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Potential benefits of intensity-modulated proton therapy in head and neck cancer

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Document Version

Final author's version (accepted by publisher, after peer review)

Publication date:
2013

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

van de Water, T. A. (2013). *Potential benefits of intensity-modulated proton therapy in head and neck cancer*. [S.n.].

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Curriculum Vitae

Tara van de Water werd geboren op 16 juli 1981 in Bombay, te India. Zij groeide op in het dorpje Ten Boer in de provincie Groningen, en haalde haar VWO-diploma in 1999 aan het H.N. Werkman-College te Groningen. In 2000 startte zij met de studie Technische Natuurkunde aan de Rijksuniversiteit Groningen. Ze koos voor de specialisatierichting Biomedische Technologie. Het afstudeeronderzoek vond plaats op de afdeling Biomedical Engineering van het Universitair Medisch Centrum Groningen (UMCG). Daar evalueerde ze een wiskundig model voor de beschrijving van de relatie tussen autofluorescentie-metingen en huidskleur. Haar stage-onderzoek deed zij ook in het UMCG, maar dan op de afdeling Radiotherapie. Het doel van dit onderzoek was het evalueren van intensiteitsgemoduleerde radiotherapieplannen voor hoofd-halstumoren. In 2005 studeerde zij af, waarna zij in 2006 startte met haar promotieonderzoek op de afdeling Radiotherapie van het UMCG. Dit onderzoek vond deels plaats in het Centrum voor Protonentherapie op het Paul Scherrer Institute, in Villigen, te Zwitserland. De resultaten van het onderzoek zijn in dit proefschrift beschreven. Sinds juli 2010 is Tara in het UMCG, op de afdeling Radiotherapie, in opleiding tot klinisch fysicus.

List of publications

Papers

- van der Laan HP, **van de Water TA**, van Herpt H, ChristianenME, Bijl HP, Korevaar EW, Rasch CR, van 't Veld AA, van der Schaaf A, Schilstra C, Langendijk JA, on behalf of the Rococo cooperative group. The potential of intensity-modulated proton radiotherapy to reduce swallowing dysfunction in the treatment of head and neck cancer: a planning comparative study. *Acta Oncol* 2012; Epub ahead of print.
- **van de Water TA**, Lomax AJ, Bijl HP, Schilstra C, Hug EB, Langendijk JA. Using a reduced spot size for intensity-modulated proton therapy potentially improves salivary gland sparing in oropharyngeal cancer. *Int J Radiat Oncol Biol Phys* 2012; 82:e313-319.
- Christianen ME, Langendijk JA, Westerlaan HE, **van de Water TA**, Bijl HP. Delineation of organs at risk involved in swallowing for radiotherapy treatment planning. *Radiother Oncol* 2011; 101:394-402.
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- **van de Water T**, van de Water H, Bukman C. A balanced team generating model. *European Journal of operational research* 2007;180:885-906.
- Mulder DJ, **van de Water T**, Lutgers HL, Graaff R, Gans RO, Zijlstra F, Smit AJ. Skin autofluorescence, a novel marker for glyemic and oxidative stress-derived advanced glycation endproducts: an overview of current clinical studies, evidence, and limitations. *Diabetes technology and therapeutics* 2006;8:523-535.

Conference contributions

- **van de Water TA**, Lomax AJ, Bijl HP, Schilstra C, Hug EB, Langendijk JA. Intensity-modulated proton therapy with a reduced spot size improves salivary gland-sparing in oropharynx cancer. 11th Biennial ESTRO meeting on Physics and Radiation Technology, London, UK, May 8-12, 2011.
- van der Laan HP, **van de Water TA**, van Herpt HE, Christianen ME, Bijl HP, Schilstra C, Langendijk JA, on behalf of the ROCOCO Group. Dysphagia reduction with optimized photon and proton intensity-modulated radiotherapy for head and neck cancer patients. 11th Biennial ESTRO meeting on Physics and Radiation Technology, London, UK, May 8-12, 2011.
- van Herpt H, **van de Water TA**, van der Laan HP, Schilstra C, van der Hulst P, Langendijk JA, van 't Veld. Impact of systematic alignment errors in spot-scanned intensity-modulated proton therapy for head and neck cancer. 11th Biennial ESTRO meeting on Physics and Radiation Technology, London, UK, May 8-12, 2011.
- **van de Water TA**, Lomax AJ, Bijl HP, Schilstra C, Hug EB, Langendijk JA. Sparing the salivary glands with scanned protons in head and neck radiotherapy: Benefits of 6-field Intensity-Modulated Proton Therapy (IMPT) as compared to 3-field IMPT, PTCOG 48, Heidelberg, Germany, September 31 - Oktober 3, 2009.
- **van de Water TA**, Lomax AJ, Bijl HP, Schilstra C, Hug EB, Langendijk JA, Comparative treatment planning study between scanned Intensity-Modulated Proton Therapy and Photon Therapy in complex oropharyngeal carcinoma. ESTRO 27 meeting, Göteborg, September 14-18, 2008.
- Jongen R, Dekker A, Qamhiyeh S, Baumert BG, De Neve W, De Meerleer G, De Ruysscher D, Eble M, Engelsman M, Fonteyne V, Habrand JL, Kanematsu N, Langendijk JA, Lomax T, Madani I, Masayuki B, Matsufuji N, Mazal A, Oelfke U, Schlegel W, Tsujii H, Verheij M, Rasch CR, **van de Water T**, Lambin P. International multicentric in silico clinical trial in lung, prostate and head & neck cancer, comparing photons, protons and C-ion therapy treatment: a multicentric planning study based on a reference dataset of patients: Evaluation of feasibility. ESTRO 27 meeting, Göteborg, September 14-18, 2008.
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therapy and Photon Therapy in complex oropharyngeal carcinoma. PTCOG 47, Jacksonville, Florida, USA, May 19-24, 2008.

List of abbreviations

3B-IMPT	Three-beam IMPT
3D-CPT	Three-dimensional conformal proton therapy
3D-CRT	Three-dimensional conformal radiotherapy
6B-SFIMPT	Six-beam split-field IMPT
CI	Conformity index or Confidence interval
CT	Computed tomography
CTCAE	Common toxicity criteria for adverse effects
CTV	Clinical target volume
CVZ	College voor zorgverzekeringen
D_{\max}	Maximum dose
D_{mean}	Mean dose
$D_x\%$	Dose level at which the cumulative DVH intersects with x% of the volume (x % of the volume receives at least this dose level)
DGT-IMPT	Distal gradient tracking IMPT
dIMRT	Dynamic IMRT
DMPO	Direct machine parameter optimization
DVH	Dose-volume histogram
DVO	Dose-volume objective
EIM	Oesophagus inlet muscle
EUD	Equivalent uniform dose
GTV	Gross tumour volume
Gy	Gray
Gy(RBE)	Gray equivalent
HI	Heterogeneity index
HNC	Head and neck cancer
HT	Helical tomotherapy
IGRT	Image-guided radiotherapy
IMPT	Intensity-modulated proton therapy
IMRT	Intensity-modulated radiotherapy with photons
ISPC study	<i>In silico</i> planning comparative study
LET	Linear energy transfer
MLC	Multi-leaf collimator
MRI	Magnetic resonance imaging

NTCP	Normal tissue complication probability
NTV	Normal tissue volume
OAR	Organ at risk
PCM	Pharyngeal constrictor muscle
PET	Positron emission tomography
PG	Prompt gamma
PSI	Paul Scherrer Institute
PTV	Planning target volume
QOL	Quality of life
RBE	Relative biological effectiveness
RCT	Randomized controlled trial
rsIMPT	IMPT with a reduced spot size
RTOG	Radiation therapy oncology group
SD	Standard deviation
SEQ	Sequential
SIB	Simultaneous integrated boost
SOBP	Spread-out Bragg peak
SPOS	Sequential prospective observational studies
ST-IMPT	Standard IMPT
ST-IMRT	Standard IMRT
SW-IMPT	Swallowing-sparing IMPT
SW-IMRT	Swallowing-sparing IMRT
SWOAR	Swallowing organ at risk
(TD) _{x%}	Total dose causing x% toxicity
TPS	Treatment planning system
UMCG	University Medical Center Groningen
$V_{x\text{Gy}}$	Volume receiving $\geq x$ Gy of the prescribed dose
$V_{x\%}$	Volume receiving $\geq x\%$ of the prescribed dose
VF	Video fluoroscopy