A study on the effectiveness of intensity modulated radiotherapy for xerostomia during head and neck radiotherapy

K. Katsura¹, S. Tanabe², M. Soga¹, T. Kobayashi¹, M. Takamura¹, E. Abe³, T. Hayashi¹

1. Division of Oral and Maxillofacial Radiology, Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan.

2. Department of Radiation Oncology, Niigata University Medical and Dental Hospital, Niigata, Japan.

3. Department of Radiology and Radiation Oncology, Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan.

Introduction

Xerostomia caused by head and neck radiotherapy (HNRT)

This is one of the main acute and late complications that result in decreased patients' QOL during and after HNRT. Especially, acute xerostomia may exacerbate oral mucositis during HNRT.

Prevention of xerostomia caused by HNRT

Intensity modulated radiotherapy (IMRT) is widely accepted as a technique for prevention¹⁾.

A. The dose distribution of three-dimensional conformal radiotherapy.
B. The dose distribution of Intensity modulated radiotherapy.

However, the effectiveness of IMRT has been mainly reported about in regard to late xerostomia^{1,2)}, and its effectiveness for acute xerostomia during HNRT has not yet been made clear.

Objectives

The purpose of this study was to investigate the amount of saliva and patients' symptoms during and after HNRT in order to identify the effectiveness of IMRT for acute xerostomia.

Patients and methods

Population of this study was composed 34 HNRT patients all of whom agrees to participate in "Study on the change of xerostomia by concurrent chemoradiotherapy for head and neck squamous cell carcinoma (Ethics Approval No. 2015-1593)".

The change in amount of saliva (unstimulated and stimulated) and the patients' symptoms (subjective xerostomia score) during and after HNRT were prospectively investigated. The amount of saliva and patients' symptom were monitored before starting HNRT, during HNRT (1-7 weeks) and after completing HNRT (12 months).

In addition, the relationship between the radiation dose of the parotid glands and the reduction of salivary function was investigated.

Conclusions

From our results, IMRT was an effective technique for recovery of stimulated saliva after HNRT, unfortunately the effectiveness for acute xerostomia and recovery of unstimulated saliva after IMRT were not indicated. Therefore, even though IMRT was selected, it is necessary to provide management of xerostomia similar to 3DCRT during and after HNRT.

Furthermore, it was shown that TD50 (the dose resulting in 50% reduction of salivary function in half patients) of the parotid glands for acute xerostomia was estimated to be approximately 10 Gy. This radiation dose was lower than the commonly accepted dose for the recommended dose to prevent severe late salivary dysfunction²⁾.

References

1. Jensen SB, et al. A systematic review of salivary gland hypofunction and xerostomia induced by cancer therapies: prevalence, severity and impact on quality of life. Supportive care cancer 18:1061-1079, 2010.
2. Saarilahti K, et al. Intensity modulated radiotherapy for head and neck cancer: evidence for preserved salivary gland function. Radiother Oncol. 74:74 251-258, 2005.

✉ : katsu@dent.niigata-u.ac.jp

Results

Patients' characteristics

	3DCRT(n=27)	IMRT(n=7)	p
Age (Mean)	49.74 (63.5)	40.52 (49.7)	< 0.001
Gender			
Male / Female	22 / 5	6 / 1	0.79
Primary site			
Nasopharynx	1	7	< 0.001
Oropharynx	10	0	
Hypopharynx	12	0	
Glottic	4	0	
Stage			
I / II / III / IV	0 / 1 / 8 / 18	1 / 0 / 5 / 1	0.56
Radiation dose (Gy)			
Submandibular gland (Mean)	44-56 (46.3)	44 (44.0)	0.48
Parotid gland (Mean)	35.9-69.1 (49.6)	30.6-45.4 (37.1)	< 0.001

3DCRT: three-dimensional conformal radiotherapy. IMRT: Intensity modulated radiotherapy.

The IMRT group was all nasopharyngeal carcinoma patients, and the age and parotid dose were significantly lower in the IMRT group than in the 3DCRT group.

Student t-test or paired t-test was used for the statistical analyses. The level of statistical significance was set at 0.05.

In both groups, the amount of saliva was significantly decreased and the patients' symptoms were significantly worse during HNRT. Additionally, there was no significant difference between the two groups.

After HNRT, IMRT group significantly recovered the amount of stimulated saliva compared to 3DCRT group, and the patients' symptoms showed a tendency to improve.

Relationship between salivary function and parotid gland dose

Two hundred twenty three data points from 34 patients showed that the salivary function at 10 Gy became less than 50% compared to before HNRT in half of the patients.