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The effect of prior radiation therapy for treatment of nasopharyngeal cancer on wound healing following extractions: incidence of complications and risk factors

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Abstract. This is a prospective study of wound healing after extractions in patients who had radiation therapy for nasopharyngeal cancer. From 40 patients who fulfilled all the study criteria were extracted a total of 155 teeth. The demographic data were analysed, checking for factors that might affect the healing process after extraction. Wound healing was divided into three groups: normal wound healing, delayed healing and osteoradionecrosis. Logistic regression was used to analyse possible relationships. There was a low complication rate: 5.8% and 1.9% of extractions showed delayed healing and osteoradionecrosis, respectively. The age of the patient at time of extraction was the only significant factor that influenced the occurrence of delayed healing. It was observed that localized radiation absorption was considerably different from the total radiation dose. In conclusion, postradiation extractions have a low risk of complications and the results point to age as a factor that may influence wound healing.

Key words: dental extractions; radiation therapy; osteoradionecrosis; delayed healing; risk factors.

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In the management of head and neck oncology, patients often receive therapeutic radiation to the oral environment. This usually includes the dentition and its surrounding structures, including the maxillary and mandibular bone, salivary glands, temporomandibular joint, muscles of mastication and oral mucosa. The side effects of radiation therapy, such as xerostomia secondary to degeneration of salivary glands [18,20], trismus from fibrosis of the muscles of mastication [7,8], radiation-induced mucositis [2] and change in oral flora [11], all predispose patients to poor oral hygiene and rampant caries. These often lead to multiple unrestorable teeth that are unsuitable for conservative treatment. The teeth become

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sources of infection, and extraction is indicated.

Radiation therapy produces a hypovascular, hypocellular and hypoxic state in the jawbone and the surrounding soft tissue, and thus extractions can lead to delayed healing (DH) or osteoradionecrosis (ORN) [12]. In its severe form, ORN is intractable and may only be amenable to surgery with adjunctive hyperbaric oxygen therapy or resection followed by reconstruction with free vascularized grafts. Clinicians are therefore reluctant to perform extractions in such patients.

With the advances in radiation therapy, studies are showing a decreasing risk of morbidity. The risk of ORN has decreased significantly from 11.8% in the premegavoltage era (before 1968) to 5.4% in the postmegavoltage era [4]. Some recent studies showed extremely low incidences of ORN at 1.7%, 0.2% and 0% [1,9,14], and DH at 6.3% [1]. This is predicted to decrease further with the increasing availability of 3D-conformal and intensity-modulated radiation therapy. These techniques allow more of the surrounding structures to be spared without compromising tumour volume control [16].

Numerous predisposing risk factors, such as location of tumour, history of tumour surgery, total dose of radiation, radiation dose per day, mode of radiation therapy, time period from radiation therapy to extraction, presence of dental trauma, dental status and competency of the clinician performing the extraction, have been proposed to be contributory to ORN development [3,6,13,15,17]. Of these, the dosage of radiation is frequently quoted as a crucial factor. A study has shown that 98.8% of ORN occurs in the region receiving direct radiation [19]. Two studies indicated that only 4.8% [13] and 2.5% [19] of their ORN samples were exposed to less than 50 Gy of radiation. Another study showed that 97% of regions that developed ORN have been exposed to a total radiation dose of more than 50 Gy [5].

There are few studies in the literature of the incidence and risk factors of DH and ORN development in an Asian population. The purpose of this study was to prospectively determine the incidence of DH and ORN after extractions in patients who received radiation therapy to the head and neck regions as a result of nasopharyngeal cancer (NPC), and its correlation with patient-related, tooth-related and radiation therapy-related risk factors.

Method

Patient eligibility and criteria

Consecutive patients previously radiated for treatment of NPC who were referred to the Department of Oral & Maxillofacial Surgery for tooth extractions between November 2001 and September 2004 were eligible for this study. The inclusive criteria were patients who (1) had received one full course of curative external beam radiation therapy, (2) had received treatment for NPC and (3) were referred for extractions after conservative treatment had been considered or failed. The exclusive criteria were patients (1) who had concomitant ORN or osteomyelitis of the jaws, (2) who were on chemotherapy or immunosuppressive drugs, (3) who had local recurrent disease, (4) who had completed radiotherapy less than 6 months ago, (5) who had received more than one course of radiation therapy or supplementary brachytherapy, (6) who did not have complete radiation data and (7) who had uncontrolled systemic disease, e.g. diabetes mellitus and hypertension.

Baseline characteristics

Patient-related characteristics included gender, age, ethnicity, smoking habit and alcohol consumption. Tooth-related characteristics charted were anatomical location, pulpal status and periodontal status. Radiation therapy-related characteristics collected included maximum mouth opening, total radiation dose delivered, time period from radiation therapy to tooth extraction and the amount of radiation absorbed by the tooth to be extracted. Data pertaining to preradiotherapy or postradiotherapy surgery to the jaws or chemotherapy were also captured.

A radiation oncologist determined all radiation data. All the patients underwent radiation therapy at the Department of Radiation Oncology, National Cancer Centre, and received conventional

Fig. 1. Simulation film (lateral) showing planning of the first phase of radiation therapy with grid showing radiation field and additional shielding. The yellow markers with numbers indicate the teeth to be extracted. (R) is the ramus and (T) is the temporomandibular joint.