</td>
<td>If objective criteria is not satisfied,</td>
</tr>
</tbody>
</table>
| beam parameters                          | Then, changes the beam parameters and/or
c|                                           | objective criteria                     |
|                                          |                                           |
The user specifies the dose and dose-volume constraints for the PTV and OARs, using a system of priorities and weights.

Normally the beam arrangement is predefined also.

The system performs iterative calculations with a quadratic function, to achieve the best possible dose distribution based on the given dose constraints.

After this, the accurate dose distribution is recalculated after considering the machine (jaw & MLC) parameters.
## Dose Constraints

1. Based on physical parameters.  
- Dose based  
- Dose volume based

2. Biological model  
- Tumor control probability.  
- Normal tissue complication probability.  
- EUD.  
- Effective volume.
OPTIMISATION

- The process by which the optimum beam weight or intensity distribution is determined that can best satisfy the **objective function**/cost function/score as specified by planner.
STEP & SHOOT VS SLIDING WINDOW IMRT

Comparing 3DCRT and inversely optimized IMRT planning for head and neck cancer: Equivalence between step-and-shoot and sliding window techniques

Barbara Longobardi\textsuperscript{a}, Elena De Martin\textsuperscript{a}, Claudio Fiorino\textsuperscript{a,\ast}, Italo Dell’oca\textsuperscript{b}, Sara Broggi\textsuperscript{a}, Giovanni Mauro Cattaneo\textsuperscript{a}, Riccardo Calandrino\textsuperscript{a}

Conclusions: With the Varian planning and delivery system, Step-and-shoot approximations of inversely optimised fluences in head-neck IMRT compare well with SW delivery, even with only five intensity levels. With a number of intensity level of 10 or more, no differences can be appreciated in PTV coverage/OAR sparing with respect to SW.

Radiotherapy and Oncology 77 (2005) 148-156
95% DOSE COLOUR WASH

7 Beam arrangement
IMRT

DVH

L parotid 42% >30Gy
R parotid 55%>30 Gy
THREE-DIMENSIONAL CONFORMAL VS. INTENSITY-MODULATED RADIOTHERAPY IN HEAD-AND-NECK CANCER PATIENTS: COMPARATIVE ANALYSIS OF DOSIMETRIC AND TECHNICAL PARAMETERS

Luca Cozzi, Ph.D.,* Antonella Fuglata, Dr.,* Alessandra Bolsi, Dr.,*† Giorgia Nicolini, Dr.,* and Jacques Bernier, Ph.D., M.D.†

Materials and Methods: Twenty-six head-and-neck cancer patients were irradiated following a feasibility internal protocol with IMRT. Treatments were performed with either the static step-and-shoot (20) or the dynamic sliding window (6) techniques on a 6 MV Varian Clinac equipped with a multileaf collimator with 80 leaves. Dose plans were computed using commercial treatment planning systems: MDS-Nordion Helax-TMS for static cases and Varian Eclipse for dynamic cases. Dose plans were evaluated in terms of physical quantities based on dose-volume histograms and isodose distributions. Each IMRT plan was also compared to a reference 3D conformal therapy plan (3DCRT).

Results: Elective target volumes ranged from 530 to 1151 cm³ with a mean of 780 ± 141 cm³. Boost volumes ranged from 248 to 832 cm³ with a mean of 537 ± 165 cm³. Thirty-two dose plans were generated with static technique and 10 with dynamic. In the static mode, 6.8 ± 3.4 fields were applied on average with 12.5 ± 1.3 segments per field. In the static mode, 264 ± 56 MU per Gy were erogated, whereas in the dynamic mode, 387 ± 126 MU per Gy were erogated, to be compared to 147 ± 20 computed for reference 3DCRT plans. For all target volumes in general, conformity was improved compared to 3DCRT (e.g., V95 increased from 85% to 93% with p < 0.001, or equivalent uniform dose normalized to prescribed dose increased from 0.86 to 0.96 with p = 0.002). Irradiation of parotid glands or spinal cord improved, as well: For parotids, Dmax reduced from 59 Gy to 41 Gy (p < 0.001). For spinal cord, Dmax reduced from about 40 Gy to about 30 Gy (p < 0.001).
IMRT V/S TOMOTHERAPY

INTENSITY-MODULATED RADIATION THERAPY (IMRT) DOSIMETRY OF THE HEAD AND NECK: A COMPARISON OF TREATMENT PLANS USING LINEAR ACCELERATOR–BASED IMRT AND HELICAL TOMOTHERAPY

Ke Sheng, Ph.D.,* Janelle A. Molloy, Ph.D.,*† and Paul W. Read, Ph.D., M.D.‡

- Dosimetric study (N=10)
- All patients had oropharyngeal carcinoma (5 BOT, 5 tonsil)
- 2 sets of plans: IMRT vs Tomotherapy
- Improved dose homogeneity within the target volume with HT (SD within the PTV reduced by 71%)
- Improved critical structure sparing (EUD of surrounding normal tissue reduced by 17.4% for BOT and 27.1% for tonsil)
- 80% reduction in NTCP of parotid glands

IMRT V/S V-MAT

Volumetric modulated arc radiotherapy for carcinomas of the oro-pharynx, hypo-pharynx and larynx: A treatment planning comparison with fixed field IMRT

Eugenio Vanetti, Alessandro Clivio, Giorgia Nicolini, Antonella Fogliata, Sarbani Ghosh-Laskar, Jai Prakash Agarwal, Ritu Raj Upreti, Ashwini Budiukkar, Vedang Murthy, Deepak Dattatray Deshpande, Shyam Kishore Shrivastava, Ketayun Ardeshir Dinshaw, Luca Cozzi

- Dosimetric study (N=29)
- Patients of carcinoma oropharynx, hypopharynx and larynx
- Conventional (Sliding Window) IMRT vs Rapid Arc (single arc) vs Rapid Arc (double arc)
- Both variants of rapid arc were significantly better in sparing normal tissue. Average doses to ipsilateral parotid were 40 Gy vs 36.2 Gy vs 34.4 Gy & to contralateral parotid were 32.6 Gy vs 30.9 Gy vs 28.2 Gy
- Rapid arc (double arc) also significantly improved target coverage & homogeneity with respect to conventional IMRT.
PROCESS OF IMRT PLANNING

- Immobilization
- Planning CT
- Image transfer
- Contouring of volumes
- Margins
- Treatment planning
- Selection of optimum plan (dose distribution & DVH analysis)
- **Plan quality assurance**
- Plan implementation
- Position verification (2D/3D)
- Treatment execution
IMRT WORKFLOW

WORKFLOW

CT simulator → Unified Database → TPS → QA

LA → LA console
What happens to the parotid glands in Conventional RT?
PAROTID SPARING

PAROTID DOSE & XEROSTOMIA

- **Eisbruch et al (1999)**: A mean parotid dose of < 26 Gy should be planning goal.
- **Eisbruch et al (2007)**: Substantial parotid flow recovery (upto 86% of pretreatment levels) at 2 years if mean doses are between 25-30Gy.
- **Eisbruch et al (2010)**: Severe xerostomia (<25% of baseline) avoided if mean parotid dose kept to <20Gy (if one parotid is to be spared) or <25 Gy (if both are to be spared)
PAROTID SPARING

DOES PAROTID-SPARING IMRT HAVE A NEGATIVE IMPACT ON LOCAL CONTROL?

- **Cannon & Lee (2008):** (N=3) All patient had recurrence near a spared parotid gland.
- **Eisbruch et al (2005):** (N=158, all stage III/IV) 19/23 failures occurred in-field, within the high-dose volume. Suggest that clinical rather than dosimetric factors predicted outcome & suggested treatment intensification in these advanced cases.
Xerostomia does not correlate with parotid doses alone.

If submandibular gland doses are kept to $\leq 39\text{ Gy}$, then also there is good recovery of salivary flow rates at 2 years.
PHARYNGEAL CONSTRUCTORS SPARING

CONSTRUCTOR DOSE & DYSPHAGIA

- Levendag et al (2007): Significant correlation between doses to superior and middle constrictors and incidence of severe dysphagia. Steep dose response curve, with 19% increase in probability with every 10Gy dose.

- Bhide et al (2009): No statistically significant correlation between radiation dose to the pharyngeal constrictors and observer-assessed/patient-reported severe dysphagia at 1 year
QUALITY OF LIFE

IMRT: IMPACT ON QOL

- Evidence-based review by Nutting et al (2010):
- Significant heterogeneity in data.
- Conflicting results.
CONCURRENT CT & IMRT

CHemo: BED

HOW MUCH RADIATION IS THE CHEMOTHERAPY WORTH IN ADVANCED HEAD AND NECK CANCER?

Mohit Kasibhatla, M.D., John P. Kirkpatrick, M.D., Ph.D., and David M. Brizel, M.D.

Department of Radiation Oncology, Duke University Medical Center, Durham, NC

Conclusions: Chemotherapy increases BED by approximately 10 Gy in standard and modified fractionated radiotherapy, equivalent to a dose escalation of 12 Gy in 2 Gy daily or 1.5 Gy twice daily. Such an escalation could not be safely achieved by increasing radiation dose alone. © 2007 Elsevier Inc.

between increase in locoregional control (LRC) and increase in BED with modified vs. standard fractionated radiotherapy. The increase in LRC with chemoradiotherapy vs. radiotherapy alone, the BED of the radiotherapy-alone arms, and the “S” value were used to calculate the BED contribution from chemotherapy and the total BED of chemoradiotherapy from each study.

CONCURRENT CT & IMRT

RTOG 00-22 (2010)

- N=69 (14 institutions)
- All patients of Ca oropharynx, stage T1-T2,N0-N1,M0
- No chemo was permitted
- RT dose was 66Gy/30# to PTV(gross disease) and 54-60Gy/30# to PTV (subclinical)
- Median FU=2.8 years
- 2-yr LRF was only 9%.
- Very low rate of severe (>grade 2) late toxicities: skin (12%), mucosa(24%). Xerostomia (grade 2) was seen in 55% patients at 6 months but reduced to 16% at 2 years
- Moderately hypofractionated IMRT without chemotherapy in early oropharyngeal carcinomas, is safe & well-tolerated.

SIB-IMRT with conc chemotherapy is well-tolerated and effective for all common head-neck sites.

- Trials included mostly locally advanced cases.
- Locoregional failure rates are around 5-20%.
- Overall survival rates are around 60-85%.
- 2-yr severe xerostomia rates are around 0-30%.
CONCURRENT CT & IMRT

INTENSITY-MODULATED RADIOTHERAPY IN THE TREATMENT OF OROPHARYNGEAL CANCER: AN UPDATE OF THE MEMORIAL SLOAN-KETTERING CANCER CENTER EXPERIENCE


CONCURRENT CHEMOTHERAPY AND INTENSITY-MODULATED RADIOTHERAPY FOR LOCOREGIONALLY ADVANCED LARYNGEAL AND HYOPHARYNGEAL CANCERS


INTENSITY-MODULATED RADIOTHERAPY IN POSTOPERATIVE TREATMENT OF ORAL CAVITY CANCERS

Evidence behind use of intensity-modulated radiotherapy: a systematic review of comparative clinical studies

Liv Veldeman, Indira Madani, Frank Hulstaert, Gert De Meerleer, Marc Mareel, Wilfried De Neve

2 Meta-analyses

Clinical Oncology 22 (2010) 643–657

Overview
A Review of the Clinical Evidence for Intensity-modulated Radiotherapy
J. Staffurth on behalf of the Radiotherapy Development Board
Cardiff University, Velindre Hospital, Whitchurch, Cardiff, UK
Siemens trial (3DCRT vs IMRT)
N=60
The aim was to analyse location of site of locoregional failure and their dose-volume correlation
It was found that the majority of failures (75%) were within the high-dose volume & only 25% were marginal.

Parotid-sparing intensity modulated versus conventional radiotherapy in head and neck cancer (PARSPORT): a phase 3 multicentre randomised controlled trial

Christopher M Nutting, James P Morden, Kevin J Harrington, Teresa Guerrero Urbano, Shreerang A Bhide, Catharine Clark, Elizabeth A Miles, Aisha B Miah, Kate Newbold, MaryAnne Tanay, Fawzi Adab, Sarah J Jefferies, Christopher Scrase, Beng K Yap, Roger P A’Hern, Mark A Sydenham, Marie Emson, Emma Hall, and on behalf of the PARSPORT trial management group

Methods—We undertook a randomised controlled trial between Jan 21, 2003, and Dec 7, 2007, that compared conventional radiotherapy (control) with parotid-sparing IMRT. We randomly assigned patients with histologically confirmed pharyngeal squamous-cell carcinoma (T1–4, N0–3, M0) at six UK radiotherapy centres between the two radiotherapy techniques (1:1 ratio). A dose of 60 or 65 Gy was prescribed in 30 daily fractions given Monday to Friday. Treatment was not masked. Randomisation was by computer-generated permuted blocks and was stratified by centre and tumour site. Our primary endpoint was the proportion of patients with grade 2 or worse xerostomia at 12 months, as assessed by the Late Effects of Normal Tissue (LENT SOMA) scale. Analyses were done on an intention-to-treat basis, with all patients who had assessments included. Long-term follow-up of patients is ongoing. This study is registered with the International Standard Randomised Controlled Trial register, number ISRCTN48243537.

Findings—47 patients were assigned to each treatment arm. Median follow-up was 44.0 months (IQR 30.0–59.7). Six patients from each group died before 12 months and seven patients from the conventional radiotherapy and two from the IMRT group were not assessed at 12 months. At 12 months xerostomia side-effects were reported in 73 of 82 alive patients; grade 2 or worse xerostomia at 12 months was significantly lower in the IMRT group than in the conventional radiotherapy group (25 [74%; 95% CI 56–87] of 34 patients given conventional radiotherapy vs 15 [38%; 23–55] of 39 given IMRT, p=0.0027). The only recorded acute adverse event of grade 2 or worse that differed significantly between the treatment groups was fatigue, which was more prevalent in the IMRT group (18 [41%; 99% CI 23–61] of 44 patients given conventional radiotherapy vs 35 [74%; 55–89] of 47 given IMRT, p=0.0015). At 24 months, grade 2 or worse xerostomia was significantly less common with IMRT than with conventional radiotherapy (20 [83%; 95% CI 63–95] of 24 patients given conventional radiotherapy vs nine [29%; 14–48] of 31 given IMRT; p<0.0001). At 12 and 24 months, significant benefits were seen in recovery of saliva secretion with IMRT compared with conventional radiotherapy, as were clinically significant improvements in dry-mouth-specific and global quality of life scores. At 24 months, no significant differences were seen between randomised groups in non-xerostomia late toxicities, locoregional control, or overall survival.
IMAGE GUIDED RADIOTHERAPY

- incorporates imaging, and matching the co-ordinates with the treatment plan to be delivered, to ensure the patient is properly aligned in the treatment room
- improves accuracy of the radiation field placement
- reduces the exposure of healthy tissue during the treatment
WHY IMAGE GUIDANCE?

- Organ motion types:
  - Interfraction motion
  - Intrafraction motion
- Even intracranial structures can move – 1.5 mm shift when patient goes from sitting to supine!!

- Types of movement:
  - Translations:
    - Craniocaudal
    - Lateral
    - Vertical
  - Rotations:
    - Roll
    - Pitch
    - Yaw
  - Shape:
    - Flattening
    - Balloning
    - Pulsation
ADAPTIVE RADIOTHERAPY

- A technique by which a conformal radiation dose plan, is modified to conform to a deformable and mobile target.

- Two components:
  - adapt to tumour motion
  - adapt to tumour/organ deformation and volume changes.
During treatment, large variations occur in the anatomy of the treatment area due to:

- **tumour regression**
- **weight loss**

so, high chances of tumour miss and higher dose to OAR.

- **Weekly imaging and modification of the initial plan according to anatomical changes.**
AS PATIENT UNDERGOES 6-7 WEEKS OF IMRT THERE ARE MARKED ANATOMICAL CHANGES
Where is the greatest uncertainty now?

Treatment Uncertainties

IMRT Improved Delivery Uncertainty
WEIGHT LOSS AND VOLUME CHANGES

- GTV decreases throughout treatment: 
  -9% (+38 to -54%)

- weight loss during treatment.
  mean weight change: -4.7% (+2.8 to -15.5%)
CONTD....

- Hansen et al – mean reduction in Parotid volume 15-21.5%
- Duprez et al - Parotid shrinkage of 24%
- Castadot et al – mean shrinkage of Parotid 0.9-1%/day.
  - moving medially by mean distance 3.4 mm

Mean reduction in Parotid vol by 15-25% by the end of treatment and also moves medially potentially into the high dose region.
VOLUME AND POSITIONAL CHANGE IN PAROTIDS

- Mean volume reduction in parotid 24.4% (0 - 53.6%) in 80-90% of the patients.

- More pronounced in the contralateral parotid
  - (mean vol loss -27% vs -22%)

- Mean parotid volume loss 0.7%/day (0 - 1.5%)

- Parotid shifts - Medially by mean 3.4mm (2 - 6.7mm)
  - Posteriorly by mean 2.7mm (0 - 8mm)
ADAPTIVE RT

At simulation

Hyoid
Thyroid cartilage

At treatment

Potential effect: high larynx dose

Daily
ON BOARD IMAGING
ADAPTIVE RT WORKFLOW

PLANNING

Diagnosis

Planning CT

Reference Imaging (eg. MRI, PET-CT etc)

Fuse Data

Target Volume Delineation

Dose planning

TREATMENT DELIVERY

Delivery of treatment fraction

Correct for setup errors

Evaluate validity of matching

Match with reference images

In room imaging

Acquire treatment images/info

Repeat as required

On treatment review

Evaluate appropriateness of plan and its delivery

COMPLETE PLANNED TREATMENT

REVIEW

Assess for adaptive planning

Need for change in plan
TAKE HOME MESSAGE

Technology is a good servant but a bad master..

Use technology judiciously...
Thank You
For Your Attention...