

Dental Pulp Status of Posterior Teeth in Patients with Oral and Oropharyngeal Cancer Treated with Radiotherapy: 1-year Follow-up

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Abstract

Introduction: Teeth may react negatively to pulp sensitivity testing in patients who have undergone radiotherapy. The aim of the current investigation was to evaluate the pulp sensibility of posterior teeth at 4, 6, and 12 months in patients who have undergone radiotherapy for oral and oropharyngeal malignancies. **Methods:** Seventy-nine patients diagnosed with malignant oral and oropharyngeal cancer undergoing radiotherapy underwent cold thermal pulp sensitivity testing and electric pulp testing of 4 teeth, 1 from each quadrant. The results were recorded at 5 different time points (TPs): before radiotherapy (TP1), at the end of radiotherapy at 66–70 Gy (TP2), 4 months after the completion of radiotherapy (TP3), 6 months after the completion of radiotherapy (TP4), and 12 months after the completion of radiotherapy (TP5). **Results:** All 288 teeth tested positive to cold thermal pulp sensitivity testing and electric pulp testing (EPT) at TP1 (100%). No tooth responded to the cold test (100%) at TP4 and TP5, and progressively higher EPT values were noted during the observation period. A statistically significant difference existed in the number of positive responses between different TPs. **Conclusions:** There was a progressive decrease in pulp sensibility from TP1 to TP5 in teeth of patients with oral and oropharyngeal cancer who underwent radiotherapy (66–70 Gy). No response to cold thermal tests was noted at TP4 (6 months) and TP5 (12 months), and teeth responded at increasingly higher EPT values from TP1 through TP5. This result was statistically significant. (*J Endod* 2018; ■:1–6)

Key Words

Oral and oropharyngeal cancer, pulp sensibility, radiotherapy

Oral cancer comprises about 85% of all head and neck cancers. According to the World Health Organization, 9570 and 8650 people worldwide died from oral cavity and pharynx cancer in 2016 and 2015, respectively. The 5-year relative survival rate for all cancers diagnosed in 2004 to 2010 was 68%, up from 49% in 1975 to 1977 (1, 2).

Radiation therapy (RT) is part of the treatment of malignant tumors because of the ability of ionizing radiation to control cell growth. RT works by damaging the DNA of cancerous cells. To reach the target cells, radiation will have to pass through healthy tissues, which may damage the DNA of normal cells (3). Teeth are a common structure in the pathway of radiation during head and neck cancer treatment and receive high doses of radiation (4). A lack of tooth sensitivity has been noted during the placement of restorations in patients who have undergone RT to the head and neck region (5). Acute hematologic abnormalities start occurring at 1-Gy radiation. Ionizing radiation causes chemical injuries in the tissues, and RT may be the reason for changes in microcirculation (6). Knowles et al (5) conducted a scanning electron microscopic study to assess changes in the pulpal innervation of teeth after RT and showed that the irradiated specimens appeared fibrous and had remarkably thickened arteriole walls (endarteritis).

The determination of pulp sensibility is an important step to assess the health or pathology of the pulp. These tests allow us to make decisions regarding endodontic intervention. Weisleder et al (7) reported that 90% of teeth that responded negatively to cold and electric pulp tests had necrotic pulps, and 97% of those that responded positively had vital pulps. Ideally, cold testing should be used in conjunction with electric pulp testing (EPT) so that the results from one test will verify the findings of the other test (8). Kielbassa et al (9) stated that exodontia of extremely carious teeth leads to a significant risk of osteoradionecrosis in patients who have undergone RT. In these patients, endodontic treatment could be an alternative. The aim of this study was to determine the effect of RT on the pulp status of posterior teeth in patients with malignant oral and oropharyngeal cancer at 5 different time points. The hypothesis was that after RT the pulpal blood flow may return to normal if enough time was given to the pulp to recover

Significance

This study showed a progressive decrease in pulp sensibility from the end of RT to 4 months and no response to cold tests and progressively higher EPT values at 6 months and 1 year in teeth receiving RT for oral and oropharyngeal cancer.

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Clinical Research

from the deleterious effects of radiation. This study was designed to check the pulpal sensibility/responsiveness at 4-, 6-, and 12-month intervals after the completion of RT.

Materials and Method

Selection of Patients: Inclusion and Exclusion Criteria

The study was approved by the Institutional Review Board, Rajiv Gandhi Cancer Institute and Research Centre, New Delhi, India, and the Ethics Committee of PDM Dental College and Research Institute, Bahadurgarh, Haryana, India. Informed consent was obtained from all subjects who participated in the study after detailed explanation of the nature of the experimental procedure. Seventy-nine patients, both men and women between 40 and 75 years of age, who presented with oral or oropharyngeal cancer at Rajiv Gandhi Cancer Institute and Research Centre before the beginning of RT were selected and agreed to participate in the investigation. None of the patients participating in the study reported impaired or lost sensory functions in the areas innervated by the 3 branches of the trigeminal nerve during the investigations. Preradiation radiographs of patients could not be performed because some of the patients had undergone surgical

intervention; a few were undergoing chemotherapy and were about to start RT. Morbidity of the patients was high, and patients were not very cooperative. A pulpal response to cold testing and a positive response to EPT at lower values was the determining variable along with no spontaneous pain and no pain on percussion. The sample size was determined from the results of a previous study conducted by the authors (6) using G Power (version 3.1.9.2; Heinrich-Heine-Universität, Düsseldorf, Germany). The sample size was calculated using the mean difference in mean pulp testing from baseline to 4 months. The mean difference for mean pulp testing was 22.34 from baseline to 4 months. The power of the study was 80%, and the 95% confidence interval was computed. The sample size was calculated to be 10. Expecting an attrition of 10%, the sample size was calculated to be 11. For the adjustment of the cluttering effect, the intraclass coefficient was estimated, and the sample size was divided by the intraclass coefficient. Thus, the sample size was calculated as follows: $11/0.843 = 13$. The study design was taken from a previous study conducted by the corresponding author (6), but no patients or their data have been included in the present study. The time frame was increased to 1 year to ascertain the changes in the pulp after RT and to test the null hypothesis.



Figure 1. Dose painting and dose-volume histogram was prepared to analyze the radiation dosage received by each tooth.

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