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Clinical Application of 3-D Conformal Radiotherapy
for Carcinoma of the Ethmoid Sinus :
. Comparative Analysis
Between Conventional 2-D and 3-D Conformal Plans

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Purpose : This is study of whether 3-D conformal radiotherapy for carcinomas of the ethmoid sinus were better than those treated with conventional 2-D plan.

Materials and Methods : The 3-D conformal treatment plans were compared with conventional 2-D plans in 4 patients with malignancy of the ethmoid sinus. Isodose distribution, dose statistics, and dose volume histogram of the planning target volume were used to evaluate differences between 2-D and 3-D plans. In addition, the risk of radiation exposure of surrounding normal critical organs are evaluated by means of point dose calculation and dose volume histogram.

Results : 3-D conformal treatment plans for each patient that the better tumor coverages by the planning target volume with improved dose homogeneity, compared to 2D conventional treatment plans in the same patient. On the other hand, the radiation dose distributions to the surrounding normal tissue organs, such as the orbit and optic nerves are not significantly reduced with our technique, but a substantial sparing in the brain stem and optic chiasm for each patient.

Conclusion : Our findings represented the potential advantage of 3-D treatment planning for dose homogeneity as well as sparing of the normal tissue surrounding the tumor. However, further investigational studies are required

to define the clinical benefit.

Key Words : 3-D conformal treatment, carcinoma of the ethmoid sinus

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(Planning Target Volume) , 3
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Table 1 .
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3- 90-110% ADAC(Pinnacle 3)
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Table 1. Patients Characteristics

No. of Case	Sex/Age	Extent of Tumor	Pathology	Surgery	Chemotherapy
1.	M/34	Ethmoid sinus Nasal cavity Frontal sinus Orbit	Squamous cell carcinoma	Craniofacial resection	No
2.	F/58	Maxillary sinus Ethmoid sinus Nasal cavity	Squamous cell carcinoma	No	Cisplatin + 5-FU (3 cycle)
3.*	M/61	Cribriform plate Orbit Ethmoid sinus Maxillary sinus Nasal cavity	Squamous cell carcinoma	No	No
4.	M/74	Ethmoid sinus Nasal Cavity	Adenocarcinoma	Partial ethmoidectomy	No

* : Recurrent case after surgery and radiotherapy

5mm
Report 50
ADAC
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2- 3 (ROCS)
6:1:1 8:1:1

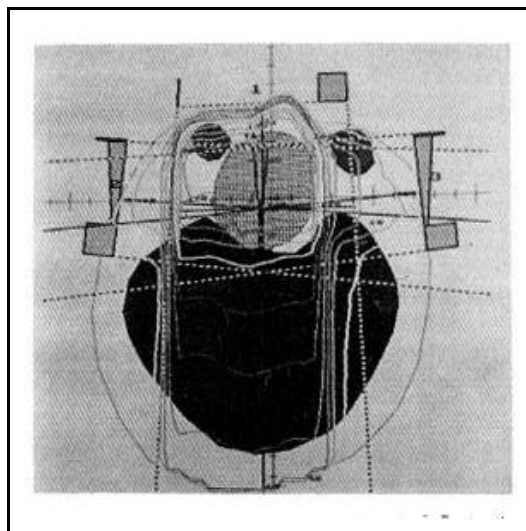


Fig. 1. Dose distribution for conventional 2-D treatment approach in carcinoma of the ethmoid sinus(Case 1).

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2Gy (Fig. 3- 가
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(Fig. 2).
 가 2Gy (dose volume histogram), (dose statistics)
 3. , V_{95} , D_{95} , D_{05}
 3-
 2- 3 3-

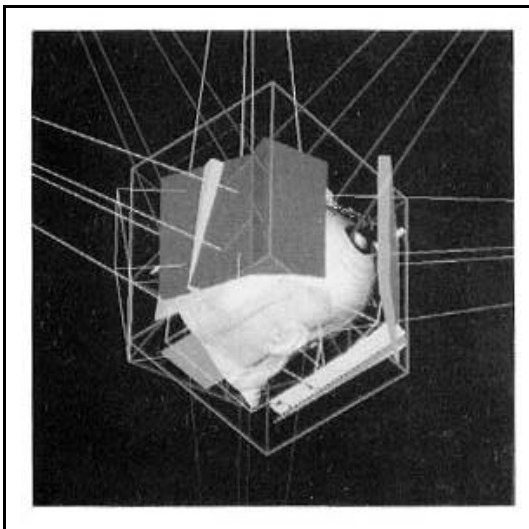


Fig. 2. Beam's eye view display of a non-coplanar beams for 3-D conformal radiotherapy in ethmoid sinus cancer.

1.
 1) 가
 2- 220.2cGy 221.3cGy 3- 10%
 , 1.1cGy
 2-
 189.6cGy 3- 197.8cGy 8.2
 cGy 가 , 3-
 200cGy
 (Table 2).
 8.3cGy
 4% 가

Table 2. Dose and Volume Statistics for PTV Comparing 2-D Plans and 3-D Plans

No. of Case	$D_{max}(cGy)$		$D_{mean}(cGy)$		$D_{95}(cGy)$		$D_{05}(cGy)$		$V_{95}(cc)$	
	2-D plan	3-D plan	2-D plan	3-D plan	2-D plan	3-D plan	2-D plan	3-D plan	2-D plan	3-D plan
1.	214.4	216.2	193.2	197.2	177	182	209	205	46.2	57.4
2.	222.2	217.6	191.2	201.3	170	190	209	215	131.4	207.0
3.	226.2	233.0	183.2	197.4	160	175	219	209	119.6	214.1
4.	223.2	214.1	190.8	195.2	175	185	214	223	130.2	201.8
mean	221.6 ± 5.16	220.2 ± 8.64	189.6 ± 4.40	197.8 ± 2.55	171 ± 7.6	183 ± 6.3	214 ± 5.8	213 ± 7.8		

D_{max} : Maximum dose in planning target volume.
 D_{mean} : Mean dose in planning target volume.
 D_{95} : The dose that 95% of the volume receives.
 D_{05} : The minimum dose that volume receives.
 V_{95} : The volume receiving 95% of the prescription.

가 95%가 74.5%, 94.5%, 77%, 93%가 95%
 V_{95} 2- 60%, 60%, 43%, 95%가 3- 95%
 D_{95} 4 3-

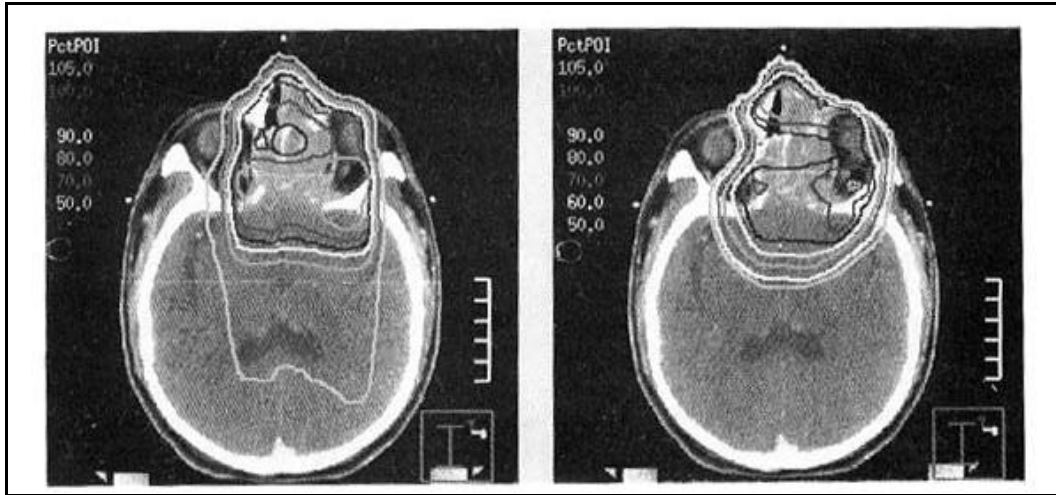


Fig. 3. Isodose displays for conventional 2-D and 3-D conformal treatment plans used for patient No. 4.

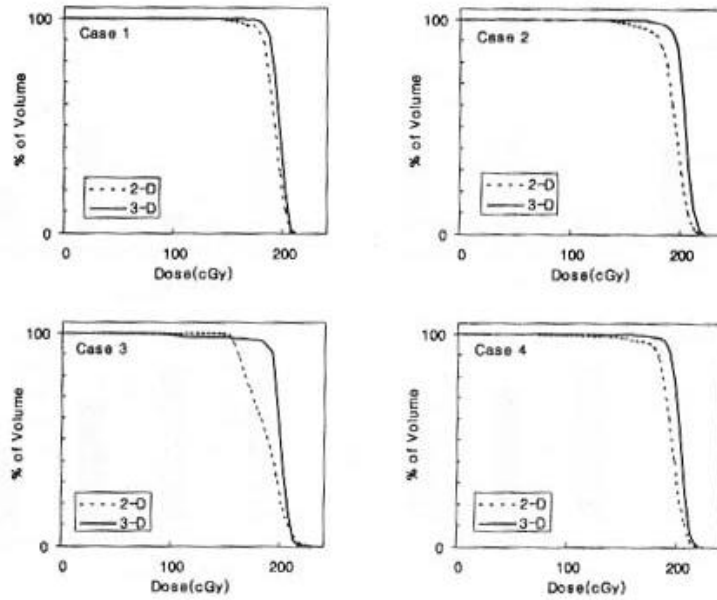


Fig. 4. Comparison of dose volume histograms derived from conventional 2-D and 3-D conformal treatment plan in each patient with carcinoma of the ethmoid sinus.

가 12.5cGy , 3- , 200cGy 4
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 Coia¹³⁾ 2.
 3- 1) 가
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 (Fig. 3). 가
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 (Fig. 4). 2) 3-
 , 2- 3-
 (cold spot) 3- , 1 3-

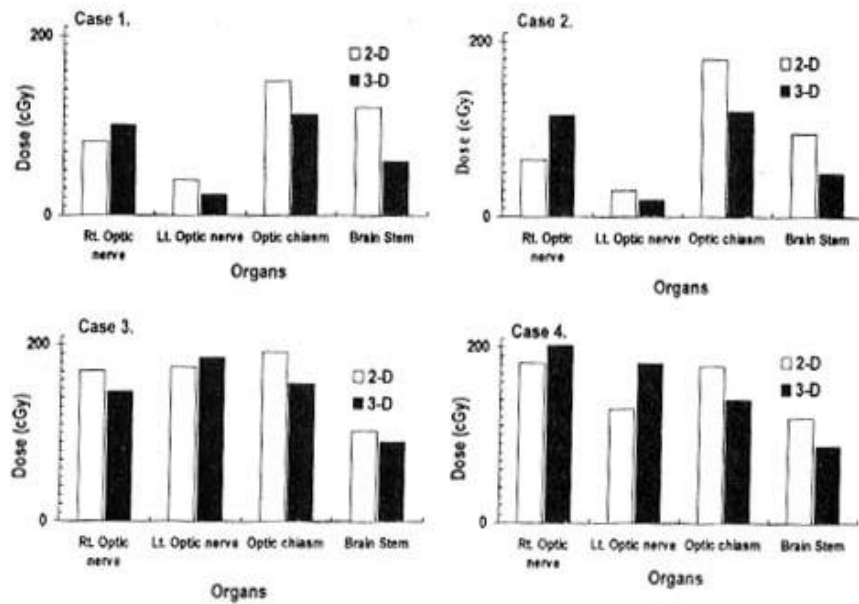


Fig. 5. Comparison of estimated point dose of various adjacent normal tissue organs for 2-D and 3-D conformal treatment plans.

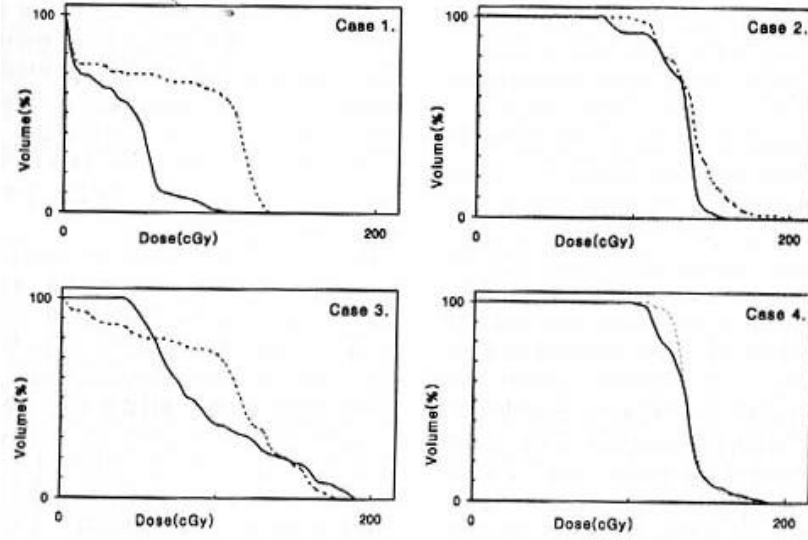


Fig. 6. Dose volume histogram for the brain stem in 2-D conventional(---) and 3-D conformal(--) plans.

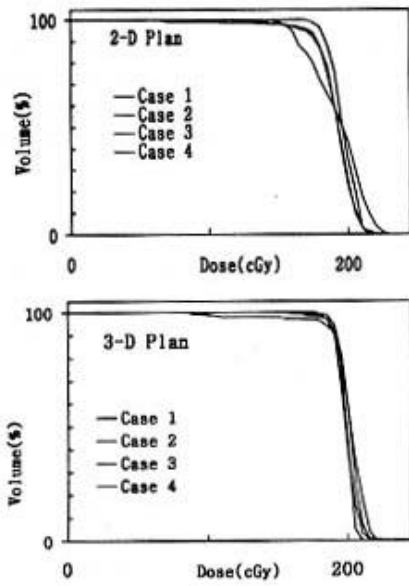


Fig. 7. Superimposed dose volume histograms comparing 2-D conventional treatment plans for (Upper panel) as well as 3-D conformal treatment plans(Lower panel).

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(Fig. 6).

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15, 16)

14-16) 가 2- 3- 가
4% dose escalation 가
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가 isodose line
8
MV가 가 17) Roa 가
Tsuji 가
가 7, 16) 가
Lane 17) "multiple 2- 가
overlapping field technique" 가 3- normal tissue
complication probability(NTCP)
가 18) 가
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2- 가 5mm
가 2- 1-2mm
Fig. 7 가
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Intensity Modulation

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3-

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