Adaptive RT for H&N Cancer: The Usefulness of Deformable Image Registration

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REGION

Adaptive RT for H&N cancer: The usefulness of deformable image registration

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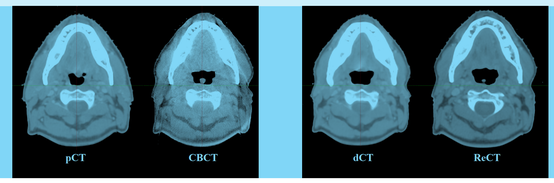


PURPOSE/OBJECTIVES

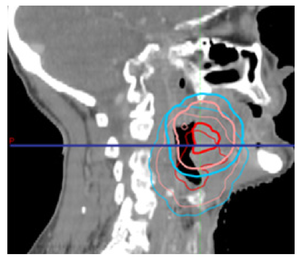
To carry out geometric and dosimetric evaluation of adaptive H&N IMRT based on a deformable image registration algorithm.

MATERIALS/METHODS

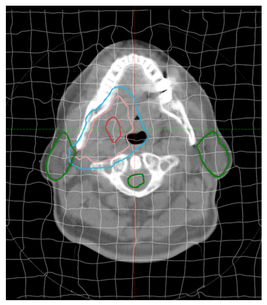
- Planning CT: pCT
- Rescan CT: ReCT
- Cone beam CT: CBCT

pCT was deformed to match the CBCT resulting in deformed structures and deformed CT: dCT

7 H&N patients
IMRT



Deformable image registration
(Varian SmartAdapt v11)
Dose calculation: AAA
(Varian Eclipse)



Patient ID	Diagnosis	site	Dose [Gy]	Fractions	CBCT [Frac]	ReCT [Frac]
1	c. occultus	Sin	68	34	17	18
2	c. oropharyngis	Dxt	68	34	17	17
3	c. cavi oris	Sin	68	34	17	17
4	c. oropharyngis	Dxt	68	34	18	18
5	c. oropharyngis	Sin	66	33	29	29
6	c. oropharyngis	Sin	68	34	24	24
7	c. oropharyngis	Dxt	68	34	23	22

List of patients indicating at which fraction the CBCT and ReCT were acquired.

RESULTS

Geometric results

Relative volume differences between dCT and ReCT, CMS (Center of Mass shifts) and DSC (Dice Similarity Coefficient)

$$DSC = \frac{2(V_{ReCT} \cap V_{dCT})}{V_{ReCT} + V_{dCT}}$$

Structure (♯ of pt.)	Relative volume difference [%]	CMS [cm]	DSC [%]
	presented as: median value (range)		
GTV-T(5)	1.9 (-9.5; 62.1)	0.25 (0.11; 0.73)	0.71 (0.59; 0.86)
CTV-T(5)	1.6 (-6.3; 8.9)	0.36 (0.14; 0.38)	0.86 (0.75; 0.93)
GTV-N dxt(4)	-15.7 (-66.7; 31.3)	0.19 (0.14; 0.35)	0.72 (0.53; 0.79)
CTV-N dxt(4)	6.2 (-16.8; 17.1)	0.15 (0.13; 0.20)	0.86 (0.85; 0.93)
GTV-N sin(4)	4.6 (-17.1; 50.0)	0.28 (0.12; 0.52)	0.64 (0.46; 0.76)
CTV-N sin(4)	7.6 (-18.5; 137.6)	0.40 (0.08; 0.57)	0.80 (0.55; 0.91)
Parotid dxt(7)	-12.1 (-28.2; 18.8)	0.30 (0.20; 0.50)	0.78 (0.71; 0.83)
Parotid sin(7)	-13.3 (-25.1; 18.5)	0.33 (0.18; 0.56)	0.76 (0.69; 0.79)
Spinal cord(7)	-24.4 (-30.6; 30.4)	0.45 (0.07; 1.0)	0.73 (0.62; 0.78)

Dosimetric results

Conformity measure	pCT [%]	dCT [%]	ReCT [%]
	presented as: median value (range)		
CI (Conformity Index)	1.3 (1.0; 1.3)	1.3 (1.2; 1.4)	1.5 (1.1; 1.9)
LCF (Lesion Coverage Fraction)	1.0 (0.95; 1.0)	0.95 (0.94; 0.99)	0.96 (0.94; 1.0)
NTOF (Normal Tissue Overdosage Fraction)	0.19 (0.04; 0.20)	0.26 (0.14; 0.29)	0.32 (0.13; 0.49)

$$CI = \frac{V_{95}}{V_{PTV}} \qquad LCF = \frac{V_{PTVand95}}{V_{PTV}} \qquad NTOF = \frac{V_{95subPTV}}{V_{95}}$$

V_{95} = Volume covered by the 95% isodose
V_{PTV} = Volume of the PTV
$V_{PTVand95} = V_{95} \cap V_{PTV}$
$V_{95subPTV} = V_{95} \setminus V_{PTV}$

CONCLUSIONS

Deformable image registration may be used as a tool for evaluating the need for replanning. However, deformed structures should, at this point, not replace manually delineated structures.

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