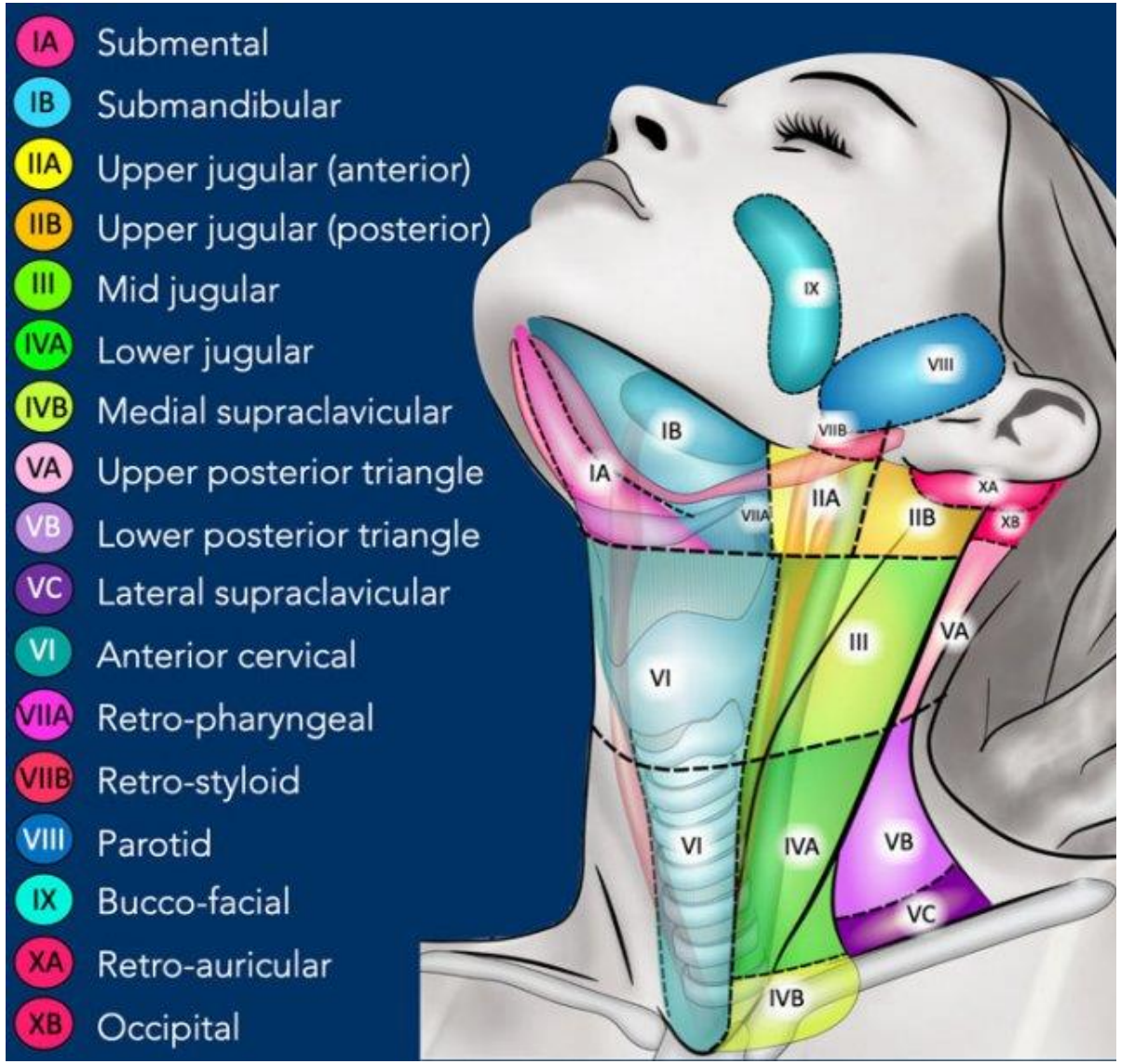
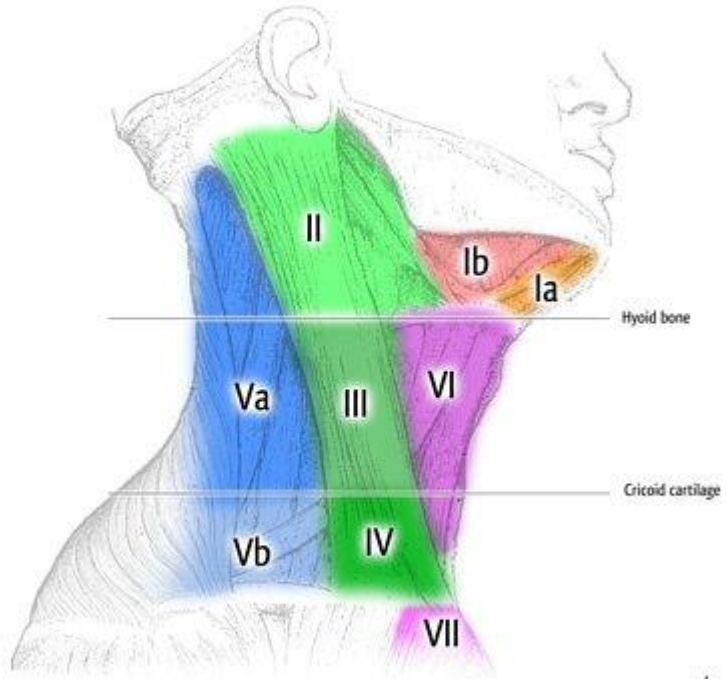
HEAD and NECK malignancies

Assist Prof Neda Milosavljević
Assist Prof Marija Živković Radojević

- Tumor location:

- Upper aerodigestive tract
- Oral cavity
- Oropharynx
- Epipharynx
- Hypopharynx
- Larynx
- Paranasal sinuses
- Salivary glands
- Regional lymph nodes - neck levels from I-V



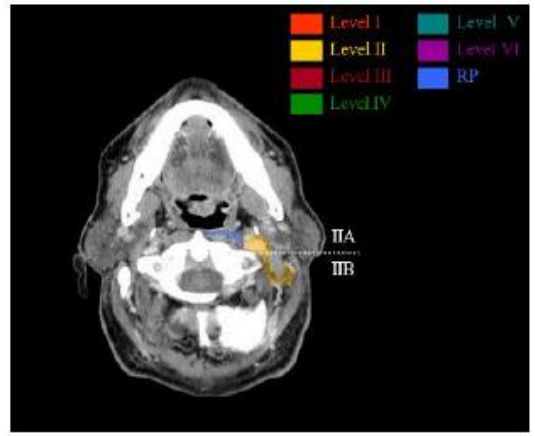


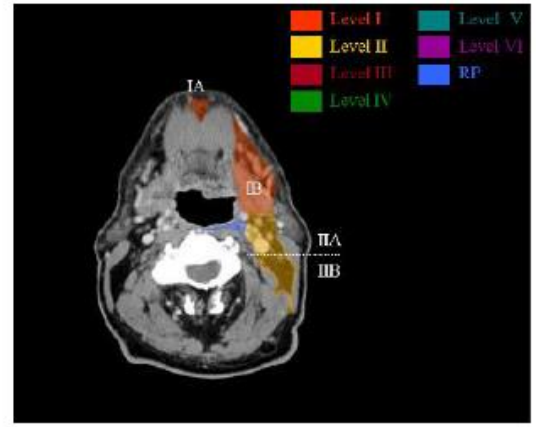
Lymph node levels

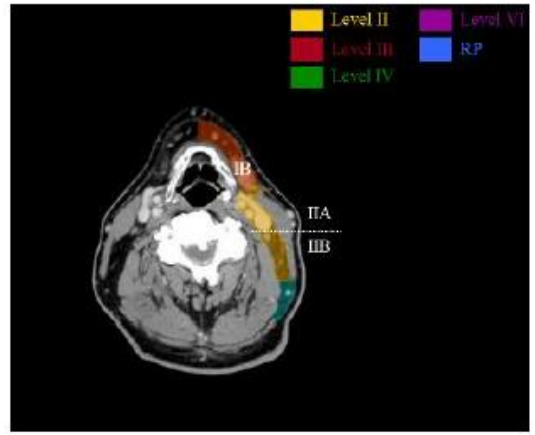
F Gaillard 2009

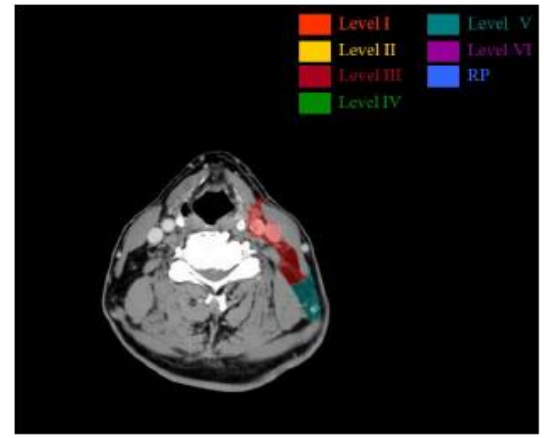
Radiopaedia.org CC-NC-SA-BY

Background image is from (with modifications) the 20th U.S. edition of Gray's Anatomy of the Human Body, originally published in 1518 and therefore lapsed into the public domain


Level I
Level II
Level III
Level IV
Level V
Level VI
RP
IIA
IIB


Level I
Level II
Level III
Level IV
Level V
Level VI
RP
IA
IB
IIA
IIB


Level II
Level III
Level IV
Level VI
RP
IB
IIA
IIB


Level I
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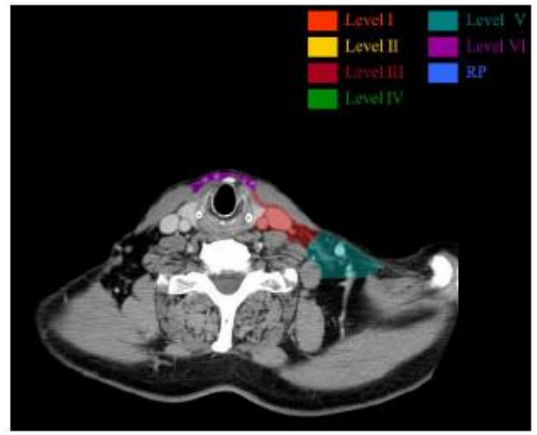
Level VI
RP


Level I
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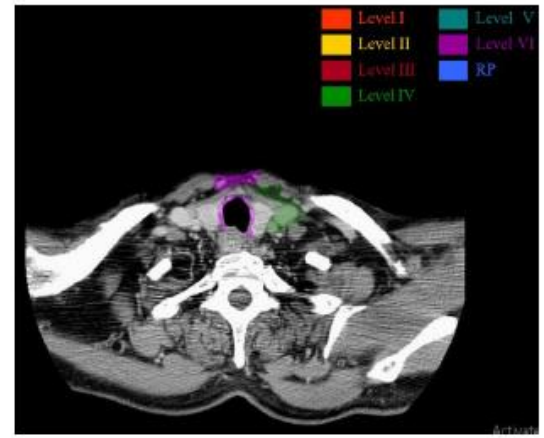
Level V
Level VI
RP


Level I
Level II
Level III
Level IV
Level V
Level VI
RP

- Radical radiotherapy ± chemotherapy:

- For unresectable head and neck tumors ± chemotherapy
- Locally advanced tumors CS III and IV
- Locally advanced tumors after neoadjuvant HT and achieved partial response (PR)
- Resectable tumors with the goal of organ preservation ± chemotherapy

- Postoperative radiotherapy ± chemotherapy

- For positive resection margins
- For present lymphnodal metastases
- For extracapsular spread in lymphnodal metastases
- Close resection margin (<5mm)
- Invasion of soft tissues and skeletal muscles
- Multicentric primary tumor
- Perineural invasion,
- Lymphovascular invasion
- Tumor differentiation (G3)
- T3-T4 tumor

- Palliative radiotherapy:

- For locally/locoregionally advanced disease in order to relieve symptoms and improve quality of life (bleeding, pain, obstruction of the aero-digestive tract)
- For distant metastases (bones, endocranium)

- Performance status (PS) should always be taken into consideration.
- Radical or postoperative RT is indicated if PS≤2
- The optimal period for starting postoperative radiotherapy is 6-8 weeks after surgical treatment
- The optimal period for starting radical radiotherapy after neoadjuvant chemotherapy is 4-6 weeks and after a partial response has been achieved

- **Necessary examinations before indicating radiotherapy of the head and neck region:**

- ECOG PS, Weight, height of the patient and BMI
- Clinical and endoscopic findings with a confirmed diagnosis of PH in non-operated patients
- Operative findings and definitive PH in operated patients.
- CT/MRI of the splanchnocranium and neck if clinically indicatedUS of the neck, X-ray of the chest, US of the abdomen
- Complete blood count and biochemistry (including renal and liver parameters as well as electrolyte status)
- Calculate creatinine clearance
- Detailed examination and dental assesment, which should be completed before immobilization for radiotherapy
- Before starting radiotherapy, an examination by a dietician is necessary to plan nutrition during radiotherapy and a recommendation for nutritional surgical gastrostomy or percutaneous endoscopic gastrostomy (PEG) if the loss can significantly compromise the application of radiotherapy

Technical Innovations & Patient Support in Radiation Oncology 1 (2017) 1–7

Contents lists available at ScienceDirect

Technical Innovations & Patient Support in Radiation Oncology

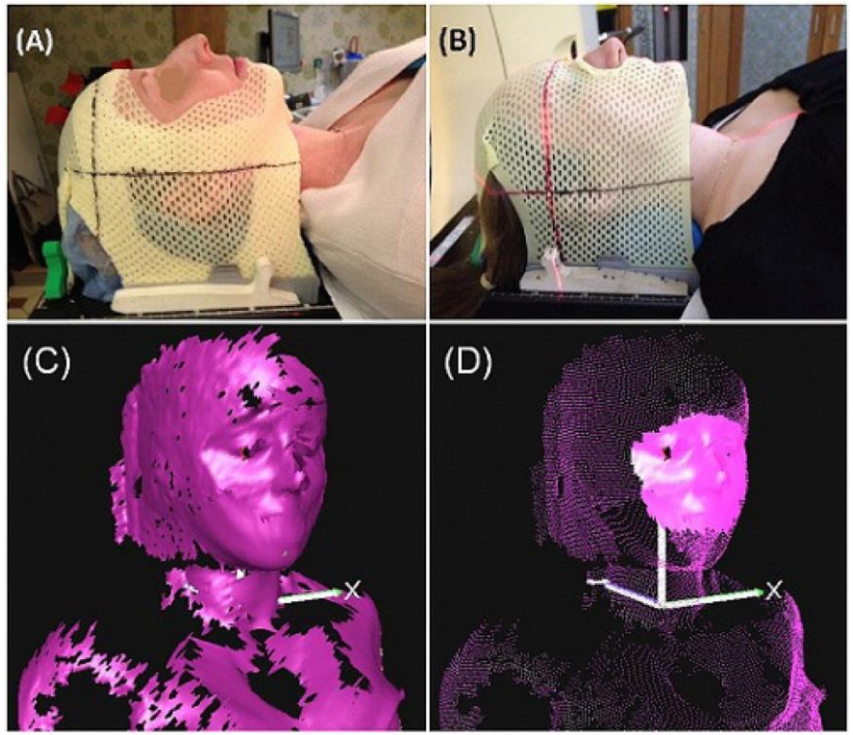
journal homepage: www.elsevier.com/locate/tipsro

Practice guidelines

ESTRO ACROP guidelines for positioning, immobilisation and position verification of head and neck patients for radiation therapists

Michelle Leech [a,*], Mary Coffey [a], Mirjam Mast [b], Filipe Moura [c], Andreas Osztavics [d], Danilo Pasini [e], Aude Vaandering [f]

[a] Applied Radiation Therapy Trinity (ARTT), Discipline of Radiation Therapy, School of Medicine, Trinity College, Dublin 2, Ireland
[b] Radiotherapy Centre West/Medical Center Haaglanden, The Hague, The Netherlands
[c] Hospital CUF Descobertas, Lisboa, Portugal
[d] Universitätsklinik für Strahlentherapie, Vienna, Austria
[e] USCU Policlinico A. Gemelli, Rome, Italy
[f] Radiation Oncology Department, Cliniques Universitaires St Luc, Brussels, Belgium



Radiotherapy and Oncology 126 (2018) 3–24

Contents lists available at ScienceDirect

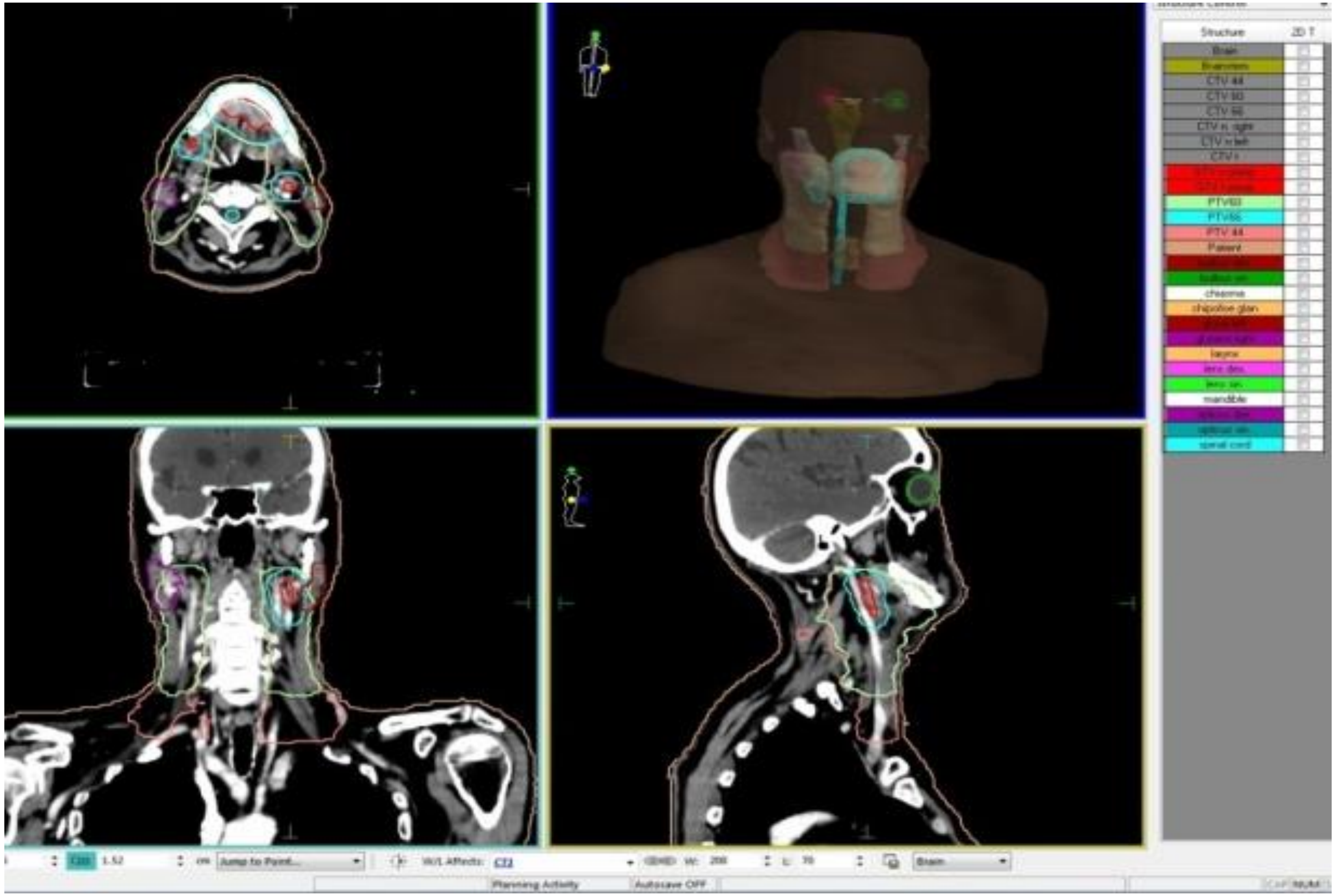
Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

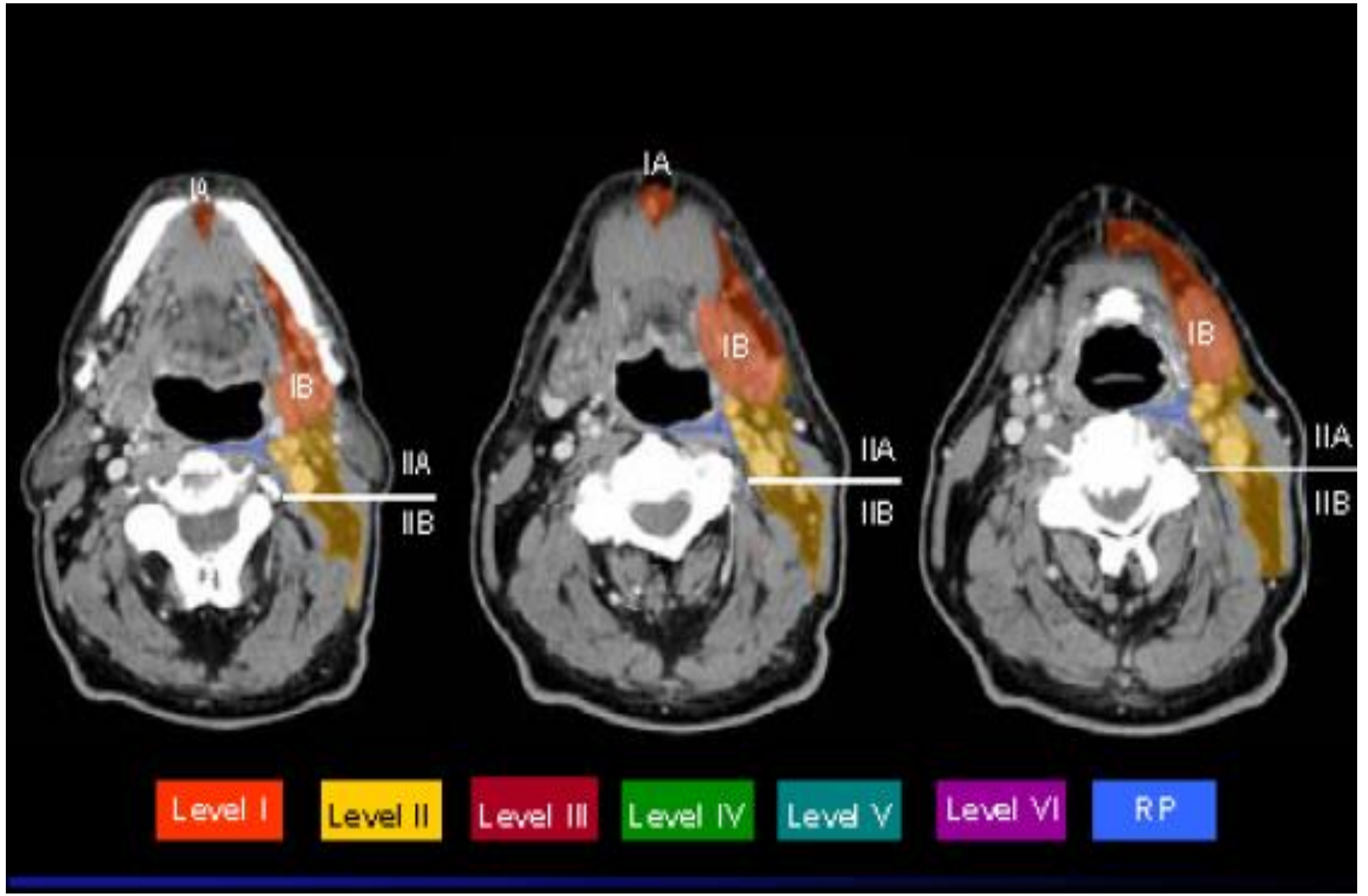
International Guideline

Delineation of the primary tumour Clinical Target Volumes (CTV-P) in laryngeal, hypopharyngeal, oropharyngeal and oral cavity squamous cell carcinoma: AIRO, CACA, DAHANCA, EORTC, GEORCC, GORTEC, HKNPCSG, HNCIG, IAG-KHT, LPRHHT, NCIC CTG, NCRI, NRG Oncology, PHNS, SBRT, SOMERA, SRO, SSHNO, TROG consensus guidelines

Vincent Grégoire [a,*], Mererid Evans [b], Quynh-Thu Le [c], Jean Bourhis [d], Volker Budach [e], Amy Chen [f], Abraham Eisbruch [g], Mei Feng [h], Jordi Giralt [i], Tejpal Gupta [j], Marc Hamoir [k], Juliana K. Helito [l], Chaosu Hu [m], Keith Hunter [n], Jorgen Johansen [o], Johannes Kaanders [p], Sarbani Ghosh Laskar [j], Anne Lee [q], Philippe Maingon [r], Antti Mäkitie [s], Francesco Micciche' [t], Piero Nicolai [u], Brian O'Sullivan [v], Adela Poitevin [w], Sandro Porceddu [x], Krzysztof Składowski [y], Silke Tribius [z], John Waldron [v], Joseph Wee [aa], Min Yao [ab], Sue S. Yom [ac], Frank Zimmermann [ad], Cai Grau [ae]



Structure
Brain
Brainstem
PTV60
PTV56
PTV 44
Patient
chiasma
larynx
mandible
spinal cord
Jump to Point...
W/L Affects:
Brain
Planning Activity
Autosave OFF


IA
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IIA
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IA
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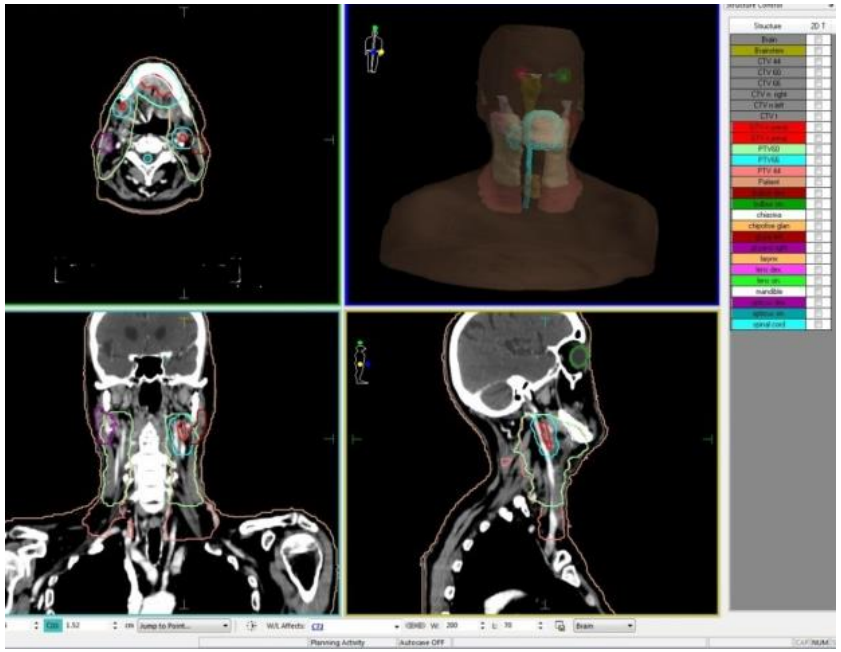
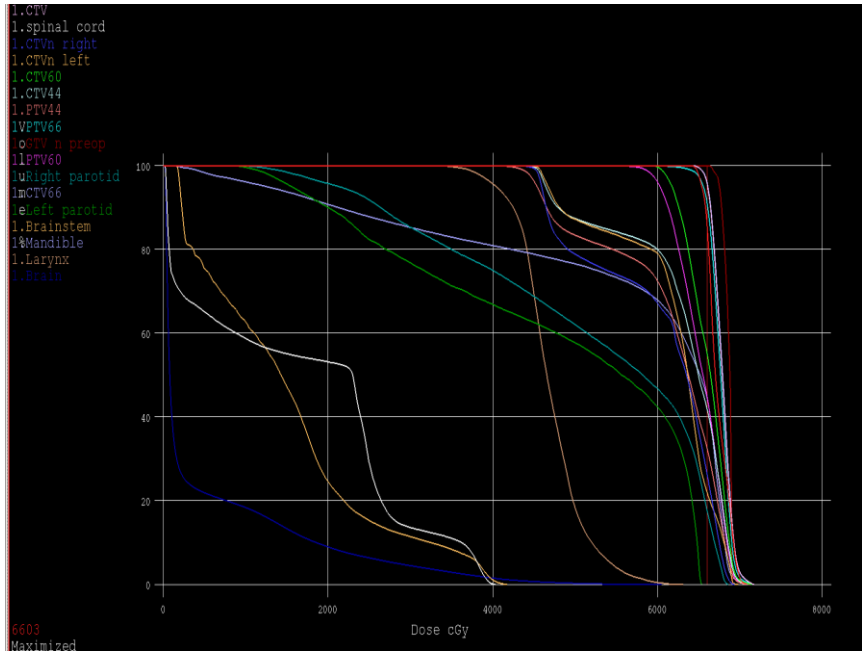
IIA
IIB
Level I
Level II
Level III
Level IV
Level V
Level VI
RP

- **Radiotherapy of head and neck tumors is most often carried out with a conventional fractionation regimen (dose per daily fraction 1.8-2 Gy)**
- **In palliative radiation therapy, a hypofractionated regimen is more often applied, with a higher daily dose (most often 2.5 Gy)**
- **Radical dose: 66-70 Gy in 33-35 fractions**
- **Postoperative dose:**
- **High-risk region: 64-66 Gy in 32-33 fractions**
- **Intermediate risk region: 60 Gy in 30 fractions**
- **Low-risk region: 44-50 Gy in 22-25 fractions**

- **Tumors of the oral cavity:**
- **Radical RTGTV: GTV t - tumor and GTV n - all involved lymph nodes (outlined based on clinical, endoscopic and imaging findings with the possibility of image fusion with imaging)**
- **Doses and fractionation: TD 66-70 Gy in 33-35 fractions**
- **CTV: Represents the entire region at risk for subclinical spread around the GTV, as well as lymph node levels for prophylactic irradiation Ib-V**
- **PTV: Represents the geometric margin around the CTV**
- **PTV = CTV + 3-5mm margins**

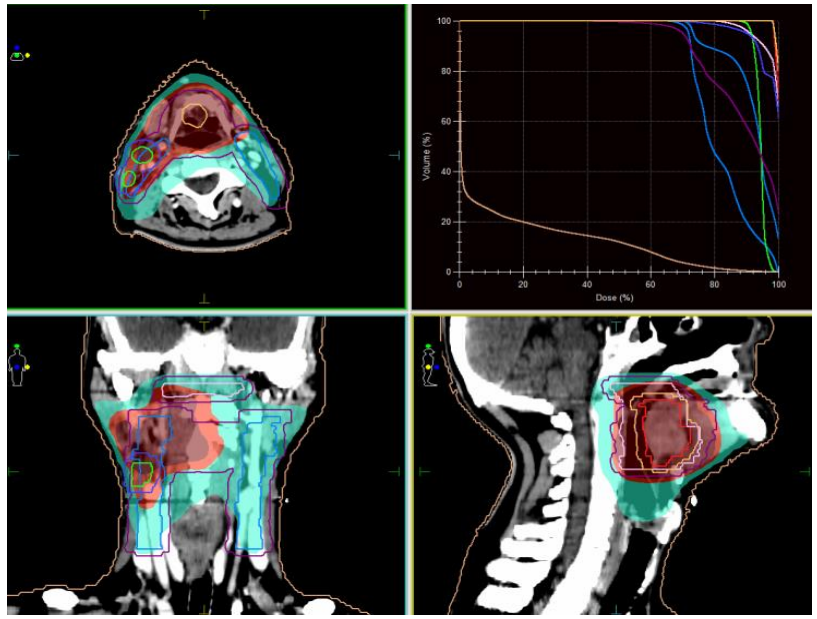
- **Post OP RT:**
- **GTV pGTV t. - preoperative tumor and pGTV n - preoperatively affected lymph nodes (outlined on the basis of clinical, endoscopic and imaging findings) with the possibility of image fusion with imaging)**
- **CTV: Represents the entire region at risk for subclinical spread around the GTV, as well as lymph node levels for prophylactic irradiation Ib-V**
- **PTV: Represents the geometric margin around the CTVPTV = CTV + 3-5mm margins**

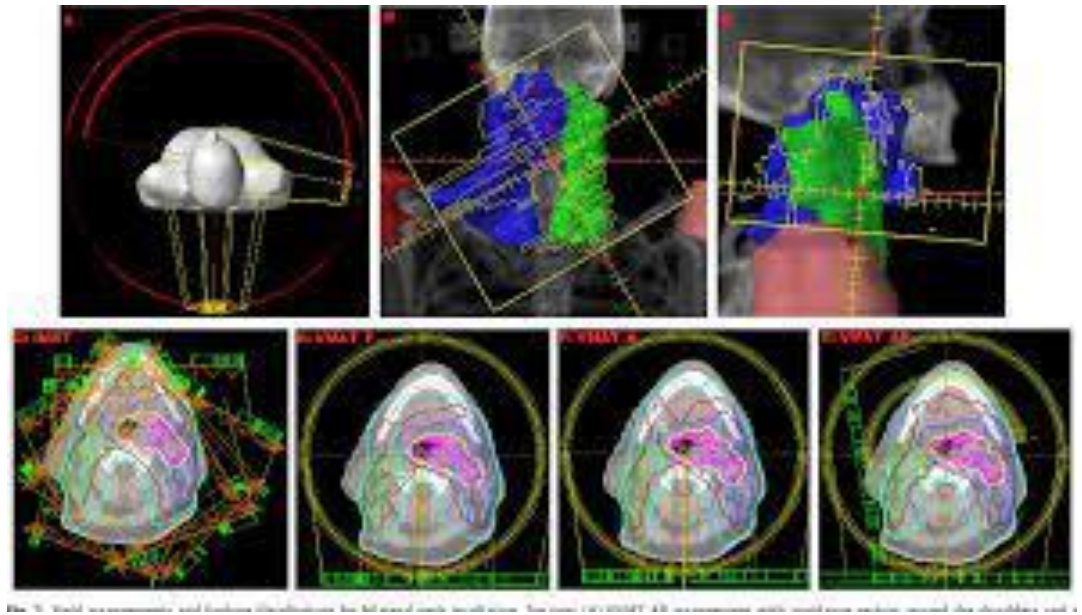



1.CTV
1.spinal cord
1.CTVn right
1.CTVn left
1.CTV60
1.CTV44
1.PTV44
1VPTV66
1oCTV n preop
1lPTV60
1uRight parotid
1mCTV66
1eLeft parotid
1.Brainstem
1%Mandible
1.Larynx
1.Brain
6603
Maximized
100
80
60
40
20
0
0
2000
4000
6000
8000
Dose cGy

- **Tumors of the oropharynx:**
- **Radical RTGTV: GTV t - tumor and GTV n - all involved lymph nodes (outlined based on clinical, endoscopic and imaging findings with the possibility of image fusion with imaging)**
- **Doses and fractionation: TD 66-70 Gy in 33-35 fractions**
- **CTV: Represents the entire region at risk for subclinical spread around the GTV, as well as lymph node levels for prophylactic irradiation II-IV + retropharyngeal LN**
- **PTV: Represents the geometric margin around the CTV**
- **PTV = CTV + 3-5mm margins**

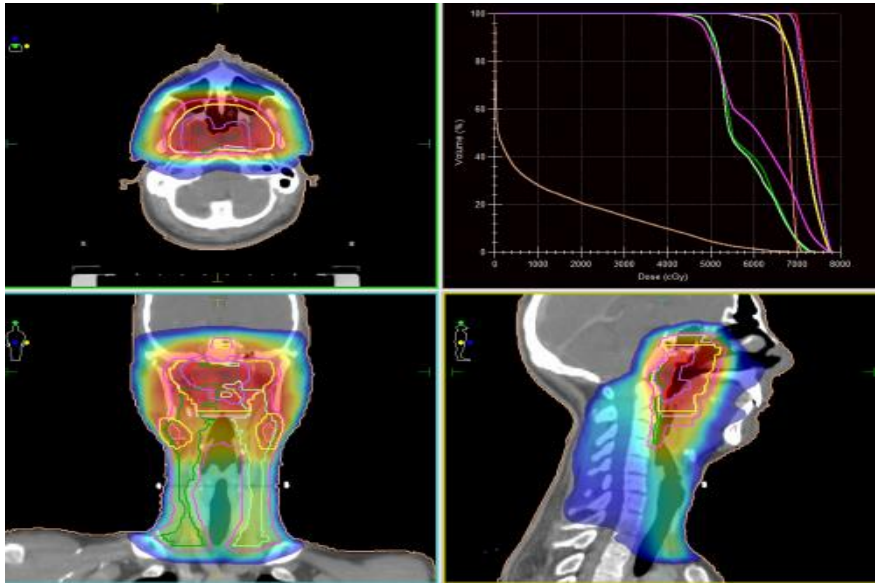
- **Post OP RT:GTV:**
- **pGTV t. - preoperative tumor and pGTV n - preoperatively affected lymph nodes (outlined on the basis of clinical, endoscopic and imaging findings) with the possibility of image fusion with imaging)**
- **CTV: Represents the entire region at risk for subclinical spread around the GTV, as well as lymph node levels for prophylactic irradiation II-IV + retropharyngeal LN**
- **PTV: Represents the geometric margin around the CTV**
- **PTV = CTV + 3-5mm margins**

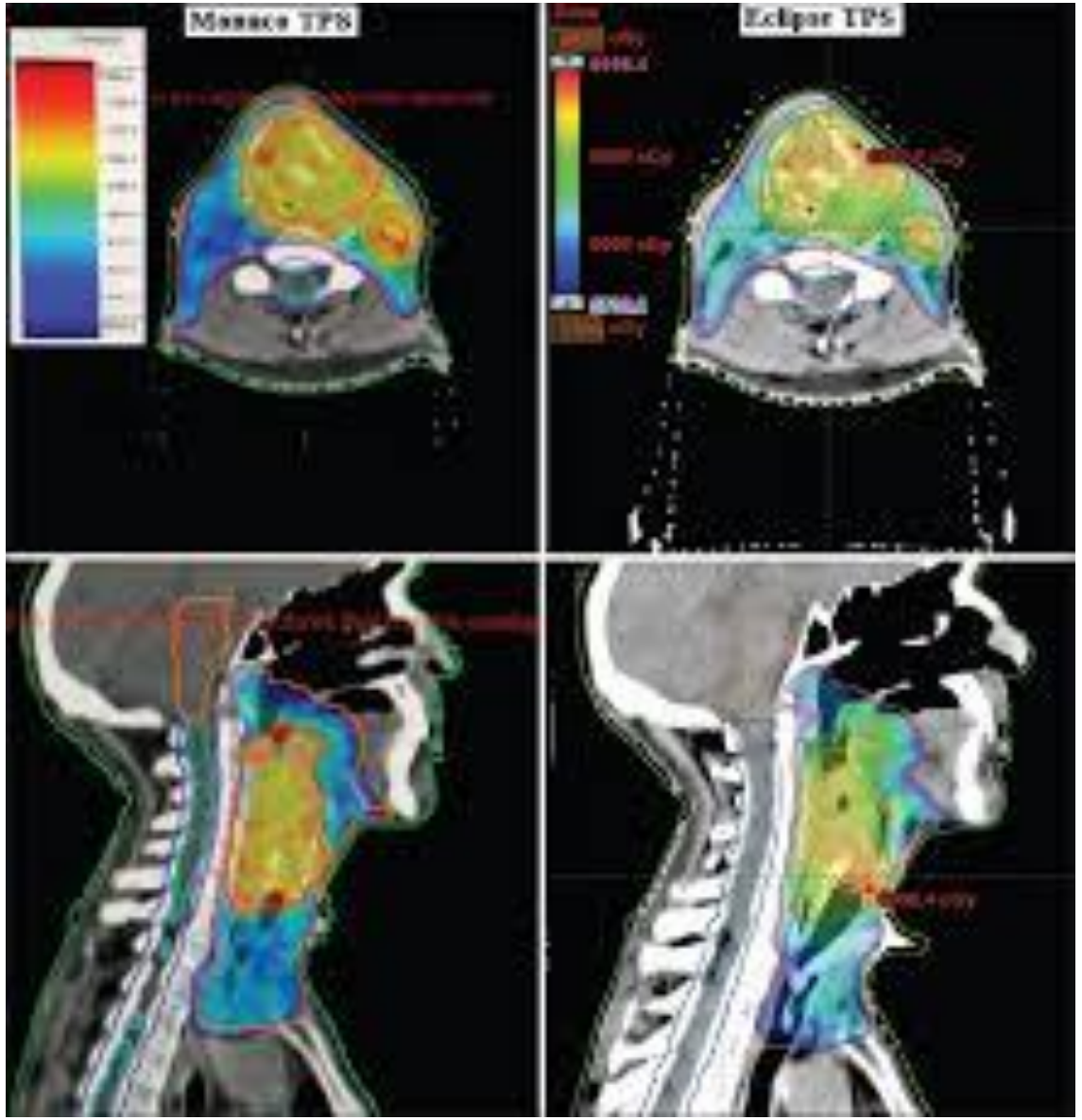

Volume (%)
Dose (%)
0
20
40
60
80
100



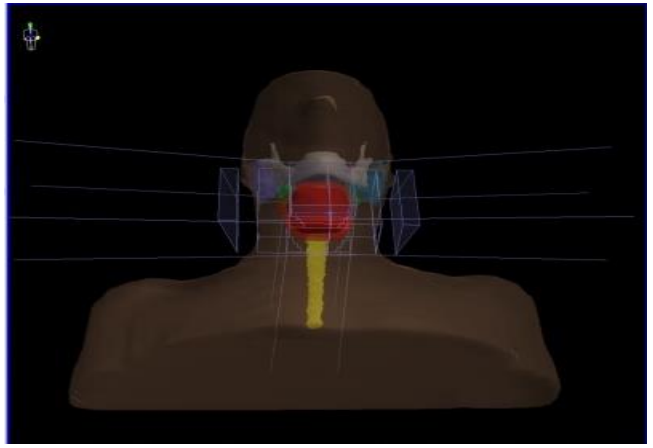
- **Tumors of the hypopharynx:**
- **Radical RTGTV:**
- **GTV t - tumor and GTV n - all involved lymph nodes (outlined based on clinical, endoscopic and imaging findings with the possibility of image fusion with imaging)**
- **CTV: Represents the entire region at risk for subclinical spread around the GTV, as well as lymph node levels for prophylactic irradiation II-IV + retropharyngeal LN**
- **PTV: Represents the geometric margin around the CTV**
- **PTV = CTV + 3-5mm margins**

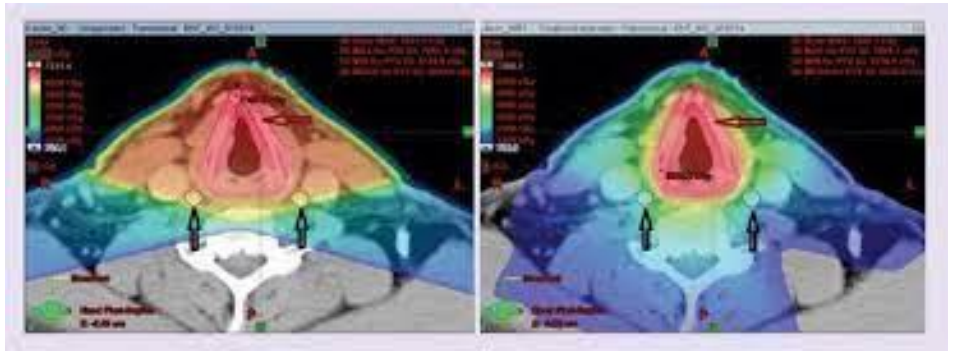
- **Post OP RT:**
- **GTV pGTV t. - preoperative tumor and pGTV n - preoperatively affected lymph nodes (outlined on the basis of clinical, endoscopic and imaging findings) with the possibility of image fusion with imaging)**
- **CTV: Represents the entire region at risk for subclinical spread around the GTV, as well as lymph node levels for prophylactic irradiation II-IV + retropharyngeal LN**
- **PTV: Represents the geometric margin around the CTV**
- **PTV = CTV + 3-5mm margins**

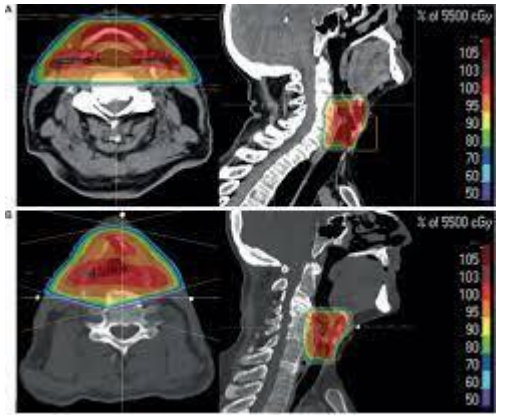

Volume (%)
Dose (cGy)

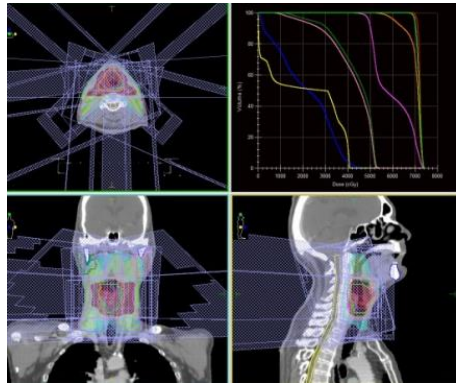

Monaco TPS
Eclipse TPS

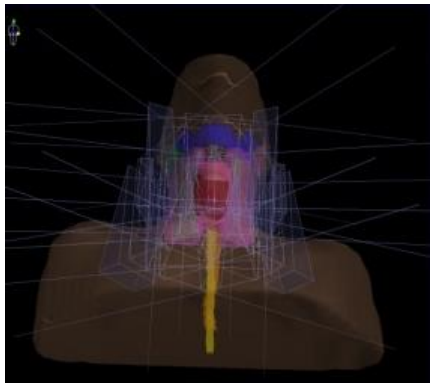
- **Tumors of the larynx:**
- **Radical RT - glottisT1N0 - TD 63-66 Gy / 2.25-2.0 Gy per fraction**
- **Prophylactic irradiation of the neck lymph nodes is not required**



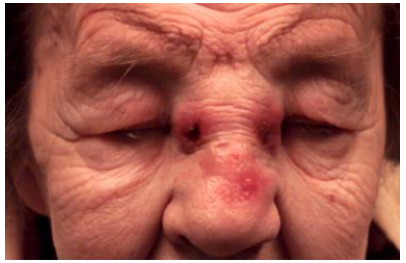








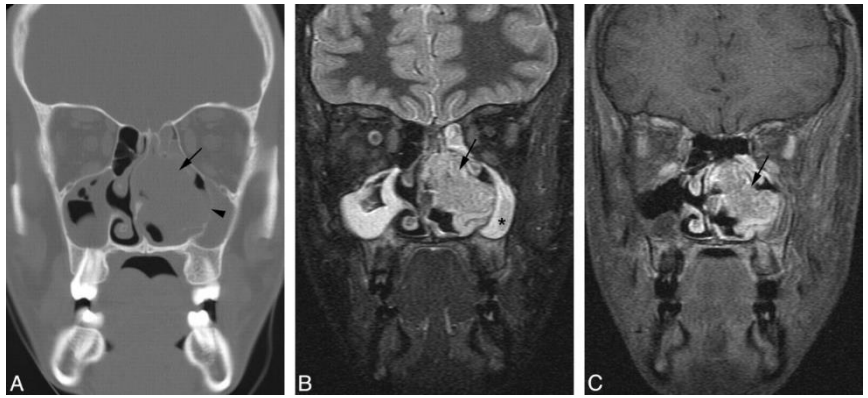
- Radical RT of tumors of other regions of the larynx
- GTV:GTV t - tumor and GTV n - all affected lymph nodes (defined based on clinical, endoscopic and imaging findings with the possibility of image fusion with imaging)
- Doses and fractionation: TD 66-70 Gy in 33-35 fractions
- CTV:Represents the entire region at risk for subclinical spread around the GTV, as well as lymph node levels for prophylactic irradiation II-IV
- PTV:It represents the geometric margin around the CTV, PTV = CTV + 3-5mm margin

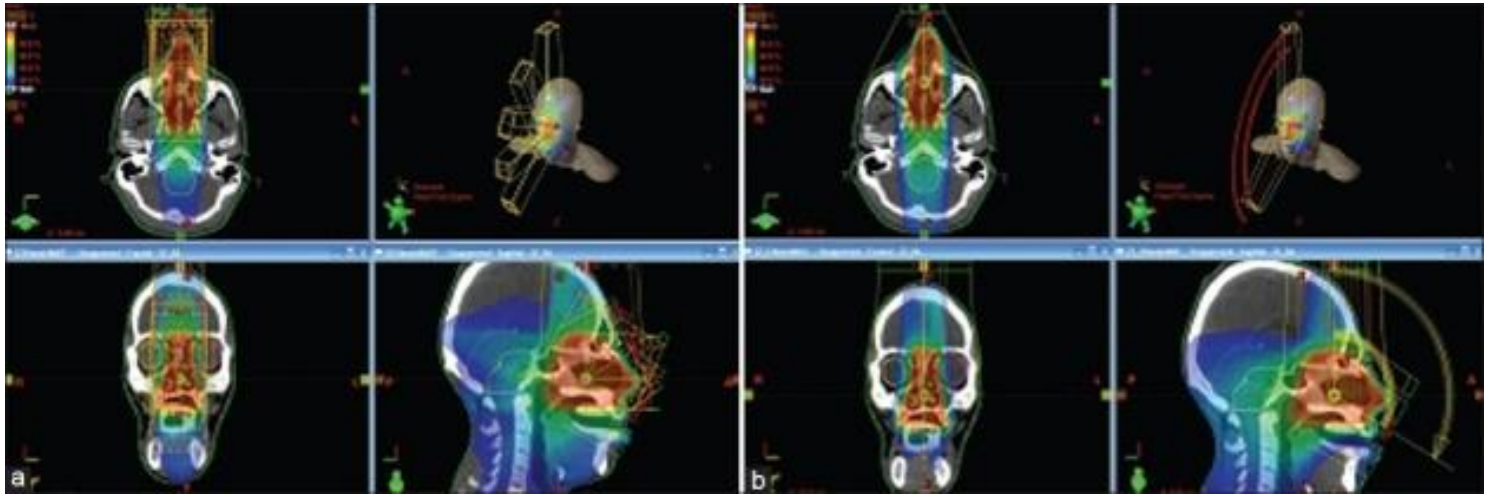


- Tumors of the paranasal cavities:

- Radical RT
- GTV: GTV t - tumor and GTV n - all affected lymph nodes (defined based on clinical, endoscopic and imaging findings) with the possibility of image fusion with imaging)
- Doses and fractionation: TD 66-70 Gy in 33-35 fractions
- CTV: Represents the entire region at risk for subclinical spread around the GTV
- Irradiation of the lymph nodes of the neck is recommended only if lymphnodal metastases are present or there is extension of the tumor to structures with a high risk for lymphnodal spread (hard palate, pharynx).
- PTV: Represents the geometric margin around the CTV PTV = CTV + 3-5mm margin

- Post OP RT:
- GTV pGTV t. - preoperative tumor and pGTV n - all involved lymph nodes (defined based on clinical, endoscopic and imaging findings) with the possibility of image fusion with imaging)
- CTV: Represents the entire region at risk for subclinical spread around the GTV
- Irradiation of the lymph nodes of the neck is recommended only if lymphnodal metastases are present or there is extension of the tumor to structures with a high risk for lymphnodal spread (hard palate, pharynx).
- PTV: Represents the geometric margin around the CTV
- PTV = CTV + 3-5mm margins


A
B
C


a
b

Paranasal sinuses malignancies
Proton radiation therapy

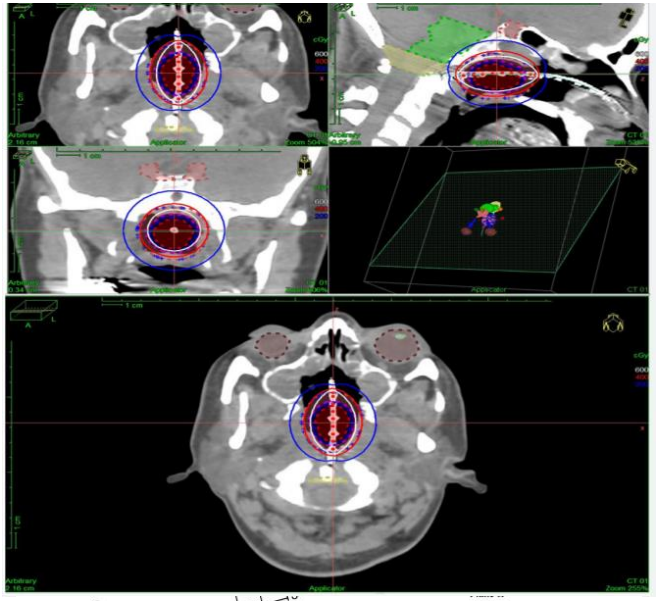
Author, institution, year	Treatment, patients	Median total dose Gy (range)	LC 5-yrs KM	RC 5-yrs KM	DC 5-yrs KM	OS 5-yrs KM	Toxicity
Mendenhall et al., UF, 2009 [10]	Pre-op RT: 8 Post-op RT: 45 Def RT: 56	Pre-op RT: 55 (48.4–64.8) Post-op RT: 64.8 (55–74.4) Def RT: 70 (50–70)	Adj.: 84% Def: 43% ($P = 0.0007$)	N0: 93% N1: 88%	81%	Adj: 73% Def: 38% ($P < 0.0001$)	Late ≥ G3 Def: 17 (30%) Late ≥ G3 Pre-op: 1 (12.5%) Late ≥ G3 Post-op: 12 (26.7%)
Chen et al., UCSF, 2007 [24]	Pre-op RT: 9 Post-op RT: 82 Def RT: 36	Pre-op RT: 60 Post-op RT: 63 Def RT: 66	GTR: 65% GRD: 44% ($P = 0.02$)	[1]120/127	[1]113/127	52%	Late ≥ G3: ($P < 0.01$) 53% (1960s), 45% (1970s), 39% (1980s), 28% (1990s), 16% (2000s)
Daly et al., UCSF, 2007 [50]	Post-op IMRT: 32 Def IMRT: 4	Post-op IMRT: 58 (51–60) Def IMRT: 70 (63–72)	58%	[1]35/36	[1]31/36	45%	Acute ≥ G3: 7 (19.4%) Any Late: 12 (40%)
Hoppe et al., MSKCC, 2008 [21]	Def RT: 39	70 (48–72) (BED)	21%	61%	51%	15%	Acute ≥ G3: 20 (51.3%) Late ≥ G3: 7 (18%)
Hoppe et al., MSKCC, 2007 [20]	Post-op RT: 85	63 (50–70)	62%	87%	82%	67%	Acute ≥ G3: 18 (21%) Late ≥ G3: 1 (2.5%)
Madani et al., Ghent University Hospital, 2009 [51]	Post-op IMRT: 75 Def IMRT: 9	Post-op/Def: 70 (48–72)	70.7%	—	82.2%	58.5%	Acute G3: 6 (7.1%) Late ≥ G3: 8 (9.5%)
Dirix et al., Leuven University Hospital, 2010 [52]	Post-op IMRT: 40	60 (60–66)	76% (2-yrs)	100% (2-yrs)	89% (2-yrs)	89% (2-yrs)	No Acute ≥ G3 No Late ≥ G3

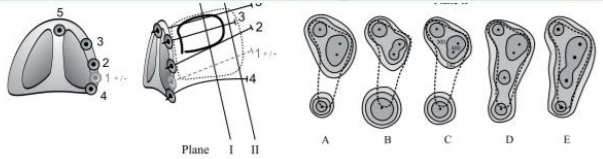
Reference	Toxicity	Median time (months, range)	Grade	D_{max} to affected OARs, Gy (RBE) (median, range)	Risk factors
Jensen, et al., 2011 [45]	7/29	na	[1]G3 mucositis: 5 [1]G3 dysphagia: 2	na	na
Demizu et al., 2009 [46]	Carbon: 1/10 Proton: 4/42[2]	C: 52 P: 34.5 (26–39)	Counting fingers or more severe	ON: 129[3] ON: 118[3], (61–126)	[4]UA: Age > 60 years; DM, D_{max}> 110 Gy (RBE) [4]MA: DM
Hasegawa et al., 2006 [47]	7/14[5]	24 (10–41)	Complete visual loss	ON: 57.6, (57.6–64)	[4]UA: MG, CMT, anemia, DM, TD, D_{max} to ON, $D_{10\text{-}50}$, MA: D_{20} > 60 Gy (RBE)
Weber et al., 2006 [48]	13/36 5-years ≥G2: % ±	31.5 (6.4–91)	[6]G1: 5 G2: 6 G3: 2 (CA, NLB)	ON: 54.7, (47.8–80) OC: 52.1, (26.2–56.4)	GTV Dose OC: D_{90} and D_{50} ON: D_{10} Younger Age
Miyawaki et al., 2009 [49]	C: 2/5 P: 3/23	C: 27.5 (19–36) P: 31 (6–49)	[7]C: G1: 1, G3: 1 [7]P: G1, G2, G3: 1	C, D_{min}: 27.5[3] (102.4–110.6) P, D_{min}: 117.1[3] (59.4–117.1)	[4]Carbon ions, Dose ≥ 80 Gy (RBE)[3], Volumes > 83, 90, 100 Gy (RBE)[3]

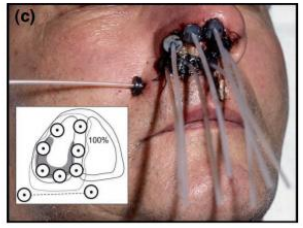
- Inadquate data from clinical trials
- 5-year OS 62-84% postoperative, 21-43% definitive tretment
- ↓ Radiation toxicity

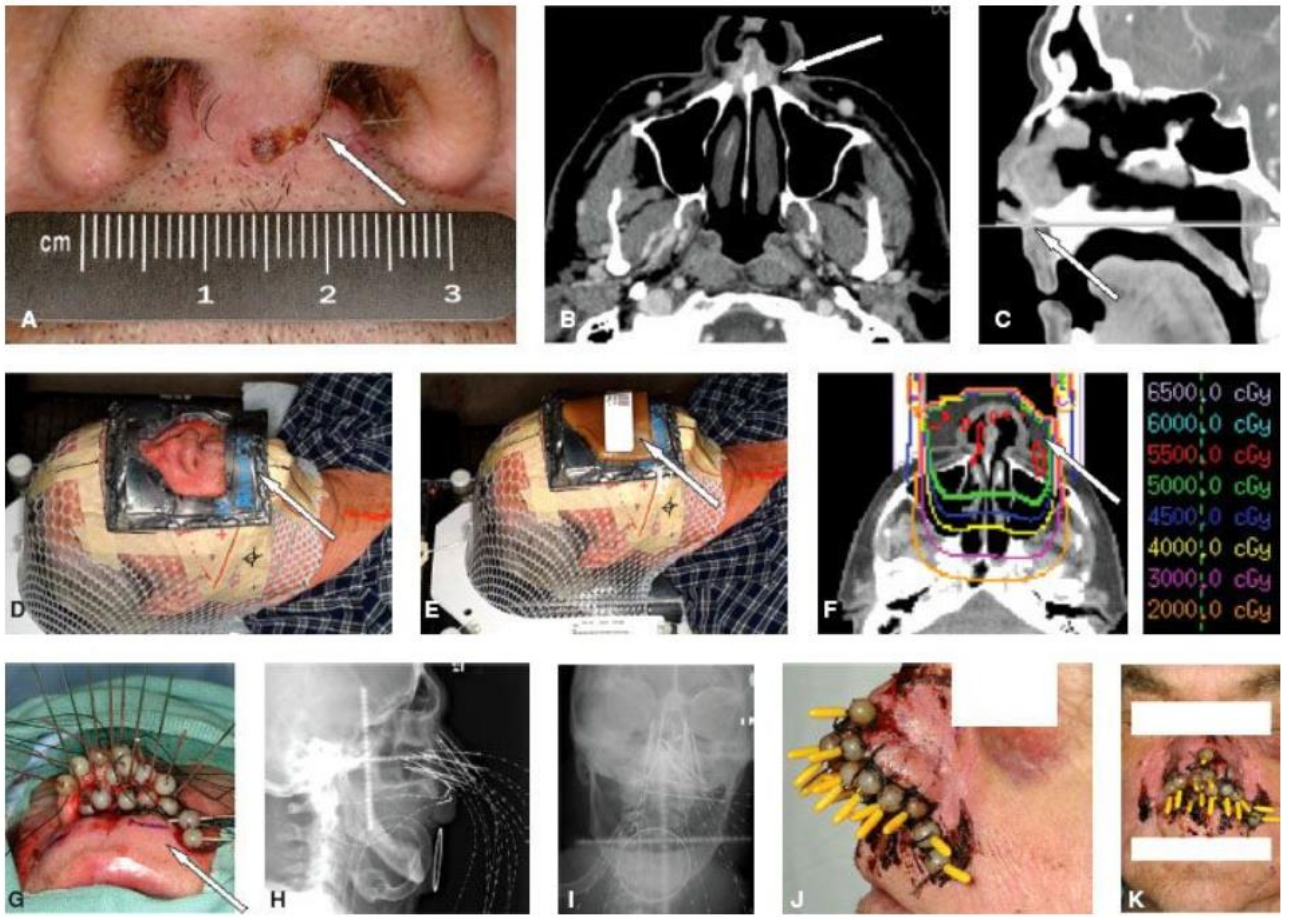
Resto, V. A., et al., 2008.; Hoppe B. S., et al, 2007.; Cianchetti M. et al., 2012.

INTERSTITIAL BRAHCHYTHERAPY

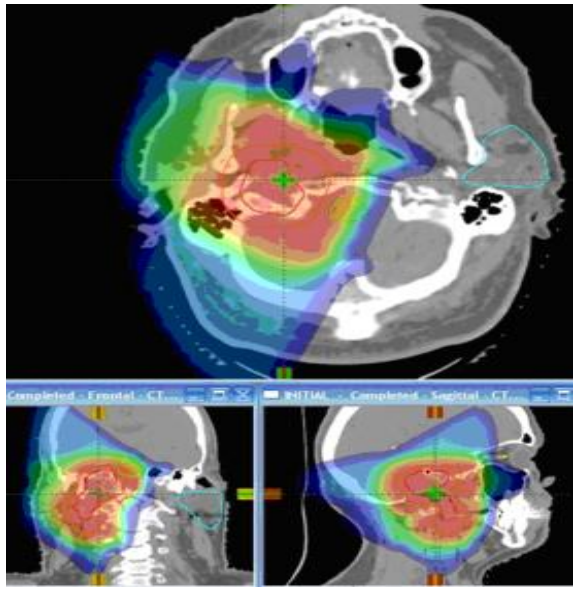


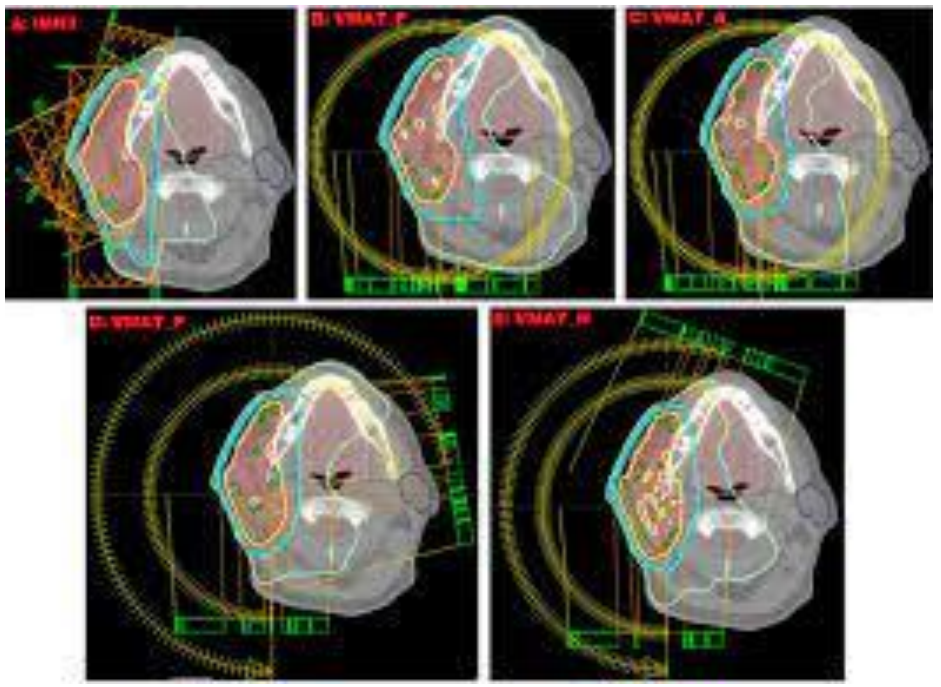






- **PAROTIDE GLAND RADIOTHERAPY**





	Dose predictors													Other predictors					
	Arytenoids	Brain	Brainstem	Buccal mucosa	Crico	Glottic area	Integral [illegible]	Mandible	Oral cavity	Parotid glands	PCM sup, mid, inf	Submand. glands	Supraglottic larynx	Age	Baseline toxicity	Baseline weight	Gender	Treatment modality	Tumour site
Swallowing domain																			
Grade 2-4 dysphagia									•		•				•			•	•
Grade 3-4 dysphagia									•		•				•			•	•
Grade 2-4 aspiration					•						•		•		•				
Moderate-severe aspiration											•				•				
Salivary domain																			
Moderate-severe xerostomia				•					•	•		•			•				
Severe xerostomia				•					•	•		•			•				
Grade 2-4 xerostomia				•					•	•					•				
Moderate-severe sticky saliva										•		•			•				
Severe sticky saliva										•		•			•				
Grade 2-4 sticky saliva				•			•		•	•		•							
Moderate-severe loss of taste									•	•				•					
Grade 2-4 loss of taste									•	•		•							
Mucosal domain																			
Grade 2-4 mucositis									•										
Grade 3-4 mucositis									•									•	
Speech domain																			
Moderate-severe hoarseness	•					•													•
Moderate-severe speech problems									•				•		•				•
Pain domain																			
Moderate-severe oral pain				•					•						•				
Moderate-severe throat pain													•		•			•	•
Moderate-severe jaw pain								•							•				
General domain																			
Grade 2-4 weight loss							•				•					•	•		
Moderate-severe nausea & vomiting		•	•				•								•				
Moderate-severe fatigue		•					•								•				