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Influence of Radiation Dose on Changes in Parotid Gland Function

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Introduction

"Radiation caries", a rapidly developing and highly destructive form of tooth decay, is a well-known dental consequence of radiotherapy of malignant tumors in the head and neck region. Hyposalivation, which is induced by irradiation (1), and dietary changes with concomitant alteration of the oralflora (2) are considered to be the most important aetiological factors (3). Former investigations showed that exposing the parotid glands to radiation may result in reduced salivary flow rate (4). A correlation between postradiotherapy flow ratio and parotid gland dose has been reported previously (4,5).

Objectives

Therefore, the aim of this study was to determine the influence of parotid-sparing radiotherapy on salivary flow rate and quality in irradiated patients up to four weeks after irradiation.

Fig. 1: Clinical example of radiation caries.

Fig. 2: Radiation caries. Radiograph taken ten weeks after radiation.

Material and Methods

The study population consisted of patients with head and neck cancer treated with primary or postoperative irradiation at the Martin-Luther-University Halle-Wittenberg between 2002 and 2003. 32 patients receiving parotid-sparing radiotherapy were included and prepared for the radiotherapy by an immobilization mask. CT-based three-dimensional treatment planning was carried out (Fig. 3, 4). The planning CT scans provided details of the three-dimensional dose distribution in each parotid gland which could be displayed in form of dose-volume-histograms (DVHs). The patients received either a mean parotid gland dose of 20-35 Gy (11 patients, group A), 35-50 Gy (11 patients, group B) or 50-65 Gy (10 patients, group C). Stimulated saliva was evaluated in regard to salivary flow, buffer capacity, colonisation with Streptococcus mutans and Lactobacillus before, three weeks after beginning and four weeks after the end of radiotherapy. For each group mean value and standard deviation were calculated. Statistical analysis was performed using ANOVA and Tukey's test.

	Group A 20-35 Gy	Group B 36-50 Gy	Group C 51-65 Gy
Before radiotherapy	0,81 ml/min (± 0,37)	0,79 ml/min (± 0,44)	0,72 ml/min (± 0,57)
Three weeks afert beginning of radiotherapy	0,63 ml/min (± 0,40)	0,39 ml/min (± 0,39)	0,41 ml/min (± 0,41)
Four weeks after the end of radiotherapy	0,47 ml/min (± 0,36)	0,17 ml/min (± 0,15)	0,15 ml/min (± 0,14)

Tab. 1: Mean value and standard deviation within the different groups.

Results

The mean stimulated salivary flow rate of all patients was 0.78 ml/min before radiotherapy. After three weeks the stimulated saliva flow was decreased in all groups. At this point no significant differences between the three groups could be observed. Patients receiving a mean dose below 35 Gy showed a salivary flow of 0.47 ml/min (60.3% of baseline) 4 weeks after irradiation. Increasing the mean parotid dose to 35-50 Gy and 50-65 Gy resulted in a significantly higher decreased flow rate of 0.17 ml/min (21.8%) and 0.15 ml/min (19.2%) compared to group A. Between group B and C no significant differences could be detected. The buffer capacity in group A retained at baseline level, while in group B and C a reduction could be observed. The colonisation with Streptococcus mutans and Lactobacillus varied little in all groups over the whole period.

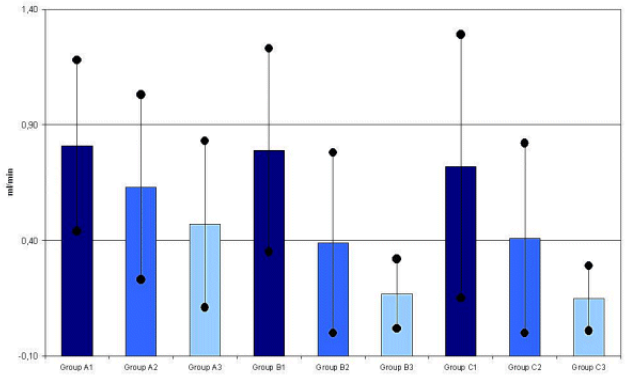

Fig. 5: Mean values and standard deviation graphically expressed in ml/min.

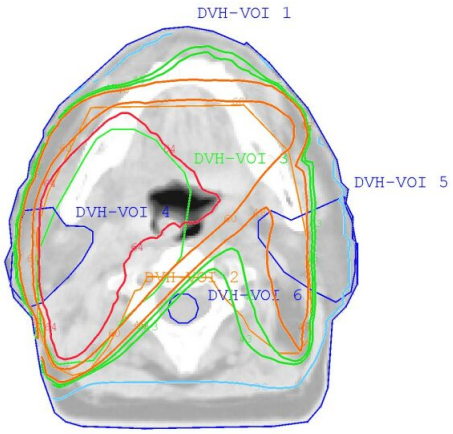

Fig. 3: CT-based radiation planning sparing the parotid gland.

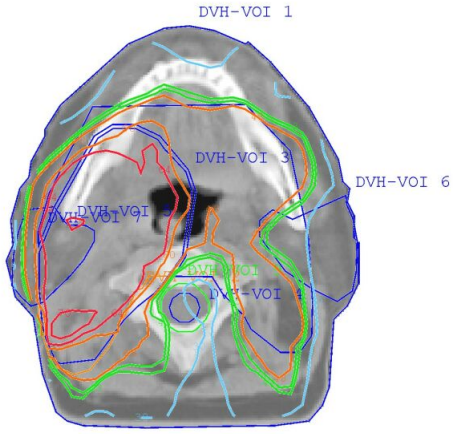

Fig. 4: CT-based radiation planning without sparing the parotid gland.

Conclusions

The results demonstrate that parotid-sparing radiotherapy has a significant influence on salivary flow. Patients treated with mean parotid gland doses lower than 35 Gy showed significant higher salivary flow compared to both other groups. Therefore, a mean parotid gland dose of at least less than 35 Gy might be desirable in radiotherapy planning.

Literature

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This poster was submitted by Dr. Christian Ralf Gernhardt.

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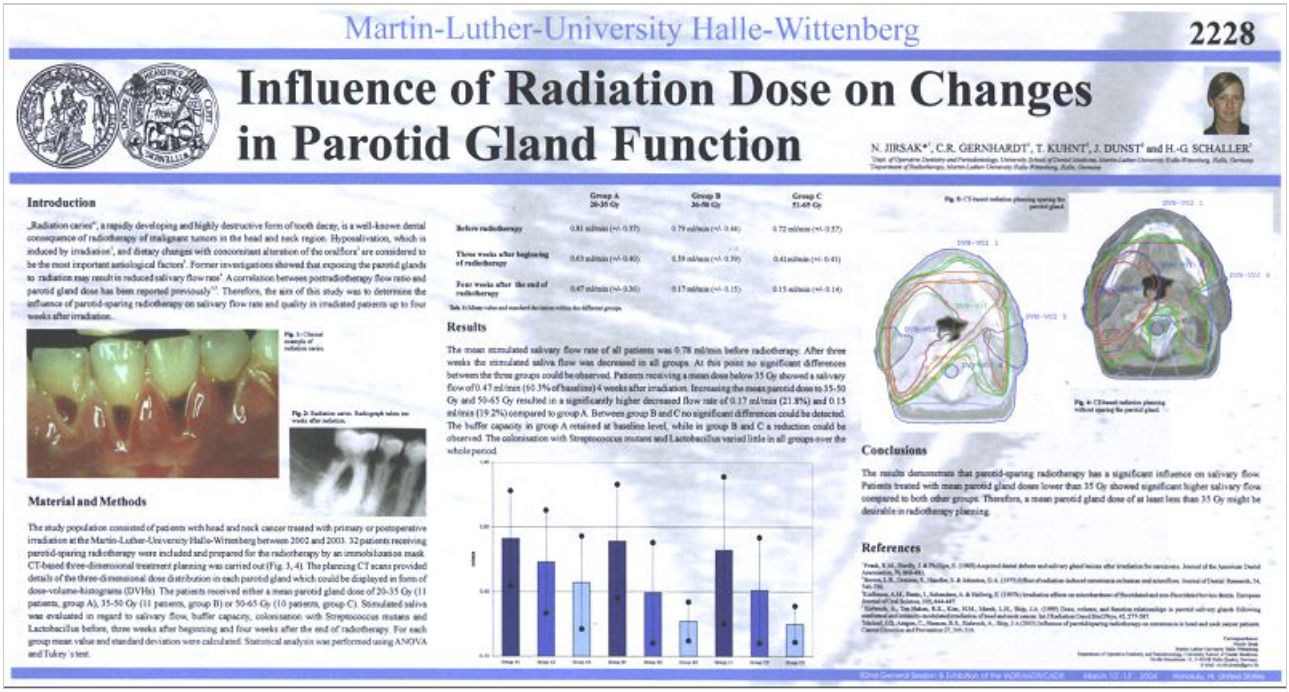

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Influence of Radiation Dose on Changes in Parotid Gland Function

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