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ORIGINAL ARTICLE

Evaluation of a community-based dental screening program prior to radiotherapy for head and neck cancer: a single-center experience

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Abstract

Purpose Oral toxicities following radiation therapy (RT) for head and neck (HN) cancer can be profound and are associated with poor health outcomes. The Division of Oral Medicine and Dentistry at Brigham and Women's Hospital and Dana-Farber Cancer Institute therefore implemented a dental evaluation program designed for community-based (CB) dentists to evaluate and treat patients scheduled for HN RT. The aim of this retrospective single-center cohort study was to assess the compliance of CB dentists with this pre-RT dental evaluation program.

Methods A retrospective analysis of dental evaluations completed by CB dentists from December 2013 to December 2015 was performed. Descriptive statistics were used to determine compliance.

Results A total of 186 dental evaluations were received. Compliance with completion of dental treatment was as follows: scaling and prophylaxis: 94.5% (172/182); dental restorations: 78.7% (48/61); endodontic therapy: 76.9% (10/13); and dental extractions: 76.9% (30/39). Compliance of CB dentists with all requested components of the pre-RT evaluation and treatment was 77.4% (144/186). The median distance traveled by patients to the CB dentist and to the hospital was 5.2 miles (range 0.03–66.0) and 46.5 miles (range 0.8–1457; $p < 0.01$), respectively.

Conclusion In this study, the majority of patients completed their necessary dental treatment in a timely manner by their CB dentist in collaboration with an oral medicine specialist. Given the high compliance of CB dentists, this program could serve as a model for other cancer centers to optimize oral and dental health prior to RT.

Keywords Head and neck cancer · Head and neck radiation · Dental screening · Caries · Osteoradionecrosis

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Introduction

It is anticipated that over 50,000 new diagnoses of head and neck (HN) cancer will be made in 2018 in the USA [1]. Depending on tumor site and staging, treatment options include surgery, radiation therapy (RT), chemotherapy, and potentially immunotherapy [2, 3]. Optimal treatment decisions require a multidisciplinary approach, which are associated with better outcomes [4–6]. Typically, the primary treatment team includes HN surgeons, medical oncologists, and radiation oncologists. Other subspecialties such as dietetics, speech and swallow therapy, physical therapy, and dentistry are also part of the multidisciplinary team [6].

Patients undergoing RT are at risk of oral adverse effects, such as mucosal atrophy and mucositis, infection, salivary gland hypofunction, rampant caries, and osteoradionecrosis of the jaw [7–9]. Such complications contribute significantly to patient morbidity and diminished oral health-related quality

of life, as well as increased health resource utilization and costs. Dentists play an important role in the multidisciplinary treatment team by evaluating patients prior to RT with the objective of optimizing oral health status and minimizing complications [6, 7, 10, 11]. The Division of Oral Medicine and Dentistry at Brigham and Women's Hospital (BWH) therefore implemented a program designed for community-based (CB) dentists to complete dental evaluations and necessary treatment for HN cancer patients scheduled for RT [10]. The aim of this retrospective single-center cohort study was to assess the compliance of CB dentists with this pre-RT dental evaluation program.

Methods

Study cohort

The study cohort included all patients diagnosed with HN cancer at Dana-Farber Cancer Institute (DFCI) between December 2013 and December 2015 who required radiation therapy, received a dental instruction guide, and had a completed dental evaluation by their CB dentist. A total of 356 new HN cancer patients were diagnosed during this time period at DFCI. Of these 356 new HN cancer diagnoses, 223 patients were planned to receive radiation therapy. The Division of Oral Medicine and Dentistry at BWH received 186 dental evaluations completed by a CB dentist. Of the remaining 37 patients who were planned for radiation therapy, but did not have a dental evaluation completed by a CB dentist, 14 patients were treated in the BWH Oral Medicine clinic, 7 patients were treated urgently for their HN cancer and did not have a full dental evaluation prior to radiation therapy, and 16 patients received RT elsewhere. A retrospective analysis was performed for these 186 dental evaluations.

Dental screening program

Following consultation for HN cancer at DFCI, patients scheduled for RT were provided with a detailed dental instruction guide (DIG) to give to their CB dentist [10]. This DIG provides education on the importance of a thorough dental evaluation and completion of dental treatment prior to RT and outlines the necessary components of the dental evaluation. CB dentists were instructed to obtain a full mouth series of intraoral radiographs within the last 6 months (or panoramic radiograph if unable to tolerate intraoral radiographs), perform a comprehensive dental evaluation, and note any radiographic findings, symptomatic teeth, caries, fractured or defective restorations, results of any vitality testing performed, percussion sensitivity, areas of gingival bleeding on probing, probing depths > 4 mm, mobility, suppuration/sinus tracts, soft tissue lesions, and the state of any removable prosthesis. The DIG advised CB dentists to perform scaling and prophylaxis if not completed within the last 3 months; restore all caries, severely abraded, and fractured teeth; perform endodontic treatment for teeth with pulpal involvement; and extract teeth with poor prognosis, or third molars if they have been symptomatic in the past. CB dentists were advised to start treatment immediately.

The completed evaluation forms and radiographs as well as the treatment plan generated by the CB dentist were returned to the BWH Division of Oral Medicine and Dentistry and reviewed by Oral Medicine specialists. Following review, a letter was sent to the CB dentists including a summary of the clinical findings and confirmation of treatment plan as well as any further treatment suggestions. If all necessary dental treatment was completed at the time of the Oral Medicine review, the patient was considered ready for RT. If the dental treatment was not complete at the time of the Oral Medicine review, CB dentists were asked complete the remaining treatment and return a treatment completion form to document if and when the necessary dental treatments had been completed. The primary means of communication between the CB dentist and the Oral Medicine specialist was through the DIG and written letters but e-mail and telephone calls were also used to supplement communication.

Statistical analysis

Descriptive statistics were used to determine compliance with the dental evaluation program. CB dentists were considered compliant with the program if all the necessary dental treatment was completed prior to RT as documented with the provided forms. If the treatment plan was not completed or the proper documentation of treatment completion was not provided, the CB dentist was considered noncompliant. Compliance was calculated per dentist rather than individual procedures. Distance traveled to the cancer center and to the patient's CB dentist were compared using Wilcoxon and Pearson tests. *P* values were considered to be statistically significant at $p < 0.05$.

Results

Demographics

A total of 186 patients scheduled for HN-RT were evaluated by their CB dentist during the 2-year study period. The median age was 60 (range 28–87), and the majority (70.4%) were male (Table 1). The most common cancer diagnosis was squamous cell carcinoma (SCC) constituting 76.9% (143/186) of the patients. The majority of the patients were dentate (98.9%) with a median of 27 remaining teeth (range 3–32). The median distance the patients traveled from home to the cancer center

Table 1 Patient characteristics

Patient characteristics ($N = 186$)	
Age (median [range])	59.5 (28–87)
Gender	
Male	70.4% (131/186)
Female	29.6% (55/186)
Tobacco	
Current	8.6% (16/186)
Former	45.7% (85/186)
Never	45.7% (85/186)
Pack years (median [range])	15 (0.13–137.5)
Cigars/pipe	4.8% (9/186)
Marijuana	3.2% (6/186)
Chewing tobacco	2.7% (5/186)
Alcohol consumption	
Current	75.0% (138/184)
Former	13.0% (24/184)
Never	12.0% (11/184)
Drinks/week (median [range])	6 (0.25–42)
Family history of cancer	
Yes	65.2% (64/184)
No	34.8% (120/184)
OSCC	1.1% (2/183)
Smoking-related	45.8% (54/118)
Distance to dentist (mi.)	5.2 (0.03–66)
Distance to BWH (mi.)	46.45 (0.8–1457)
Denture-wearing	3.2% (6/186)

OSCC oral squamous cell carcinoma

and to the CB dentist was 46.5 miles (range 0.8–1457) and 5.2 miles (range 0.03–66), respectively ($p < 0.01$).

Timing and coordination of care

The median time from HN radiation consultation to RT initiation was 27 days (range 15–85). The median time from the HN radiation consultation to the CB dental examination was 9 days (range 1–70). The median time from the CB dental evaluation to the Oral Medicine review was 7 days (range 0–62). The median time from the Oral Medicine review to RT initiation was 11.5 days (range 0–81). Given the median time for patients to have the CB dental evaluation was 9 days, and the median time to start RT was 27 days; this allowed a median time of 18 days to have their dental evaluation and any necessary treatment completed (Fig. 1).

Treatment and compliance

Scaling and prophylaxis was required for all dentate patients (97%, 182/186). More than half of patients (103/186, 55.4%) required dental treatment (other than scaling and prophylaxis), including restorations ($n = 61$ median = 2), extractions ($n = 39$, median = 2), or endodontic therapy ($n = 13$, median = 1). Compliance for completion of scaling and prophylaxis was 94.5% and for restorations, extractions, and endodontic therapy was 76.9–78.7% (Table 2). By the time of the Oral Medicine review, all necessary dental treatment was completed in the majority of patients (113/186, 60.8%). For the remaining 73 patients requiring further dental treatment, 42.5% (31/73) of the completion forms were returned by their CB dentist. As such, total compliance with the protocol including completion of all required paperwork and all necessary dental treatment was 77.4% (144/186).

Discussion

Comprehensive dental examination prior to RT is important considering the reported rate of dental pathologies identified prior to RT ranges from 49.5 to 97% [11–14]. In this study, 55.4% (103/186) of patients treated by their CB dentist had dental pathology requiring dental treatment (other than scaling and prophylaxis). Rosales et al. showed dental examination and treatment prior to radiotherapy significantly decreased the need for dental treatment after RT [13]. Their patient population included 148 patients who did not have a dental examination prior to RT, while 209 patients did. The need for dental treatment after RT in the examined vs. unexamined population were substantially different as follows: restorations, 16.5% vs. 52%; extractions, 8.9% vs. 34.7%; and endodontic treatment, 10.8% vs. 41% [13]. While dental screening and identification of pathology are important components of the pre-RT evaluation, completion of the proposed dental treatment is key as compliance has been shown to be low in the HN radiation population by Lockhart and Clark [11]. In their population of 131 patients, only 19% of patients were compliant with the proposed treatment before HN radiation [11]. In this study, compliance with pre-RT dental examination and treatment was 77.4%. One reason for higher compliance in this study could be due to the direct instruction and communication with the patient's CB dentist which was not seen in other studies.

While RT must be delivered in a highly specialized facility, often requiring extensive travel for patients, dental care can generally be provided in a patient's local community [15]. Traveling great distances for cancer treatment is associated with increased physical symptoms and additional emotional distress especially if there are time constraints [16]. The median distance traveled from home for radiation treatment was 46.5 miles. However, patients lived within a median distance of 5.2 miles from their CB dentist. The majority (55.4%) of the patients in this population had dental needs that require multiple visits to their CB further adding to travel time and a limited time window in which to complete them. Patients took

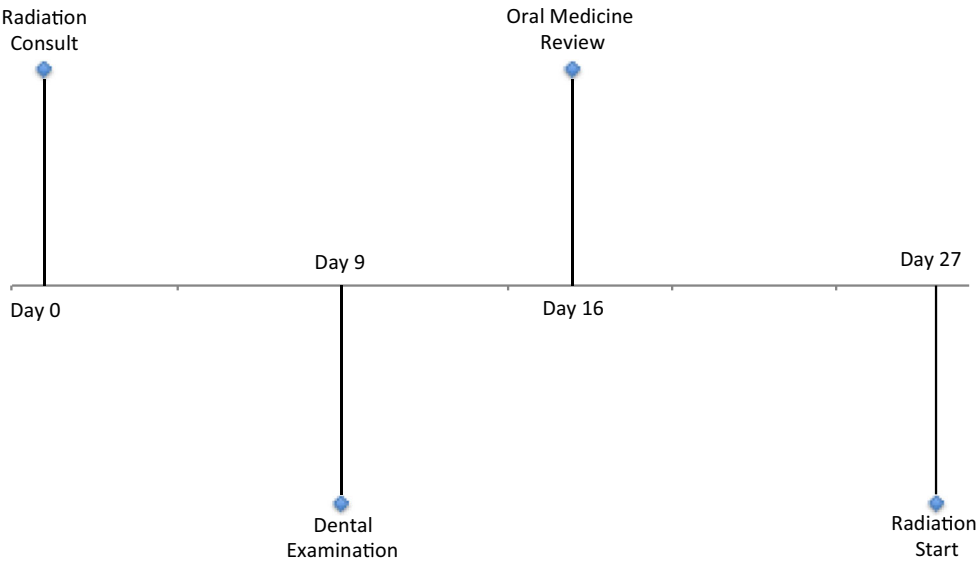

Fig. 1 Radiation timeline in median days

Table 2 Treatment completion

Treatment	
Radiographs	
Proposed	186
Completed	163
Full mouth	86.6% (161/186)
Panoramic	49.0% (91/186)
Other	8.0% (15/186)
Compliance	87.6% (163/186)
Scaling and prophylaxis	
Proposed	182
Completed	172
Compliance	94.5% (172/182)
Restorations	
Proposed	157
Completed	107
Compliance	78.7% (48/61)
Extractions	
Proposed	98
Completed	72
Compliance	76.9% (30/39)
Endodontic therapy	
Proposed	18
Completed	10
Compliance	76.9% (10/13)
Reevaluate*	
Proposed	45
Completed	4
Compliance	21.7% (5/23)
Returning treatment completion	42.5% (31/73)
Compliance	77.4% (144/186)

*Dentists who were asked to reevaluate possible pathology such as caries or periapical radiolucencies

a median of 9 days to see their CB dentist for evaluation leaving a median time of 18 days to have all necessary dental treatment completed. This time would also ideally include healing time for any extractions to reduce the risk of osteoradionecrosis. Not only does going to a CB dentist reduce travel time but also has the added advantage of allowing patients to continue their care with a dental provider with whom they already have an established relationship.

While having the patient see their CB dentist can save time and allow the patient to be more comfortable, many CB dentists may not have experience with treating patients with HN cancer. Working together with the Oral Medicine service provides the CB dentist with the guidance and support to ensure that the patient is receiving appropriate and optimal dental care. For the majority of the reviews, the CB dentist's findings and treatment plans were confirmed, but it was not uncommon to ask the CB dentist to reevaluate some aspect of the patient's case ($n = 45$). The review by an Oral Medicine specialist can be done in a timely manner as the median time for review after the CB dental evaluation was 1 week. While the DIG and written letters were the primary source of communication between the Oral Medicine department and the CB dentists, telephone calls and e-mail were also often utilized either for more in depth discussions or to expedite communication. This program was also more efficient when the CB dentist could send the evaluation paperwork and radiographs electronically. Not all CB dental offices were equipped to do this, which is a potential reason for outliers for the timeline for the Oral Medicine review (Fig. 2). Patients play a central role in this program and can also lead to potential outliers for the timeline. For example, patient barriers include lack of financial resources or dental insurance and time constraints.

In this screening program, it is the role of the radiation oncologist to provide the patients with the DIG and document receipt in the electronic medical record (EMR). According to a

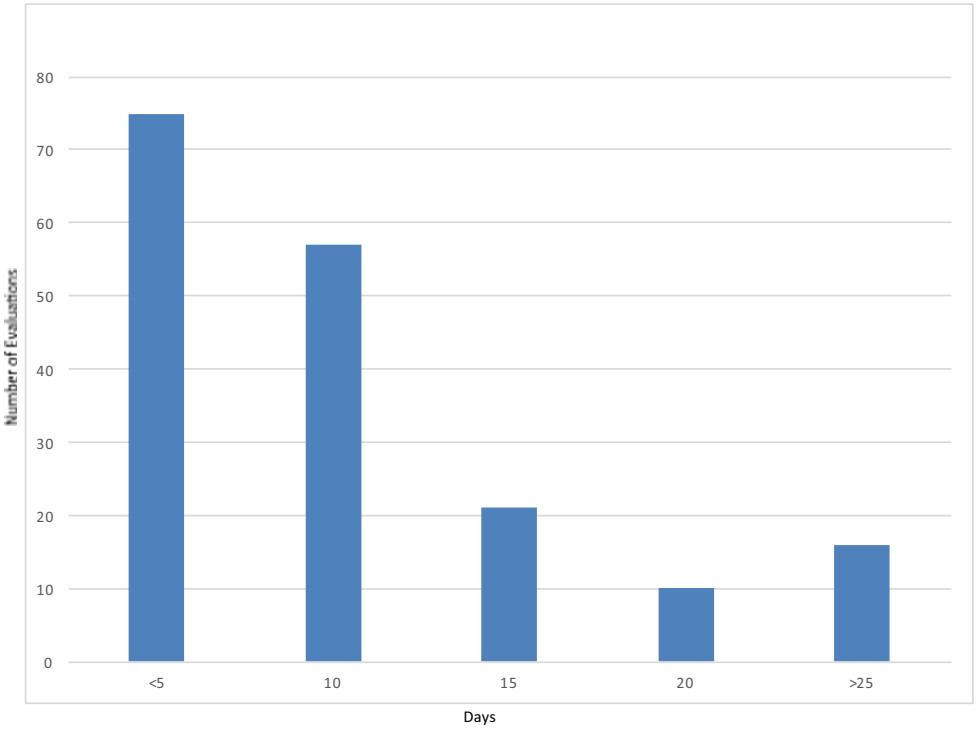

Fig. 2 Time for completion of Oral Medicine review

previous study performed at DFCI, compliance of the radiation oncologist with documenting a patient's receipt of the DIG in their EMR was only 53% [10]. For patients who had documentation of receiving a DIG, 89% of these patient's dental evaluations were received by the Oral Medicine clinic [10]. Due to low compliance of documentation of the DIG, it cannot be confirmed if all HN cancer patients received the DIG prior to RT. Additionally, some patients undergo surgery prior to RT and may have severe trismus or other impairments that make a dental evaluation challenging prior to post-surgical RT. Another limitation of this study was the low compliance of dentists returning the treatment completion form. Dental treatment was not completed at the time of the Oral Medicine review for 39.3% of patients (73/186) and dentists were asked to return a treatment completion form for these patients. Less than half of dentists (42.5%) who were asked to complete this treatment completion form returned it. As such, there is considerable missing data on whether or not recommended treatment was completed, and therefore actual compliance rates may be higher than reported. Additional efforts and/or better mechanisms (e.g., new technologies) to follow-up with CB dentists regarding treatment completion letter and documentation could increase compliance with the program. Patients with no CB dentist or those who were unable to identify one in a timely manner ($n = 14$) were seen in the BWH Division of Oral Medicine and Dentistry for dental evaluation and treatment. Additionally, patients who required urgent initiation of RT may have had limited time resulting in the need to start cancer-directed treatment without completing all recommended components of the dental treatment plan.

In summary, the compliance with the pre-RT dental evaluation protocol for HN cancer by the CB dentists was 77.4%. Our dental evaluation program in collaboration with CB dentists has several advantages. Most patients completed necessary treatments in a timely manner in collaboration with an Oral Medicine specialist, and they had better access to care because they could be treated in their community which is often located at some distance from the hospital. Emphasis on continuing education of community-based dentists on the importance of pre-RT dental evaluation is vital to the success of this protocol. Given the high compliance of CB dentists, this pre-RT dental evaluation program could serve as a model for other head and neck oncology centers.

Compliance with ethical standards

Conflict of interest Dr. Margalit reports personal fees from Galera Therapeutics, outside the submitted work. The corresponding author is in full control of the primary data and gives permission to the journal to review if requested.

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