Awareness of pre-radiation dental assessment of head and neck cancer patients among dentists in Malaysia and New Zealand

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Abstract

Aims: The aim of this study was to investigate the approaches taken for dental assessment of patients with head and neck cancer (HNCa) by hospital dentists in New Zealand and Malaysia, in order to assist with the development of contemporary uniform guidelines for pre-radiation oral health management.

Methods: A review of national guidelines was conducted from United Kingdom, United States, Australia, and New Zealand. A questionnaire-based survey of specialists and hospital dentists working in a hospital setting within New Zealand and Malaysia was undertaken. Information was collected about knowledge of the effects of radiotherapy on the oral environment, current practice regarding the dental management of HNCa patients prior to radiotherapy, guidelines practitioners were currently using and problems that they faced treating HNCa patients.

Results: One hundred questionnaires were distributed; 50 for each country and the response rate was 75%. The respondents were consultants/specialist (34.7%), specialist registrars (8.0%), general dentists/ dental officers (38.7%), house surgeons/ first year dental officers (17.3%) and other (1.3%). The majority of respondents stated that multidisciplinary meetings (MDM) were held at their centre (New Zealand - 51.4%; Malaysia - 52.5%) but the health practitioners attending the MDM varied. Only 48.6% New Zealand and 2.5% Malaysian respondents followed formal guidelines or protocols for dental assessment of HNCa patients. Problems that were highlighted included late referral from the medical team, lack of radiation information and inadequate knowledge among the dentists themselves in managing these patients.

Conclusion: This study highlights the need for developing clinical guidelines to support effective dental treatment and management strategies for this vulnerable population. Effective communication between health professionals and improved training could enhance patient outcomes.
Acknowledgement

IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

My special dedication goes to my lovely parents who always give me words of wisdom and encouragement when I started to doubt myself. The people who saw my potential and made me what I am today. Without them, the journey to New Zealand would only be a dream. Thank you for always remembering to say a prayer for me from afar.

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A special thank you to my supervisors. Professor Alison Rich for guiding me all the way through this research. Your knowledge and insight had helped me a lot. You were always available to lend a helping hand. Not to forget, Associate Professor Jonathan Broadbent, your skills and knowledge about questionnaires and data analysis was mind blowing. Thank you for sharing a fraction of your knowledge with me. This study went smoothly because of these two amazing people.

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Thank you everyone for this wonderful experience.
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## Abbreviations

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<tbody>
<tr>
<td>CPP-ACP</td>
<td>Casein phosphopeptide–amorphous calcium phosphate</td>
</tr>
<tr>
<td>CT</td>
<td>Computerized tomography</td>
</tr>
<tr>
<td>DHB</td>
<td>District Health Board</td>
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<tr>
<td>DPH</td>
<td>Dental Public Health</td>
</tr>
<tr>
<td>FYDO</td>
<td>First year dental officer</td>
</tr>
<tr>
<td>GDP</td>
<td>General Dental Practitioner</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>HNCa</td>
<td>Head and neck cancer</td>
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<td>HNRT</td>
<td>Head and neck radiotherapy treatment</td>
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<td>HPV</td>
<td>Human Papilloma Virus</td>
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<tr>
<td>MDM</td>
<td>Multidisciplinary meeting</td>
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<tr>
<td>IMRT</td>
<td>Intensity Modulated radiation therapy</td>
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<tr>
<td>IOPA</td>
<td>Intra-oral periapical</td>
</tr>
<tr>
<td>ISOO</td>
<td>International Society for Oral Oncology</td>
</tr>
<tr>
<td>MASCC</td>
<td>Multinational Association of Supportive Care in Cancer</td>
</tr>
<tr>
<td>MDM</td>
<td>Multidisciplinary meeting</td>
</tr>
<tr>
<td>MDT</td>
<td>Multidisciplinary team</td>
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<tr>
<td>OHP</td>
<td>Oral hygiene practice</td>
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<tr>
<td>OMF</td>
<td>Oral maxillofacial surgery</td>
</tr>
<tr>
<td>OMFS</td>
<td>Oral maxillofacial surgeon</td>
</tr>
<tr>
<td>OPG</td>
<td>Orthopantomogram</td>
</tr>
<tr>
<td>ORL</td>
<td>Otorhinolaryngology</td>
</tr>
<tr>
<td>ORN</td>
<td>Osteoradionecrosis</td>
</tr>
<tr>
<td>OS</td>
<td>Oral surgery/surgeon</td>
</tr>
<tr>
<td>OSCC</td>
<td>Oral squamous cell carcinoma</td>
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<tr>
<td>PBW</td>
<td>Posterior bitewing</td>
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<tr>
<td>SD</td>
<td>Standard deviation</td>
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<td>SND</td>
<td>Special Needs Dentistry/Dentist</td>
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1. INTRODUCTION

Radiation therapy to the head and neck region can lead to various dental and orofacial complications such as mucositis, xerostomia, radiation-related dental caries, trismus and osteoradionecrosis. Multiple studies have been done with regards to delivery of optimum dosage and dosimetry of radiation. Advances in radiotherapy treatment aim to achieve a balance between therapeutic dosage while sparing as much normal tissue from irradiation as possible, thus reducing radiation-induced complications and allowing a better quality of life (Bhide and Nutting, 2010). It is widely noted that three-dimensional (3D) conformal radiation therapy and intensity-modulated radiotherapy (IMRT) are far superior compared to two-dimensional radiation therapy. Target volume and organs at risk can be demonstrated clearly in 3D while IMRT delivers a higher dose of radiation to the specific target area, sparing adjacent tissues and organs. However, despite advances in radiotherapy, long term irreversible damage to salivary glands, connective tissue, vasculature and bone is still present. Recommendations for dose limits to these organs to minimize the complications has been described by Wang and Eisbruch (2016).

Multidisciplinary team care is widely accepted as best practice for patients with HNCa. It can influence treatment decisions, improve cancer staging and outcomes, ensure consistent follow up and enable inclusion of allied health professionals in managing these patients holistically (Friedland et al., 2011). Dental treatments for patient that will be undergoing radiotherapy for HNCa are planned according to the intended radiotherapy treatment (dosimetry and commencement date), co-morbidities, patient motivation on oral care, overall dental condition and the potential risk of osteoradionecrosis if dental treatments need to be done post-radiotherapy. It is really important to establish good communication between the cancer team and the dental team so information regarding cancer treatment can be aligned in accordance with the dental treatment plan. Through multidisciplinary meetings (MDM), communication between the medical team and the dental team can be improved.
A more proactive approach to reduce radiation-induced oral complications is by having dental assessment prior to radiotherapy treatment. Though it is recommended that HNCa patients have this assessment, there are many reasons why it does not always occur. Lack of medical and dental clinicians’ awareness and limited time before commencement of radiotherapy hinder appropriate dental treatments. The International Society for Oral Oncology (ISOO) and the Multinational Association of Supportive Care in Cancer (MASCC) has stated the necessity of prevention and management of orodental complications of cancer patients. It is noted that untreated oral foci or dental problems that are not fully resolved before starting radiotherapy will increase the need for tooth extraction post-radiotherapy, thus increasing the risk of osteoradionecrosis (ORN) (Schuurhuis et al., 2011). Through prevention and effective early management of oral disease, radiotherapy treatment completion will be facilitated and emergency dental and medical treatment needs will be reduced.

Research has been undertaken to seek the best evaluation tools and protocols for managing the dental needs of patients undergoing radiotherapy to the head and neck. Review of the literature has shown that there was not a specific evaluation tool that had been developed to aid efficient referral between radiation oncologists and dentists (Allard et al., 1993). Frequently, management is merely based on the clinician’s experience and opinions rather than evidence-based research (Jansma et al., 1992; Ben-David et al., 2007). Variations in clinical guidelines for managing dental issues before radiotherapy among treatment centres have been addressed (Patel et al., 2012; Barker et al., 2005). It is prudent to identify the foci of oral disease in these patients, develop a systematic dental assessment and evidence-based protocols for dental management (Schuurhuis et al., 2015).

Despite the advances in radiotherapy, pre-radiation dental assessment and multidisciplinary management of HNCa patients, the dental team is still facing a multitude of challenges. These challenges include the high number of patients lost to follow-up dental care, lack of an effective treatment for xerostomia, poor patient compliance and a lack of standardised guidelines. There is also a significant gap in the provision of oral and dental care such as the lack of guidelines or knowledge of
available guidelines and also the absence of integrated dental and medical services (Barker et al., 2005).

HNCa patients usually were not provided with specialist dental care. Some of them sought treatment with their general dentists prior to radiotherapy while others did not receive any dental care at all (Epstein et al., 2007). Research has shown that good oral health is linked to better quality of life (Nuttall et al., 2001; Saub and Locker, 2006; Yiengprugsawan et al., 2011; Sönmez and Top, 2016; Masood et al., 2017), thus inclusion of the dental team in the management of HNCa patient before, during and after radiotherapy is crucial. Recent publications have attempted to define the role of a general dentist within the multidisciplinary team and to standardise oral care, in particular to highlight the importance of long-term regular support within the community and facilitate specialised care where necessary (Brody et al., 2013). Further investigation is required to evaluate the variety of guidelines that have been used and the dental management during pre-radiation dental assessment. Furthermore, by identifying the barriers that are faced by dentists in providing dental treatment for HNCa patients that will be undergoing radiotherapy, it is hoped that delivery of dental care can be enhanced.

For this research, Malaysia and New Zealand were chosen for a comparison study because of the variation in incidence and aetiological factors for HNCa. No comparison study has been done previously with regards to this topic. A comparison study may be useful in determining factors contributing to the provision of dental care and for considering the multiple factors needed to deliver the best dental treatment and management such as local protocols, differences in healthcare system and also variances of treatment modalities. The choice of Malaysia and New Zealand was also to simplify the survey process since we have contacts in both countries.
2. LITERATURE REVIEW

2.1 Head and neck cancer

Head and neck cancer is a broad group of lesions and includes all malignancies of the nasopharynx, nose and paranasal sinuses, larynx, oropharynx, hypopharynx, thyroid and salivary glands as well as the oral cavity and lips (Malaysian Society of Otorhinolaryngologists and Head & Neck Surgeons, 2012; National Head and Neck Cancer Tumour Standards Working Group, 2013; Cancer Society of New Zealand, 2015). The recent World Health Organization classification of head and neck tumours grouped the lesions according to their location and with further sub-classification into the types of tumours (El-Naggar et al., 2017). Head and neck tumours are classified into:

- Tumours of nasal cavity, paranasal sinus and base of skull
- Tumours of the hypopharynx, larynx, trachea and parapharyngeal space
- Tumours of the oral cavity and mobile tongue
- Tumours of the oropharynx (base of tongue, tonsils, adenoids)
- Tumours and tumour-like lesions of the neck and lymph nodes
- Tumours of the salivary glands
- Odontogenic and maxillofacial bone tumours
- Tumours of the ear
- Paraganglion tumours

Worldwide, HNCa is the sixth most common type of cancer following lung, breast, colorectal, stomach and liver cancer and it is more common in developing countries (Warnakulasuriya, 2009; Ferlay et al., 2015). The male to female ratio ranges from 2:1 to 4:1. About 90% of all head and neck cancers are squamous cell carcinomas (World Health Organisation, 2014). The risk of HNCa increases with age. Most of the HNCa cases occur in patients over 50 years old (Vigneswaran and Williams, 2014). However, globally, experts noted that there has been an increase in HNCa cases among younger
adults (less than 45 years old) over the past 30 years and the tongue was the most common site for oral cancer (Majchrzak et al., 2014; Hussein et al., 2017). Differences in tobacco use, alcohol use, exposure to sunlight and habits such as the use of betel quid and sexual practices between countries contributed to a variation of HNCa trends worldwide (Simard et al., 2014).

In Malaysia, head and neck cancer represents 11.6% of all cancers. This statistic is lower for New Zealand where only 3.5% of all cancers are HNCa (Ferlay et al., 2013). These statistics captured cancer of lip and oral cavity, nasopharynx, other pharyngeal, larynx and thyroid. The most common location for HNCa differs between Malaysia and New Zealand; nasopharynx (Malaysia) and lip and oral cavity (New Zealand). In Malaysia the incidence of cancer of the nasopharynx was the highest among the Chinese compared to other ethnicities between 2007 up to 2011 (National Cancer Institute, 2015). As for New Zealand, oral squamous cell carcinoma (OSCC) mainly affected New Zealand Europeans (Gavidi et al., 2014). However, HNCa incidence as a group was significantly higher in indigenous (Maori) men in New Zealand compared to their non-indigenous counterparts (Moore et al., 2015). The prognosis and survival of patients with HNCa is dependent on disease stage at presentation and the quality of care provided to each patient (Wong et al., 2015).

The primary causes of HNCa are tobacco, alcohol use and Human Papilloma virus (HPV). The carcinogenic effect of tobacco is related to the smoking rate in packs per day and duration of smoking in years (“pack-years”) (Thompson, 2014). Tobacco use includes cigarette smoking, cigar and pipe smoking, reverse smoking and smokeless tobacco (chewing tobacco, moist or dry snuff). Cigar and pipe smoking increases the risk of lip cancer while hard palate cancer is related to reverse smoking (Vigneswaran and Williams, 2014). Smokeless tobacco causes high cancer prevalence involving the mandibular buccal sulcus and gingiva (Rodu and Jansson, 2004). The combination of alcohol consumption and tobacco use increases the risk of HNCa because of its synergistic effect (Hashibe et al., 2007; Dal Maso et al., 2016). This is related to the conversion of ethanol into acetaldehyde, which is toxic and a known carcinogen (Xue et al., 2012). Alcohol will aid harmful tobacco chemicals into cells of the body and also
prevent repair of the damaged DNA caused by tobacco (National Cancer Institute, 2013).

Human Papilloma Virus infection has been linked to cancers of the oropharynx, tonsil and base of tongue in younger adults (Rettig and D’Souza, 2015). A systematic review and meta-analysis on the global prevalence and distribution of HPV in HNCa (HPV-HNCa) showed that it was more prevalent in the oropharynx (45.8%) than larynx/hypopharynx (22.1%) and oral cavity (24.2%). 82.2% of all HPV-HNCa was caused by HPV16 (Ndiaye et al., 2014). Oral sexual behaviours are believed to be the primary mode of transmission of HPV to head and neck region (Rettig and D’Souza, 2015). HPV-positive tumours have better responsiveness to radiation, chemotherapy, or both, and might be more susceptible to immune surveillance of tumour-specific antigens compared to HPV-negative tumours (Licitra et al., 2006).

Other risk factors for HNCa are areca nut chewing, sun exposure, immune suppression secondary to solid organ transplant and Epstein-Barr virus for nasopharyngeal cancer. Lip cancers are associated with chronic sun exposure and ultraviolet light radiation (Warnakulasuriya, 2009). Many studies have reported a link between nasopharyngeal cancer with increased risks associated with certain foods such as salted fish, certain preserved foods and hot spices, all of which are high in carcinogenic nitroso compounds and volatile nitrosamines (Parkin et al, 2011).

2.2 Treatments for head and neck cancer

Early detection of HNCa and advances in its management has led to somewhat better prognosis, but the associated morbidity and mortality remains high. The mortality rate was 6.6% for Malaysia and 2.3% for New Zealand (Ferlay et al., 2013). HNCa is classified according to the TNM staging system where T (tumour) describes the primary tumour size and invasion of nearby tissues, N (Lymph nodes) lymph node involvement while M is related to metastases to other sites. TNM provides a consistent
method of describing a tumour and linking this to its behaviour and malignancy. TNM is also useful for estimation of cancer prognosis and to determine the treatment modality (van der Schroeff and Baatenburg de Jong, 2009). Multiple factors contribute to the selection of treatment modalities such as differences in the availability and quality of oncology surgery, radiotherapy and medical oncology services, patient’s comorbidities as well as socioeconomic factors.

HNCa treatments vary depending on the type of tumour, its location and TNM staging. Treatment planning is tailored specifically for each patient. Treatments can be radiotherapy, surgery, chemotherapy or a combination of these. Chemotherapy agents have evolved from drugs that caused systemic toxicity to specific molecular-targeted agents which can selectively kill cancer cells (Rao et al., 2012). Systemic therapy acts by non-specifically inhibiting cell replication. The drugs include cisplatin (induces DNA damage), fluorouracil (interferes with DNA replication) and taxanes (disrupts mitosis). Cetuximab, a monoclonal antibody which is an epidermal growth factor receptor (EGFR) inhibitor, is the only approved molecular-targeted therapy for use in HNCa. Research for others targeted agents mainly focused on the EGFR pathway (Rao et al., 2012).

In terms of radiotherapy treatment, options include external beam radiation, internal radiation (brachytherapy), intensity modulated radiation therapy (IMRT) and tomotherapy. IMRT is a technique of high-precision radiation therapy that uses computer-controlled linear accelerators (known as linacs) to deliver precise radiation doses that specifically target the tumour. IMRT allows for the radiation dose to shape precisely to the tumour by ‘modulating’ (varying) the intensity of the radiation beam. As a result, high radiation doses can be focused into the tumour while avoiding the surrounding normal body tissues as much as possible (The Royal Australian and New Zealand College of Radiologists, 2015). Various studies have concluded that IMRT seems to cause substantially less damage to normal tissue while providing equally good or improved tumour control rates (Lee et. al 2002; Puri et. al 2005; Studer et. al 2011).
Currently, external beam radiotherapy is the principal method of radiotherapy for head and neck cancer in Malaysia and brachytherapy is also available in a small number of centres. Besides external beam radiotherapy, IMRT is also available in many hospitals in Malaysia. However, there may still be linear accelerators which are not capable of carrying out IMRT (Malaysian Oncological Society, 2015). In New Zealand, three-dimensional conformal radiotherapy is the minimum requirement for radical radiotherapy plans. IMRT is the principal method for HNCa treatment in New Zealand. If a centre does not have an IMRT program, the patients will be referred to another centre for IMRT treatment (National Head and Neck Cancer Tumour Standards Working Group, 2013).

2.3 Multidisciplinary team in management of head and neck cancer patients

Multidisciplinary care is important in providing the best-practice treatment and care for patients with HNCa (Kelly et al., 2013). Effective multidisciplinary treatment planning meetings will improve continuity of care, coordination of services, communication between care providers, allow more efficient use of time and resources and ultimately improve patient outcomes. This multidisciplinary care is provided by various clinicians. Some of the examples of the health professionals/services that are involved or may have access to attend MDM are as listed (Table 1). It may not portray the practice of all centres in that particular country. Documented information for Malaysia was unavailable. The members of MDM constitute both core members who will attend all meetings and associate team members who may attend upon referral for specific cases. Generally, core members of MDM should comprise of radiation oncologist, otolaryngologist/head and neck surgeon, plastic and reconstructive surgeon, maxillofacial surgeon, radiologist, pathologist, dentist, dietician, clinical specialist nurse and head and neck cancer coordinator.
<table>
<thead>
<tr>
<th>Country and author</th>
<th>Health practitioners involved</th>
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<tbody>
<tr>
<td>United Kingdom (National Institute for Clinical Excellence, 2004)</td>
<td>Surgeons (Otorhinolaryngology (ORL), maxillofacial, or plastic surgeons), clinical oncologists, restorative dentists, pathologists, radiologists, clinical nurse specialists, speech and language therapist, senior nursing staff from the head and neck ward, palliative care specialists (doctor or nurse), dietitians, team secretary, data manager, multidisciplinary team (MDT) co-ordinator, and other extended team members</td>
</tr>
<tr>
<td>United States (National Comprehensive Cancer Network, 2016)</td>
<td>Head and neck surgery, radiation oncology, medical oncology, plastic and reconstructive surgery, specialized nursing care, dentistry/prosthodontics, physical medicine and rehabilitation, speech and swallowing therapy, clinical social worker, clinical nutrition, pathology, diagnostic radiology, adjunctive services (neurosurgery, ophthalmology, psychiatry, audiology, palliative care) and other support services</td>
</tr>
<tr>
<td>Australia (National Cancer Expert Reference Group, 2016)</td>
<td>Care coordinator (as determined by multidisciplinary team members), clinical trials coordinator, dietitian, general practitioner, head and neck surgeon, medical oncologist, nuclear medicine physician, nurse (with appropriate expertise), occupational therapist, oral and maxillofacial surgeon, palliative care specialist, pathologist, pharmacist, physiotherapist, plastic and reconstructive surgeon, psychiatrist, psycho-oncology, radiation oncologist,</td>
</tr>
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</table>
radiation therapist, radiologist/imaging specialists, social worker, special needs dentist, speech pathologist

New Zealand (National Head and Neck Cancer Tumour Standards Working Group. 2013) Otolaryngologist/head and neck surgeon, plastic and reconstructive surgeon, maxillofacial surgeon, maxillofacial prosthodontist, oral health consultant, radiation oncologist, medical oncologist, clinical nurse specialist, head and neck cancer coordinator, speech-language therapist, dietitian, pain specialist, psychologist, palliative care specialist, radiologist with expertise in head and neck oncology, pathologist with expertise in head and neck oncology, gastrostomy services, neurosurgeon, adolescent and young adult key worker.

Dental management should be considered as part of overall cancer management especially if patients are at risk of developing oral complications such as mucositis, dry mouth and radiation-related dental caries from cancer treatment. Multidisciplinary meeting (MDM) is the best platform to address these issues. The outcome of dental management is enhanced when there is an understanding of the inter-relationship between the oral and medical conditions, good interdisciplinary communication through integrated record keeping and optimal service provision facilitated by the utilization of evidence-based guidelines (Barker et al., 2005). Also, with good communication between the multidisciplinary management team, rapid delivery of dental care such as extractions may be able to be achieved if enough notice is given, appropriate resources are available and the hospital management has adequate prioritisation for this activity. Information such as the names of the surgeon and oncologists, diagnosis of cancer, TNM staging, cancer prognosis, date of commencement for radiotherapy treatment, types of treatment such as chemo-radiotherapy and radiotherapy (IMRT, external beam) and dosimetry of the radiotherapy treatment (total cumulative dose, fractions and field of direct radiotherapy) are needed from the MDM team to help with the dental treatment planning for these patients (Ray-Chaudhuri et al., 2013). This information will
determine the types of dental treatment that are suitable for the patient such as extraction versus conservative management (restoration or periodontal treatment), the risk of osteoradionecrosis in relation to extractions if the radiotherapy treatment begins in less than 14 days, prognosis of retained teeth and retention of removable prosthesis due to dry mouth in relation with high radiation doses.

Kelly et. al (2013) compared care patterns before and after the introduction of MDT model for management of head and neck cancer patients. Pre-treatment dental assessment was one of the clinical quality indicators for evaluating the process of patient treatment. Other clinical quality indicators were pre-treatment nutritional assessments, Positron Emission Tomography (PET) staging where indicated, chemo-radiation treatment referrals for stage III and IV disease, as well as for post-operative positive margins or extra capsular spread and the time interval from surgery to the start of radiation treatment. They noted that patients in the post-MDT group had higher rates of dental assessment and improvement in other areas such as nutritional assessment, PET staging and chemo-radiation referrals and shorter time from surgery to radiotherapy treatment. Overall, delays between diagnosis and multimodality treatment could be kept to a minimum, suggestive of enhanced efficiency which is mainly contributed by effective communication within the MDT.

2.4 Side effects of radiotherapy on oral environment

Advances in radiotherapy treatment have seen improvement in tumour control and survival rates. The incidence and severity of radiotherapy-related side effects compared to previous radiotherapy modalities has reduced but, currently, there is not one mode of radiotherapy that manages to successfully eliminate all the side effects. Radiotherapy for HNCa can induce devastating side effects both immediate and in the longer term. Post-radiation oral and dental sequelae are significant, well-known and can result in needless morbidity (Beumer et. al, 1983). Radiotherapy-related side effects include mucositis, candidiasis, alteration of taste, hyposalivation, radiation-
related caries, increased risk of periodontal disease, trismus and osteoradionecrosis (ORN) (Vissink et al., 2003; Sciubba and Goldenberg, 2006; Jawad et al., 2015). Damage to the oral mucosa is strongly related to radiation dose, fraction size, volume of irradiated tissue, fractionation scheme and type of ionizing irradiation (Scully and Epstein, 1996). Management of these complications is problematic and they can add an additional burden to patients who are already battling cancer. Pre-existing oral and dental disease and poor oral care during and after cancer treatment are considered important risk factors for side effects of radiotherapy to the oral region. These patients will always remain as a high risk group for caries, oral infection and functional impairment following radiotherapy (Brody et. al, 2013).

Oral mucositis, which is inflammation of the oral mucosa, is the most common complication and affects around 80% of head and neck radiotherapy treatment (HNRT) patients (Brown and Yoder, 2002). Its clinical presentations range from mild up to severe such as pain, ulceration, bleeding, infections and difficulty in feeding. Mucositis can also become so severe that eating and drinking is not possible, such that the patient requires parenteral nutrition and may have to temporarily stop cancer treatment to allow recovery. Cancer therapy leads to damaged mucosa and reduced immunity which can have effect on the patient’s quality of life and make them more susceptible towards candida infection or septicaemia. Mucositis may occur during the second or third week of radiation therapy. It will gradually subside within two or three weeks of completing treatment (Lalla et al., 2014).

Saliva is important for daily functions such as speaking, eating, swallowing, taste, denture retention and prevention of oral diseases (caries, periodontal diseases and candidiasis). Impaired salivary output will affect these functions, which can lead to malnutrition, weight loss and reduced quality of life. Involvement of salivary glands in radiotherapy treatment causes xerostomia (subjective feeling of dry mouth) and/or hyposalivation (low salivary flow rate). The normal unstimulated salivary flow rate is 0.3-0.5 ml/minute. The consistency of saliva may change such as thin secretions with neutral pH or it may become more viscous with altered salivary pH, electrolyte and immunoglobulin content. Plaque also became more sticky and difficult to remove. The
parotid glands produce 60-70% of stimulated saliva while submandibular, sublingual and numerous minor salivary glands primarily produce unstimulated saliva (Dawes and Wood, 1973). Secretions from the parotid glands are serous while other salivary glands produce mucous secretions. Sparing at least one parotid gland so that it receives a mean dose of less than 20 Gy or ensuring that both glands receive a mean dose of less than 25 Gy tends to avoid severe xerostomia. Confining the submandibular glands to a mean dose of <35 Gy also reduces xerostomia symptoms (Deasy et al., 2010). Hyposalivation and trimus usually improve months after radiotherapy finishes, but may not return to normal. Salivary gland function will steadily recover from 6 months up to 2 years after HNRT, provided that the damage is not too severe (Eisbruch et al., 2001; Blanco et al., 2005).

Radiation-related caries can develop within three months of the completion of radiation. The effect of irradiation on teeth can be direct or indirect. Hypotheses regarding the cause of radiation-related caries include a combination of direct radiation damage to the dentition, reduction in the quantity and quality of saliva, changes in taste perception leading to consumption of highly flavoured, possibly sweetened foods, changes in nutritional status requiring consumption of highly calorific foods and changes to the oral microbiota (Jawad et al., 2015). It was postulated that radiotherapy causes disruption of pulpal collagen and degeneration of odontoblast processes which leads to fragility at the amelodentinal junction (Jawad et al., 2015). Rapid decalcification is related to the imbalance of organic and inorganic components of the teeth, in conjunction with intense acid attack. Radiation-related caries usually presents as decay around the tooth neck which can lead to complete amputation of the crown of the tooth.

The risk of ORN is related to the dosage and location of radiation; high (more than 60 Gy), moderate (between 40 to 60 Gy) and low (below 40Gy) (Gourmet and Chaux-Bodard, 2002). The mandible is at more risk of developing ORN than the maxilla and the posterior segment is more at risk compared to the anterior segment possibly because the mandible and posterior region has lower blood supply compared to the maxilla and the anterior segment (Thariat et al., 2010). A study done by Thariat and
colleagues (2012) suggested the use of Dentalmaps as a guide to dental care of IMRT patients. It is an automatic atlas-based segmentation framework of the dental structures based on Computed Tomography (CT) images. It provides a reliable dental dosimetry for the maxilla, mandible and for each individual tooth. This information can be used to assess the risk of ORN more accurately if extraction is indicated. Dentalmaps represents a useful documentation and communication tool between radiation oncologists and dentists. A simple approach is to incorporate the risk-adapted dental care (RaDC) which is a form used for marking individual risk areas for dental treatment on the mandible and maxilla (Studer et al., 2011). It requires the radiation oncologists to topographically define ORN risk areas prior to dental treatment. The areas will be marked as low, intermediate or high risk. It will help with dental treatment planning so comprehensive treatments in high-risk areas can be undertaken in comparison to a less invasive approach in the regions that will receive lower doses of radiation.

Surgery and radiotherapy can cause trismus because both may affect temporomandibular joints and the muscles of mastication particularly the masseter and pterygoid muscles. Trismus can cause persisting problems with pain, chewing and eating. A recent systematic review revealed that the prevalence of trismus was 25.4% for conventional radiotherapy and 5% for IMRT (Bensadoun et al., 2010).

### 2.5 Pre-radiation dental assessment

It is widely noted that older adults are now are retaining more teeth compared to many previous generations (Burt and Eklund, 1999; Ministry of Health New Zealand, 2010; Thomson, 2012). It is more apparent in developed countries compared to developing countries where the rate of edentulism is still increasing because painful teeth are often extracted, rather than treated conservatively (Petersen and Yamamoto, 2005). The rate of edentulism also tends to vary among different regions or within a country (Wu et al., 2013; Hewlett et al., 2015; Olofsson et al., 2017).
Edentulism is closely associated with socioeconomic psychological and health-related factors. It is more prevalent in poor populations and in women. Other contributing factors include age, education background, access to dental care, dentist/population ratios, and insurance coverage (Islas-Granillo et al., 2011).

This leads to the connotation that more teeth equal more problems for these people. It is one of the reasons that led to recognition of the importance of pre-radiation dental assessment in an attempt to reduce oral complications post-radiotherapy.

Between 68% to 97% of patients examined prior to radiotherapy needed immediate dental care (Lockhart and Clark, 1994). A study on the oral health status of 207 HNCa cancer patients before, during and after radiotherapy in Brazil showed that 58% required dental treatment on first assessment and around 50% of the patients needed at least one extraction before radiotherapy (Jham et al., 2008). A cross-sectional study on oral health status of HNCa patients treated at an Austrian tertiary hospital noted that around 90% out of 48 patients had large treatment needs due to caries and periodontal disease (Bertl et al., 2016). Around 50% of these patients mentioned that that they did not consult a dentist after cancer diagnosis. Dental management of HNCa patients is often complicated because they are more likely to have a high burden of dental disease, poor compliance with recommended treatment and low socioeconomic status (Lockhart and Clark, 1994).

In centres with well organised multidisciplinary care, patients that are about to undergo radiotherapy are likely to be referred to a dentist, usually hospital-based, for assessment of their dental condition prior to treatment. Pre-radiation dental assessment aims to identify and manage oral foci such as carious teeth, periodontal diseases, impacted teeth and radiographic abnormalities, in an attempt to reduce or prevent oral complications related to radiotherapy treatment (Figure 1 and Table 2) (Schuurhuis et al., 2015; Buglione, Cavagnini, Di Rosario, Maddalo, et al., 2016). Other management include preventive treatment and fabrication of radiation stent to minimize mucositis by reducing back scatter of metal dental restorations (Ben-David et al., 2007; Studer et al., 2011).
Figure 1 Significant oral foci that should be effectively eliminated or treated before onset of radiotherapy (Schuurhuis et al., 2015)

Active periodontal disease: Pockets ≥ 6mm, furcation grade 1, mobility > grade 1, gingival recession 6mm, combination of these periodontal problem

Non-restorable teeth with large restorations, extend to gum line, root caries, severe erosion/abrasion

(Partially) impacted or partially erupted teeth not fully covered by bone or showing radiolucency; cysts and other radiographic abnormalities

Periapical granuloma and avital teeth

Deep caries in which excavation may lead to pulpal exposure
Table 2: Types of dental treatment provided prior to head and neck radiotherapy treatment (Buglione et al., 2016)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restorative dental procedure</td>
<td>• Loose contact points should be repaired to prevent food and plaque impaction, thus reducing the chance of periodontal disease and dental caries</td>
</tr>
<tr>
<td></td>
<td>• Sharp dental cusps or anything that might cause intra-oral trauma should be removed (to minimize mucosal injury during radiotherapy)</td>
</tr>
<tr>
<td></td>
<td>• Resin-modified GIC, composite resin, and amalgam restorations perform better than conventional GIC</td>
</tr>
<tr>
<td>Extraction to minimize ORN risk</td>
<td>a) Dental risk factors:</td>
</tr>
<tr>
<td></td>
<td>• Primary and secondary deep caries (non-reparable)</td>
</tr>
<tr>
<td></td>
<td>• Root caries &gt; 1/2 of root circumference</td>
</tr>
<tr>
<td></td>
<td>• Pulpal disease and periapical disease (avital pulps and no previous root canal treatment)</td>
</tr>
<tr>
<td></td>
<td>• Periapical osteitis &gt; 3 mm</td>
</tr>
<tr>
<td></td>
<td>• Internal/external root resorption</td>
</tr>
<tr>
<td></td>
<td>• Periodontal disease (probing depth &gt; 6 mm, gingival recession &gt; 6 mm, spontaneous gingival bleeding, furcation involvement, mobility &gt; 2 mm)</td>
</tr>
<tr>
<td></td>
<td>• Non-functional teeth (partially impacted teeth, residual root tips, fully impacted teeth with pericoronal radiolucencies)</td>
</tr>
<tr>
<td></td>
<td>• Poor oral hygiene</td>
</tr>
<tr>
<td></td>
<td>• Low dental awareness.</td>
</tr>
<tr>
<td></td>
<td>• Lack of cooperation</td>
</tr>
<tr>
<td></td>
<td>b) Malignancy/ treatment-related risk factors:</td>
</tr>
<tr>
<td></td>
<td>• Radiation dose &gt; 55 Gy</td>
</tr>
<tr>
<td></td>
<td>• Radiation field includes mandible and molar teeth</td>
</tr>
<tr>
<td></td>
<td>• Teeth in close proximity to tumour</td>
</tr>
<tr>
<td></td>
<td>• Time to radiotherapy &lt; 14 days</td>
</tr>
<tr>
<td></td>
<td>• Tumour site</td>
</tr>
</tbody>
</table>
Thorough history taking such as documentation of current complaints, medical co-morbidities, dental and social history, in conjunction with extra-oral and intra-oral baseline examination and radiographic assessment is crucial. It is recommended to take at least a panoramic radiograph. Additional radiographs such as bitewings and periapical radiographs are only done when indicated (Schuurhuis et al., 2015). Dental management during these assessments includes preventative measures, discussion about complications of radiotherapy affecting oral tissues and extraction of problematic teeth to allow healing prior to radiotherapy. Scaling and restorations can be done if time and circumstances permit or they can be postponed until radiotherapy treatment is finished. Preventative measures include smoking cessation advice, diet and sugar control, effective oral hygiene care and fluoride therapy such as high fluoride toothpaste and fluoride trays. Radiation stents are custom-made devices that displace or shield tissues. The stents are usually fabricated by the dental team. They do not prevent radiotherapy-related oral complications but they can reduce the incidence and severity of mucositis and xerostomia. Other types of aids that are used for the protection of healthy tissues include intra-oral shields used in the treatment of lip cancers and positioning masks for patient immobilisation during radiotherapy delivery (Figure 2) (Brody et al., 2013; Matsuzaki et al., 2017).

Sometimes, pre-radiation dental assessment can be a difficult dental appointment for both patient and dentist. It is understandable that since the patient has just recently been given the news of the cancer diagnosis they might not engage during dental consultations. A patient who does not have any dental problems, may not want or see the need for dental treatment in light of their cancer diagnosis. Cost of the dental care might also be an issue. Patients should be advised about the reason they have to be seen by a dentist before their radiotherapy as it might seem unrelated to their main diagnosis. Making sure that patients understand the importance of dental care is an integral part of the pre-radiation work-up and it is useful if they accept that frequent recalls are likely to help with their oral health. Advice regarding continuation of follow-up treatment post-radiotherapy is also important. Post-radiotherapy follow-up allows management of dry mouth, reinforcement of preventive programs and early intervention to detect and treat caries. Thus, it is recommended to deliver clear,
concise information, directed partly at any carer and reinforced with written information and a summary letter (Ray-Chaudhuri et al., 2013). Patients can also be directed to online resources and support groups.
**Figure 2** Dental management of head and neck cancer patients receiving radiotherapy treatment (Adapted from Walker et al., 2011; Brody et al., 2013)

**Factors to consider:**
- Past medical history
- Past dental history
- Socioeconomic factors
- Care and support
- Access to care

**Dental management of head and neck cancer patient**

**Pre-radiotherapy**
- Oral-dental exam
- Education: Importance of good OH and regular dental recalls, side effects of radiotherapy, jaw exercises
- Professional cleaning
- Oral hygiene instructions
- Custom trays made for topical fluoride treatments
- Fabrication of radiation stents
- Extractions
- Minimal to moderate dental decay: appropriate restoration
- Existing restoration with minimal to moderate secondary dental decay: appropriate replacement restoration

**During radiotherapy**
- Management of mucositis
- Reinforce OH and jaw exercises
- Frequent dental recalls
- Management of dry mouth and radiation caries
- Reinforce OH
- Extractions: Avoid if possible, atraumatic extractions
- Monitor suspicious oral lesions

**Post radiotherapy**
2.6 Barriers to providing dental care

Previous research has shown that there are multiple barriers faced by clinicians in order to provide dental care before the commencement of radiotherapy. Dental care providers noted there was often little time between initial dental consultation and the start of radiation, potentially leading to sub-optimal pre-radiotherapy dental treatment (Patel et al., 2012). Late referrals happened because oral care management may have been overlooked by the oncology or medical team. This highlights the need to educate the radiation oncologists regarding the importance of dental assessment for these patients to benefit and improve patient’s pathway of care and the importance of dental involvement in multidisciplinary planning groups. Apart from that, there is the possibility of diagnosis in very advanced stages, when radiotherapy has to be commenced rather urgently, thus affecting timely referrals to the dentists.

A further barrier to providing dental care is illustrated by multiple studies that have noted the lack of knowledge among dental students and dentists to assess, identify and manage dental problems related to cancer therapy for head and neck cancer (Güneri et al., 2008; Alpöz et al., 2013).

There is also a lack of internationally accepted protocols on managing the dental needs of HNCa patients undergoing radiotherapy. This leads to a variety of treatment decisions which may complicates the improvement of knowledge in relation to the prevention/management of orodental complications of cancer patients (Barker et al., 2005).

2.7 Knowledge and practice of dentists and radiation oncologists

Head and neck cancer patients that will be undergoing radiotherapy need a dental treatment plan formulated by their dentist and/or dental specialist, who have taken into consideration the advice and information given by the radiation oncologist and
other medical specialists. It will facilitate optimal oral health, minimise potential complications and coordinate dental and medical care. Management complexity varies on a case by case basis. Dental care may have to be provided by the patient’s dentist who may be practising remote from the main centre, with advice from the main oncology specialist team (Joshi, 2010).

Several studies have investigated knowledge of HNCa therapy complications and management among dental students, dentists and even radiation oncologists (Güneri et al., 2008; Patel et al., 2012; Alpöz et al., 2013). They noted that the respondents had basic knowledge of the complications of cancer therapy, but failed to answer questions about required clinical practices. A study by Patel et. al (2012) indicated that there was a need for continuing education for dentists and radiation oncologists on clinical guidelines for effective oral and dental management of patients receiving radiotherapy to the head and neck region. 55% of dental respondents reported that they considered they were not adequately trained at dental school to treat patients who will or have had head and neck radiotherapy. 25% of radiation oncologists reported inadequate preparation to treat patients with oral health complications due to HNRT.

Continuing education alone may not be sufficient to enable dentists to be confident and clinically competent to treat post-radiotherapy patients in clinical practice. Multiple literature reviews have recommended re-evaluation of current undergraduate curricula and organization of postgraduate courses to incorporate the dental management of oncology patients pre-, peri- and post-radiotherapy (Güneri et al., 2008; Alpöz et al., 2013). Continuous education for dentists and radiation oncologists regarding the dental management of these patients is also beneficial (Patel et. al 2012; Alpoz et. al 2013).

2.8 Protocols and guidelines

Pre-radiation dental decisions are often very challenging (Bruins et. al, 1999), but
careful dental review and treatment helps the patient during their radiotherapy course and particularly has an impact post-radiotherapy. The decision to either extract or restore a tooth with a questionable prognosis is often challenging considering there are no clear guidelines. It will depend on the status of the tooth and the rest of the dentition, patient factors and choices, radiotherapy dosimetry and the clinicians’ own expertise and preference regarding mode of treatment (The Royal College of Surgeons of England / The British Society for Disability and Oral Health, 2012; Dewan et al., 2014).

Worldwide, there are multiple national and local hospital guidelines available with general recommendations for the management of the oral health of HNCa patients but there is inconsistency of the recommendations when these guidelines were compared. These guidelines and recommendations include those by Jansma (1992), Shaw (2000) and Grotz (2003), but such policies are based on experience and opinions rather than evidence-based clinical guidelines. It is recommended that a consensus statement about the medical necessity of oral and dental care, before, during, and after cancer therapy should be developed and guidelines established (Epstein et al., 2004).

The Royal College of Surgeons of England / The British Society for Disability and Oral Health have developed a national guideline specific for the management of oral conditions in oncology patients requiring radiotherapy, chemotherapy and/or bone marrow transplantation (Table 3). It is quite comprehensive and detailed with inclusion of an oral health care screening chart and a patient information leaflet. They noted that there is no universally accepted pre-cancer therapy dental protocol because of the lack of clinical trials evaluating the efficacy of a specific protocol. The guideline from the National Comprehensive Cancer Network (USA) is user friendly and also detailed the needed dental care before, during and after cancer treatment. Detailed definition of teeth that need to be extracted was not provided in either guideline. Other national guidelines mentioned in Table 3 are management of head and neck cancer (Australia and New Zealand) and nasopharyngeal cancer (Malaysia). Worldwide, dental recommendations were general and only comprised a small fraction of the guidelines. In Malaysia, dental care was minimally mentioned in the Clinical Practice Guideline for
management of nasopharyngeal carcinoma. The guidelines noted that it is essential that nasopharyngeal patients received dental assessment prior to radiotherapy to minimise post-treatment oral complications, but there was no retrievable evidence on specific dental management (Malaysia Health Technology Assessment Section, 2016). In New Zealand, Standards of Service Provision for Head and Neck Cancer Patients also mentioned that patients receiving cancer treatment that involves or affects the oral cavity should be seen by an oral health consultant prior to treatment. There were only general recommendations, such as the need for appropriate chair, lighting and equipment for assessment and advice that extractions should be completed more than 14 days prior to commencement of radiotherapy. In fact, comprehensive dental management includes taking radiographs, eliminating potential oral infection, optimising oral hygiene and formulating an initial plan for future oral and maxillofacial rehabilitation (National Head and Neck Cancer Tumour Standards Working Group, 2013).
| Country                                      | Type                  | Dental personnel involved | Pathway of care                  | Commencement of extraction | Types of teeth for extraction | Mucositis management          | Preventive treatment | Dry mouth management | Other management   | Dental recall |
|---------------------------------------------|-----------------------|---------------------------|----------------------------------|-----------------------------|------------------------------|-------------------------------|---------------------|---------------------|---------------------|----------------|--------------|
| United Kingdom: The Royal College of Surgeons of England / The British Society for Disability and Oral Health (2012) | Specific guideline    | Restorative dentist specialist Dental hygienist | Pre, during and post cancer treatment | From 21 days up to 10 days before starting radiotherapy | Deep caries, deep perio pockets, non-vital teeth | Yes Mucosal guard fabrication | Chlorhexidine and specific fluoride regime Fluoride trays | Yes | Trismus | 3 months |
| United States: National Comprehensive Cancer Network (2016) | General guideline     | Not mentioned             | Pre, during and post cancer treatment | Completed 2 weeks before starting radiotherapy | Not specified | Yes Mucosal guard fabrication | Specific fluoride regime Fluoride trays | Yes | Trismus | 3 or 6 months |
| Australia: National Cancer Expert Reference Group, 2016 | General guideline     | Special needs dentist     | Pre, during and post cancer treatment | Not mentioned | Not mentioned | Not available | Not available | Not available | Not available | Not available |
| New Zealand: National Head and Neck Cancer Tumour Standards Working Group (2013) | General guideline     | Not mentioned             | Pre cancer treatment              | Completed more than 14 days before starting radiotherapy | Not specified | Not available | Yes but not specified | Not available | Not available | Not available |
| Malaysia Health Technology Assessment Section (2016) | General guideline     | Not mentioned             | Pre cancer treatment              | Not mentioned | Not specified | Not available | Chlorhexidine rinse and fluoride regime but not specified | Yes | ORN | Not available |
A model for dental decision support (MDDS) was proposed by Bruins et. al (1999) to contribute to the development and analysis of guidelines and also to act as a training tool. A comprehensive oral health and panoramic radiograph evaluation tool for standardized data collection of HNCa patients has been developed, but it is still in the validation process (Jackson et al., 2015). These tools can be used for systematic collection of information relating to long-term oral clinical/radiographical complications, prevalence, and severity. They were said to be user-friendly and to provide a comprehensive, reproducible and inexpensive means to evaluate post-therapy oral health of HNCa patients (Jackson et al., 2015). The tool developed by Jackson et. al enhanced/expanded the original tool develop by Bruins et. al and was more comprehensive due to the inclusion of oral and radiology section.

Multiple specific forms have been constructed to help with efficient referral between radiation oncologist and the dentist, but they were not widely used. Studer et. al (2011) proposed risk-adapted dental care (RaDC) prior to IMRT. The RaDC requires radiation oncologists to topographically define mandibular ORN risk areas as high, intermediate and low (according to the radiation dosage) prior to dental treatment using a particular form. Thus, robust dental treatment can be performed in high risk areas and less invasive work in the regions that will receive lower doses of treatment. In general, there will be reduced swelling and faster tissue healing due to the less aggressive dental treatment. Thus, radiotherapy can be done sooner after dental treatment is finished.

Evaluation tools such as Oral Health Evaluation Tool (OHET) and Panoramic Radiograph Evaluation Tool (PRET) have been developed to ensure assessment of all relevant oral health issues. They can also be used to collect information for research. This tool can be incorporated for use in clinical trials, clinical databases and routine dental care. The Oral Health Evaluation Tool (OHET) is a systematic assessment of dental health with emphasis on oral health outcomes common to HNCa patients. Panoramic Radiograph Evaluation Tool (PRET) records clinically significant oral health outcomes assessable by panoramic radiography. Discrepancies could be based on a single patient (ORN), a single tooth (impaction), or single quadrant (periodontal bone loss) (Jackson et al.,
Advocating the usage of these evaluation tools in assessing HNCa patients undergoing radiotherapy might be beneficial.

### 2.9 Summary

Pre-radiation dental assessment of HNCa patients is an important matter for HNCa patients and health professionals. A variety of approaches toward managing patient dental needs is the main focus of discussion. Management of dental problems can be complicated by the complexity of the planned radiotherapy treatment, the patient's dental condition and their motivation towards dental care. Socioeconomic factors, access issues and the influence of family and caregivers should also be considered. Barriers such as late referrals, lack of clinical guidelines and lack of knowledge among dental and medical professionals related to this issue can also hinder good quality of patient care. Improvement in certain aspects of care is expected to improve the patients’ outcome.
2.10 Research aims

The aims of this study are:

1. To investigate the knowledge and practice of dentists in Malaysia and New Zealand regarding pre-radiation dental assessment and management prior to radiotherapy treatment for patients with HNCa
2. To determine the protocols or guidelines currently used by dentists in Malaysia and New Zealand for pre-radiation dental treatment
3. To investigate the problems that are faced by dentists in Malaysia and New Zealand in providing dental treatment for HNCa patients that will be undergoing radiotherapy

2.11 Research hypotheses

1. The level of knowledge and practice of hospital dentists managing these patients will range from low to moderate
2. Most of the hospital-based dentists will not be using specific protocols for pre-radiation dental assessment for HNCa patients
3. There will be some differences between the responses in each country
3. MATERIALS AND METHODS

3.1 Ethics approval, Maori consultation and Funding

This research was a cross-national study related to topics surrounding pre-radiation dental assessment for HNCa patients. It compared differences between Malaysia and New Zealand. Ethical approval from both New Zealand and Malaysia was obtained before commencing this research. Ethical approval for the New Zealand arm of the study was obtained from the University of Otago Human Ethics Committee (H16/068), and the Ngāi Tahu research consultation committee was also consulted before commencing the research. Ethical approval from the Medical Research Ethics Committee at the National Institute of Health, Malaysia was obtained for the Malaysian arm of the project. This process ensured the project received all approvals required under Malaysian law. This included: (1) approval from the Economic Planning Unit at the Prime Minister’s Department of the Malaysian Government, (2) institutional approval from the Oral Health Division at the Malaysian Ministry of Health, and (3) registration with the National Medical Research Registry of Malaysia. Funding for this research was provided by a Fuller Scholarship from the Faculty of Dentistry at the University of Otago.

3.2 Participants

According to the recent New Zealand Dental Council Workforce Analysis (2017), there were 20 hospital-based specialists and 78 general dentists that were employed by the District Health Boards (DHB) in 2015. In Malaysia, the annual report by the Oral Health Division stated that there were 59 hospital-based specialists working under the Ministry of Health in 2014. There were 4021 general dentists/dental officers that were working in the public sector (dental public clinics and hospital-based dentistry) but the data for hospital-based dentists alone were not available. Dental paediatric specialists and oral medicine specialists were not included in this count for the purpose of this
study. Though Malaysia has a larger workforce the number of hospital-based dentists in Malaysia is still relatively small. Thus, the sample size of 50 participants was considered adequate for the purpose of this study.

Hospital dentists working in Dental Departments during the period of questionnaire distribution were included in this study. They consisted of general dental practitioners (GDP), including house surgeons and registrars, oral and maxillofacial surgeons (OMFS), oral surgeons (OS), special needs dentist (SND) and other dental clinicians such as clinical practice manager, dental public health specialist, restorative specialist or prosthodontist who work with the hospital's oral oncology patients at the date of survey. Dental officers and first year dental officers (FYDO) in Malaysia are similar to GDP and house surgeon positions in New Zealand respectively. In both countries, those who were primarily based in private dental clinics and dentists who were working at the dental paediatric clinics or oral medicine clinics during the period of questionnaire distribution were also excluded. This is in relation to the low prevalence of HNCa incidence in children (thus excluding paediatric dental specialists) and the fact that this study relates to the specialist discipline of SND, not oral medicine, thus excluding oral medicine specialists.

A list of Malaysian dental practitioners was acquired through the Dental Practitioner Information Management System (accessible online) of the Malaysian Dental Council. Potential participants were filtered by looking through the address provided and including those who listed a hospital as their location of practice. Further confirmation with the National Specialist Register, Malaysia Ministry of Health website was done to exclude registered paediatric dental specialists and oral medicine specialists.

A list of New Zealand dental practitioners was obtained from the New Zealand Dental Council register (accessible online). Participants were selected by practice type; status as a specialist in oral and maxillofacial surgery, oral surgery, special needs dentistry, public health dentistry or general dental practice. Practitioner details were then matched by address to determine whether they were likely to be based in a hospital or private dental clinic.
The power calculation for sample size was estimated based on the number of hospital-based specialists and dentist as previously discussed. Based on the confidence level of 95% and confidence interval of 9.75, a sample size of 50 respondents was required. Simple random sampling was conducted using the Research Randomizer software and 50 randomly-selected participants were invited to participate in this study from each country.

3.3 Questionnaire development

No previous studies of pre-radiation dental assessment for HNCa patients have been conducted in Malaysia or New Zealand, but studies from Turkey, United States and United Kingdom have previously been published (Güneri et al., 2008; Patel et al., 2012; Alpöz et al., 2013; Dewan et al., 2014). In consideration of the findings of these previous studies, a 20-item self-administered questionnaire was developed for use in this study. The questionnaire had both quantitative and qualitative elements, and the questionnaire contents for both countries were similar except for the ethnicity section (Q2), reporting of current position (Q3) and referral from health professionals (Q10). The ethnicity section was classified according to Department of Statistics, Malaysia and Stats New Zealand Classification and Standards. For current position, house surgeon and general dentist in New Zealand were replaced with FYDO and dental officer in Malaysia respectively, which are similar in terms of definition and job scope. For referral from health professionals, general medical practitioner (GP) in New Zealand was replaced with medical officer in Malaysia.

The main themes of the questionnaire were as listed:

i. Socio-demographic data

ii. Pre-radiation dental assessment

iii. Multidisciplinary meetings

iv. Clinical guidelines
v. Knowledge and practice regarding the dental management of patients that will be undergoing HNRT
vi. Adequacy of training for management of HNCa patients
vii. Barriers and suggestion to improve
viii. Comment/suggestions

Pre-testing of the questionnaire was conducted to evaluate the internal validity of the questionnaire. This was conducted by distributing the initial questionnaire to six people; two specialists (an oral surgeon and a special needs dentist), two general dentists and two experts in survey research both in Malaysia and New Zealand. The aim of this pre-test was to evaluate whether the questionnaire was appropriate in terms of structure, content and language that was being used. Feedback was provided and adjustments were made accordingly. The questionnaire did not need to be translated to Bahasa Melayu which is the official language in Malaysia as the respondents were specialist/dentists and it is known these types of professionals in Malaysia have a good level of proficiency in English.

3.4 Data Collection

One hundred questionnaires (50 for each country) along with cover letters and information sheets (Appendix 8.5, 8.6 and 8.7) were posted out to the participants with a return stamped envelope. Those who had not responded within 8 weeks of the first wave were again invited to participate by a second mailing. Those who did not respond to the second mailing wave within a further 8 weeks were invited for a third time. In cases where a practitioner’s registered address was incorrect and an alternative correct address could not be identified, another randomly-selected practitioner was invited in their place.
3.5 Statistical analysis

Data was analyzed separately for both countries using Statistical Package for the Social Sciences software (version 24.0; IBM Corp., Armonk NY). Descriptive analysis was used for categorical data. Categorical variables were described as frequencies and percentages. Continuous variables were described using mean and standard deviation. The Pearson’s chi-square test was used to determine any statistical differences between two countries and association of variables. Fisher’s exact test was used to analyse small sample size. Independent sample T-test was done for continuous variables such as respondent’s working experience. Analysis of Variance (ANOVA) was then used to confirm the differences between the mean of working experience and working time in between these two countries. Simple linear regression analysis was used to observe the relationship between certain variables.

The numerical data of working experience (in years) was converted to categorical data of level of working experience (low, moderate, highly experienced) based on the number of years they have been working as a dentist. The number of hospital-based working hours was divided into two groups, full time or part time. Full time and part time working hours were defined according to regulation in Malaysia and New Zealand. For Malaysia respondents, working more than 34 hours per week was considered as full time employment. As for New Zealand respondents, full-time employment was measured as working 30 hours or more per week. Some of the categorical data were recoded to simplify data analysis and results interpretation. Instead of four different categories, it was recoded into just two categories of responses. For example, ‘never and sometimes’ was recoded into one category and ‘often and always’ into another category.
3.6 Analysis of the qualitative data

A deductive approach was taken to analyse an open ended question in the questionnaire. The process of qualitative data analysis involved organizing the data, identify framework, sorting the data into framework, using the framework for data analysis and second order analysis. Recurrent and related themes were identified. Content analysis approach was adopted to interpret the written transcript for this study.
4. RESULTS

100 questionnaires were posted out or emailed and the total number of respondents was 75; 40 from Malaysia and 35 from New Zealand. The response rate was 80% from Malaysia and 70% from New Zealand. The prevalence (%) of these results was counted within country unless stated otherwise in individual tables.

4.1 Socio-demographic characteristics

4.1.1 Characteristics of respondents

Overall, there were similar proportions of respondents by gender. Ethnicity was classified differently for both countries. The main ethnicity groups in Malaysia were Malay, Chinese, Indian and indigenous people (Table 4). There were no respondents from the indigenous group.

In New Zealand, ethnicity was categorized as European, Asian and others (Table 4). European, New Zealand European and other European respondents were classified under the European group. Asians consisted of Asian, Southeast Asian and Chinese. Due to the small number of respondents, Maori, Middle Eastern, African and others which were not specified were classified under ‘Others’.

There were significant differences in the respondents’ current positions (Table 4). The majority of the respondents were ‘specialist/consultant’ for New Zealand and ‘dental officer’ for Malaysia. The specialist trainees that responded to the questionnaire consisted of Oral Surgery (OS) (4 people) and Special Needs Dentistry (2 people).

The number of hospital-based working hours was divided into two groups, full time or part time. Significantly more respondents worked full time than part time (Table 4).
Table 4 Characteristics of respondents by country

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>0.598 (0.492)</td>
</tr>
<tr>
<td>Male</td>
<td>17 (42.5)</td>
<td>18 (51.4)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>23 (57.5)</td>
<td>17 (48.6)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td>69.260 (&lt;0.001)*</td>
</tr>
<tr>
<td>Malay</td>
<td>29 (72.5)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Chinese</td>
<td>5 (12.5)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Indian</td>
<td>6 (15.0)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>-</td>
<td>21 (60.0)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>-</td>
<td>9 (25.7)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>-</td>
<td>5 (14.3)</td>
<td></td>
</tr>
<tr>
<td>Current position</td>
<td></td>
<td></td>
<td>13.435 (0.009)*</td>
</tr>
<tr>
<td>Consultant/specialist</td>
<td>10 (25.0)</td>
<td>16 (45.7)</td>
<td></td>
</tr>
<tr>
<td>Specialist trainee</td>
<td>2 (5.0)</td>
<td>4 (11.4)</td>
<td></td>
</tr>
<tr>
<td>Dental officer/general dentist</td>
<td>23 (57.5)</td>
<td>6 (17.1)</td>
<td></td>
</tr>
<tr>
<td>FYDO/house surgeon</td>
<td>5 (12.5)</td>
<td>8 (22.9)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>0 (0.0)</td>
<td>1 (2.9)</td>
<td></td>
</tr>
<tr>
<td>Full time hospital-based work</td>
<td></td>
<td></td>
<td>11.248 (0.001)*</td>
</tr>
<tr>
<td>Yes</td>
<td>37 (92.5)</td>
<td>21 (60.0)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3 (7.5)</td>
<td>14 (40.0)</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05
4.1.2 Respondent’s working experience

The minimum working experience as a dentist for both Malaysian and New Zealand respondents was one year. The maximum was 23 years (Malaysia) and 46 years (New Zealand).

The minimum time working in hospital-based dental care in both countries was recorded as zero years which was interpreted as less than one year. The maximum was 23 (Malaysia) and 30 (New Zealand) (Table 5).

Independent sample T-tests were carried out for all variables. The results were statistically significant, indicating that the group variances were unequal in the population. Welch’s t-test was done and was statistically significant. It was concluded that there was a difference between the mean work experience time working as a dentist and working in a hospital-based setup between the two countries.

**Table 5** Respondent's working experience by country

<table>
<thead>
<tr>
<th></th>
<th>Malaysia</th>
<th>New Zealand</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years as a dentist</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>7.4</td>
<td>16.3</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Median</td>
<td>6.5</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>5.2</td>
<td>12.9</td>
<td></td>
</tr>
<tr>
<td><strong>Years working in hospital-based</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>5.2</td>
<td>10.3</td>
<td>0.003*</td>
</tr>
<tr>
<td>Median</td>
<td>4.5</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>4.9</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td><strong>Hours per week working in hospital-based</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>37.4</td>
<td>30.8</td>
<td>0.003*</td>
</tr>
<tr>
<td>Median</td>
<td>40.0</td>
<td>33.0</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>8.5</td>
<td>9.8</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05
Working experience was divided into low, moderate and highly experienced based on the working hours provided. Half of the respondents from Malaysia were moderately experienced dentists (52.5%) while majority of the New Zealand respondents were highly experienced dentists (48.6%). Hospital-based dentistry work experience was mainly low in the Malaysian respondents and moderate for the New Zealanders. A significant difference of the working experience of the respondents was observed between these two countries (Table 6). It was concluded that the majority of the New Zealand respondents consisted of dentists with higher working experiences compared to the Malaysian respondents.

Table 6 Level of working experience by country

<table>
<thead>
<tr>
<th></th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>( \chi^2 ) value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working experience as a dentist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>16 (40.0)</td>
<td>10 (28.6)</td>
<td>16.753 (&lt;0.001)*</td>
</tr>
<tr>
<td>Moderate</td>
<td>21 (52.5)</td>
<td>8 (22.8)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>3 (7.5)</td>
<td>17 (48.6)</td>
<td></td>
</tr>
<tr>
<td>Hospital-based working experience</td>
<td></td>
<td></td>
<td>8.735 (0.013)*</td>
</tr>
<tr>
<td>Low</td>
<td>22 (55.0)</td>
<td>10 (28.6)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>17 (42.5)</td>
<td>18 (51.4)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>1 (2.5)</td>
<td>7 (20.0)</td>
<td></td>
</tr>
</tbody>
</table>

*p< 0.05
4.2 Pre-radiation dental assessment details

4.2.1 Number of HNCa patients seen (per year) and availability of fixed timeslots

An independent-samples t-test was conducted to compare the mean number of HNCa patients seen by respondents in Malaysia and New Zealand. The respondents were asked to estimate the average number of HNCa patients that were seen by them prior to radiotherapy (per year). There was no significant difference in the number of patients seen in Malaysia (M=42, SD=98) and New Zealand (M=29, SD=44); t (55.6) = 0.71, p = 0.479. Respondents were asked if fixed timeslots/scheduled appointment times/dedicated clinic appointments were available for pre-radiation dental assessment. Over two-third of respondents stated that they have a fixed timeslot to accommodate these patients for assessment (Table 7).

Table 7 Availability of fixed timeslots for pre-radiation dental assessment by country

<table>
<thead>
<tr>
<th></th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>Chi^2 value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed timeslots for</td>
<td></td>
<td></td>
<td>0.840 (0.657)</td>
</tr>
<tr>
<td>assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28 (70.0)</td>
<td>25 (71.4)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>9 (22.5)</td>
<td>9 (25.7)</td>
<td></td>
</tr>
<tr>
<td>I am unsure</td>
<td>3 (7.5)</td>
<td>1 (2.9)</td>
<td></td>
</tr>
</tbody>
</table>

4.2.2 Radiographs taken during pre-radiation dental assessment

Orthopantomographs (OPGs) were usually taken during the pre-radiation dental assessment (New Zealand respondents – 94.3% and Malaysian respondents - 67.5%). Intra-oral periapical radiographs (IOPAs) and posterior bitewings (PBWs) were sometimes taken. The differences in taking routine dental radiographs for HNCa patients between these two countries were statistically significant. Other radiographs taken were computerized tomography (CT) scan or cone beam computed tomography
scan (CBCT) (Table 8). But it was unclear in the analysis if these CT and/or CBCT were taken as part of determining cancer diagnosis and staging or requested separately by the dental team, specifically for dental assessment.
Table 8 Routine radiographs that was taken during pre-radiation dental assessment by country

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>χ² value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
<td>NZ</td>
<td>Malaysia</td>
<td>NZ (%)</td>
<td>Malaysia</td>
</tr>
<tr>
<td>IOPA</td>
<td>7 (17.5)</td>
<td>1 (2.9)</td>
<td>22 (55.0)</td>
<td>15 (42.9)</td>
<td>10 (25.0)</td>
</tr>
<tr>
<td>PBW</td>
<td>22 (55.0)</td>
<td>1 (2.9)</td>
<td>13 (32.5)</td>
<td>12 (34.3)</td>
<td>4 (10.0)</td>
</tr>
<tr>
<td>OPG</td>
<td>4 (10.0)</td>
<td>1 (2.9)</td>
<td>2 (5.0)</td>
<td>0 (0.0)</td>
<td>7 (17.5)</td>
</tr>
<tr>
<td>Others</td>
<td>35 (87.5)</td>
<td>31 (88.6)</td>
<td>1 (3.5)</td>
<td>3 (8.6)</td>
<td>2 (5.0)</td>
</tr>
</tbody>
</table>

*p <0.05
4.2.3 Characteristics of referrals

Referrals for dental assessment in these two countries were done by two different groups of health practitioners. The majority of the referrals were from medical officers (MO) in Malaysia (75.0%) and radiation oncologists in New Zealand (88.6%) and there was a statistically significant difference between these routes of referral (Table 9). Most of the ‘other’ medical personnel that referred these patients were ORL specialists although there were also referrals from clinical nurse specialists (oncology), other hospital dental services, plastic surgeons and medical oncologists.

Respondents were asked about the frequency and types of radiation information provided by the radiation oncologist at the time of referral. Specific information required was type, location, dosimetry and commencement date of the radiation therapy. A statistically significant difference was observed in the responses with 41.9% of radiation oncologists in New Zealand ‘always’ providing the information compared to Malaysia (15.4%). Survey respondents in both countries highlighted that there were instances where radiation information was ‘never’ provided by the radiation oncologist.
Table 9 Referral characteristics for pre-radiation dental assessment by country

<table>
<thead>
<tr>
<th>Health personnel who made the referral</th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation oncologist</td>
<td>26 (65.0)</td>
<td>31 (88.6)</td>
<td>5.686 (0.029)*</td>
</tr>
<tr>
<td>MO/GP</td>
<td>30 (75.0)</td>
<td>3 (8.6)</td>
<td>33.430 (&lt;0.001)*</td>
</tr>
<tr>
<td>GDP</td>
<td>11 (27.5)</td>
<td>5 (14.3)</td>
<td>2.999 (0.223)</td>
</tr>
<tr>
<td>Others</td>
<td>9 (22.5)</td>
<td>14 (40.0)</td>
<td>2.689 (0.134)</td>
</tr>
</tbody>
</table>

Radiation information provided by radiation oncologist (if applicable)

<table>
<thead>
<tr>
<th></th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>7 (26.9)</td>
<td>3 (9.7)</td>
<td>11.783 (0.019)*</td>
</tr>
<tr>
<td>Sometimes</td>
<td>9 (34.6)</td>
<td>10 (32.3)</td>
<td></td>
</tr>
<tr>
<td>Often</td>
<td>6 (23.1)</td>
<td>5 (16.1)</td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>4 (15.4)</td>
<td>13 (41.9)</td>
<td></td>
</tr>
</tbody>
</table>

*Multiple response question

*N(%) by total of referral from radiation oncologist

*p< 0.05

MO= Medical Officer
GP= General Practitioner
GDP= General Dental Practitioner
4.3 Multidisciplinary meetings

More than half of the respondents in Malaysia and New Zealand stated that MDMs took place at their centres (Table 10). The main health practitioners that were involved in MDMs were radiation oncologists, dentists, OS/OMFS and ORL surgeons. There was a statistically significant difference between the composition of the MDMs with variation in the inclusion of associates such as dieticians, audiologists/speech therapists, clinical specialist nurses, head and neck cancer co-ordinators and others. In Malaysia, the main other health practitioners involved were plastic surgeons, whilst in New Zealand other health practitioners comprised pathologists, radiologists, plastic surgeons, oral medicine specialists, rehabilitation specialists, social workers, medical oncologists, prosthodontists and dental technicians.

Table 10 Differences in multidisciplinary meeting arrangements by country

<table>
<thead>
<tr>
<th></th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Held at centre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>21 (52.5)</td>
<td>18 (51.4)</td>
<td>1.659 (0.436)</td>
</tr>
<tr>
<td>No</td>
<td>12 (30.0)</td>
<td>14 (40.0)</td>
<td></td>
</tr>
<tr>
<td>I am unsure</td>
<td>7 (17.5)</td>
<td>3 (8.6)</td>
<td></td>
</tr>
</tbody>
</table>

Health practitioners involved in MDM

<table>
<thead>
<tr>
<th></th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation oncologist</td>
<td>19 (47.5)</td>
<td>18 (51.4)</td>
<td>0.115 (0.819)</td>
</tr>
<tr>
<td>ORL</td>
<td>14 (35.0)</td>
<td>17 (48.6)</td>
<td>1.418 (0.251)</td>
</tr>
<tr>
<td>OS/OMFS</td>
<td>20 (50.0)</td>
<td>14 (40.0)</td>
<td>0.753 (0.487)</td>
</tr>
<tr>
<td>Dentist</td>
<td>12 (30.0)</td>
<td>18 (51.4)</td>
<td>3.571 (0.097)</td>
</tr>
<tr>
<td>Dietician</td>
<td>2 (5.0)</td>
<td>12 (34.4)</td>
<td>10.545 (0.002)*</td>
</tr>
<tr>
<td>Audiologist/speech therapist</td>
<td>3 (7.5)</td>
<td>14 (40.0)</td>
<td>11.248 (0.001)*</td>
</tr>
<tr>
<td>Clinical specialist nurse</td>
<td>2 (5.0)</td>
<td>14 (16.0)</td>
<td>13.626 (&lt;0.001)*</td>
</tr>
<tr>
<td>Head and neck cancer co-ordinator</td>
<td>3 (7.5)</td>
<td>15 (42.9)</td>
<td>12.794 (&lt;0.001)*</td>
</tr>
<tr>
<td>Others</td>
<td>1 (2.5)</td>
<td>10 (28.6)</td>
<td>10.138 (0.002)*</td>
</tr>
</tbody>
</table>

*p < 0.05

ORL= Otorhinolaryngology
OS= Oral Surgeon
OMFS= Oral Maxillofacial surgeon
Practitioners who worked in major cities were more likely to participate in MDMs than practitioners in small centres, and the observed difference was statistically significant. 50% of the New Zealand practitioners who participated in MDMs were significantly more likely to report that they followed a published clinical guideline for the dental management of HNCa patients who would be undergoing radiotherapy treatment. However, only 4.7% of the Malaysia practitioners who were involved with the MDM would practice the same thing (Table 11).

**Table 11** Associations between MDM, location and usage of clinical guideline by country

<table>
<thead>
<tr>
<th></th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDM held in major cities</td>
<td>18 (85.7)</td>
<td>13 (72.2)</td>
<td>24.930 (&lt;0.001)*</td>
</tr>
<tr>
<td>Participation in MDM and usage of clinical guideline by respondents</td>
<td>1 (4.76)</td>
<td>9 (50.0)</td>
<td>7.835 (0.020)*</td>
</tr>
</tbody>
</table>

* $p < 0.05$

N(%) by total of MDM held
4.4 Clinical guidelines for pre-radiation dental assessment

4.4.1 Usage of clinical guidelines

The majority of Malaysian respondents did not use formal clinical guidelines for dental assessment of HNCa patients prior to radiotherapy treatment (Table 12). Many were unaware such guidelines existed. Only one person mentioned that he/she used a guideline, but the actual guideline was not specified. As for New Zealand respondents, almost half of them mentioned that they used clinical guideline(s). A significant difference was observed between these two countries.

**Table 12** Usage of clinical guidelines for pre-radiation dental assessment by country

<table>
<thead>
<tr>
<th></th>
<th>Malaysia</th>
<th>New Zealand</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1 (2.5)</td>
<td>17 (48.6)</td>
<td>21.751 (&lt;0.001)*</td>
</tr>
<tr>
<td>No, I am aware of a guideline but do not follow it</td>
<td>5 (12.5)</td>
<td>2 (5.7)</td>
<td></td>
</tr>
<tr>
<td>No, I am not aware of any such guidelines</td>
<td>34 (85.0)</td>
<td>16 (45.7)</td>
<td></td>
</tr>
</tbody>
</table>

* $p<0.001$

New Zealand respondents used a mixture of resources as guidelines such as national guidelines, journal articles, hospital protocols and local guidelines (Table 13). The guidelines used by the New Zealand respondents were as listed (in no particular order):


vii. Referred paper/journal articles/consensus statement

viii. Hospital protocols and local guidelines
<table>
<thead>
<tr>
<th>Types</th>
<th>Dental personnel involved</th>
<th>Pathway of care</th>
<th>Commencement of extraction</th>
<th>Types of teeth for extraction</th>
<th>Mucositis management</th>
<th>Preventive treatment</th>
<th>Dry mouth management</th>
<th>Other management</th>
<th>Dental recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Royal College of Surgeons of England / The British Society for Disability and Oral Health (2012)</td>
<td>Specific guideline</td>
<td>Restorative dentist specialist Dental hygienist</td>
<td>Pre, during and post cancer treatment</td>
<td>21 days up to 10 days before cancer treatment</td>
<td>Deep caries, deep perio pockets, non-vital teeth</td>
<td>Yes Mucosal guard fabrication</td>
<td>Chlorhexidine Fluoride regime Fluoride trays</td>
<td>Yes</td>
<td>Candidiasis Trismus ORN</td>
</tr>
<tr>
<td>National Head and Neck Cancer Tumour Standards Working Group (2013)</td>
<td>General guideline</td>
<td>Not mentioned</td>
<td>Pre cancer treatment</td>
<td>Completed more than 14 days before starting radiotherapy</td>
<td>Not specified</td>
<td>Not available</td>
<td>Yes but not specified</td>
<td>Not available</td>
<td>Not available</td>
</tr>
<tr>
<td>Studer et al., (2011)</td>
<td>Journal article</td>
<td>Not mentioned</td>
<td>Pre, during and post cancer treatment</td>
<td>More than 10 days before radiotherapy</td>
<td>Non-vital teeth, apical pathology, advanced periodontal disease, deep caries</td>
<td>Yes</td>
<td>Fluoride regime Fluoride trays</td>
<td>Yes</td>
<td>Candidiasis Trismus</td>
</tr>
<tr>
<td>Ben-David et al., (2007).</td>
<td>Journal article</td>
<td>Not mentioned</td>
<td>Pre and post IMRT</td>
<td>More than 14 days before IMRT</td>
<td>Yes (please refer to the text below)</td>
<td>Radiation guard</td>
<td>Fluoride regime Fluoride trays</td>
<td>Not available</td>
<td>Not available</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Type of publication</td>
<td>Dental practitioner</td>
<td>Time before cancer treatment</td>
<td>Fluoride regime</td>
<td>Fluoride trays</td>
<td>Candidiasis</td>
<td>Prevention Type</td>
<td>Information availability</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td>-----------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>-------------</td>
<td>-----------------</td>
<td>--------------------------</td>
<td></td>
</tr>
<tr>
<td>Buglione et al., (2016).</td>
<td>Consensus statement</td>
<td>Dentist</td>
<td>Pre, during and post cancer treatment</td>
<td>Yes (Please refer Table 2)</td>
<td>Not available</td>
<td>Not available</td>
<td>Fluoride regime</td>
<td>Fluoride trays</td>
<td></td>
</tr>
<tr>
<td>Walsh LJ (2010)</td>
<td>Journal article</td>
<td>General dental practitioner</td>
<td>Pre, during and post cancer treatment</td>
<td>Yes</td>
<td>Yes</td>
<td>Chlorhexidine Fluoride regime CPP-ACP</td>
<td>Not available</td>
<td>candidiasis 3 months</td>
<td></td>
</tr>
<tr>
<td>Referred paper/journal articles/consensus statement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Information not available</td>
<td></td>
</tr>
<tr>
<td>Hospital protocols and local guidelines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Information not available</td>
<td></td>
</tr>
</tbody>
</table>
4.4.2 Association between respondent's characteristics and usage of clinical guidelines

Consultants/specialists used guidelines more often compared to other dentists (61.1%). GDP/dental officer usually were not aware of any guidelines available in managing these patients compared to other groups (44.0%). Among the consultant/specialist group, SND specialists usually used guidelines for managing this group of patients (54.5%) followed by Dental Public Health or Master of Community Dentistry (DPH/MComDent) graduates. Majority of the OS/OMFS were not aware of any available guidelines pertaining to this matter (75.0%). The majority of the dentists with limited experience were not aware of any available guidelines (56.0%). A statistically significant association was observed for specialization, working experience as a dentist and hospital-based working experience (Table 14).
Table 14 Association between respondent’s characteristics and usage of clinical guidelines

Do you follow a clinical guideline for pre-radiation dental assessment?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No, I am aware of a guideline but do not follow it</th>
<th>No, I am not aware of any such guidelines</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
</tr>
<tr>
<td>Current position</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consultant/specialist</td>
<td>11 (61.1)</td>
<td>3 (42.9)</td>
<td>12 (24.0)</td>
<td>0.058</td>
</tr>
<tr>
<td>Specialist trainee</td>
<td>1 (5.6)</td>
<td>2 (28.6)</td>
<td>3 (6.0)</td>
<td></td>
</tr>
<tr>
<td>GDP/ dental officer</td>
<td>5 (27.8)</td>
<td>2 (28.6)</td>
<td>22 (44.0)</td>
<td></td>
</tr>
<tr>
<td>House surgeon/ FYDO</td>
<td>1 (5.6)</td>
<td>0 (0.0)</td>
<td>12 (24.0)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Specialization</td>
<td></td>
<td></td>
<td></td>
<td>0.001*</td>
</tr>
<tr>
<td>OS/OMFS</td>
<td>2 (18.2)</td>
<td>3 (100)</td>
<td>9 (75.0)</td>
<td></td>
</tr>
<tr>
<td>SND</td>
<td>6 (54.5)</td>
<td>0 (0.0)</td>
<td>2 (16.7)</td>
<td></td>
</tr>
<tr>
<td>DPH/MComDent</td>
<td>3 (27.3)</td>
<td>0 (0.0)</td>
<td>1 (8.3)</td>
<td></td>
</tr>
<tr>
<td>Working experience (as a dentist)</td>
<td></td>
<td></td>
<td></td>
<td>0.020*</td>
</tr>
<tr>
<td>Low</td>
<td>1 (5.6)</td>
<td>2 (28.6)</td>
<td>23 (46.0)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>8 (44.4)</td>
<td>3 (42.9)</td>
<td>18 (36.0)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>9 (50.0)</td>
<td>2 (28.6)</td>
<td>9 (18.0)</td>
<td></td>
</tr>
<tr>
<td>Hospital-based working experience</td>
<td></td>
<td></td>
<td></td>
<td>0.007*</td>
</tr>
<tr>
<td>Low</td>
<td>2 (11.1)</td>
<td>2 (28.6)</td>
<td>28 (56.0)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>14 (77.8)</td>
<td>3 (42.9)</td>
<td>18 (36.0)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>2 (11.1)</td>
<td>2 (28.6)</td>
<td>4 (8.0)</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05
N (%) by columns
Analysed with Fisher’s exact test
The MDM team was classified into groups depending on the number of specialities of other health practitioners involved. 46.2% had one to four specialities involved in their MDM while 53.8% had the involvement of five to nine specialities. 41.0% of the MDM with this large group of people were held in major cities. It is noted that 77.8% of the respondents who were not involved in MDM, did not follow any guideline and were not aware of such guidelines. For groups that had five to nine health practitioners involved in their MDM, only 38.1% of the dentists used guidelines while 52.4% were not aware of any available guidelines. There were statistically significant associations in the number of specialities involved in MDM with the availability of MDM held in their respective centres and also MDM that was held in major cities compared to the small cities (Table 15).

**Table 15** Associations between MDM meetings and guideline usage with the MDM team size

<table>
<thead>
<tr>
<th>Number of specialities involved in MDM</th>
<th>No MDM N (%)</th>
<th>1-4 specialities N (%)</th>
<th>5-9 specialities N (%)</th>
<th>( \chi^2 ) value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDM meetings held (^a)</td>
<td>0 (0.0)</td>
<td>18 (46.2)</td>
<td>21 (53.8)</td>
<td>75.000 (&lt;0.001)*</td>
</tr>
<tr>
<td>Practicing in major city (^a)</td>
<td></td>
<td></td>
<td></td>
<td>24.793(&lt;0.001)*</td>
</tr>
<tr>
<td>Yes</td>
<td>0 (0.0)</td>
<td>15 (38.5)</td>
<td>16 (41.0)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0 (0.0)</td>
<td>3 (7.7)</td>
<td>5 (12.8)</td>
<td></td>
</tr>
<tr>
<td>Following a guideline (^b)</td>
<td></td>
<td></td>
<td></td>
<td>14.346 (0.006)*</td>
</tr>
<tr>
<td>Yes</td>
<td>8 (22.2)</td>
<td>2 (11.1)</td>
<td>8 (38.1)</td>
<td></td>
</tr>
<tr>
<td>No, I am aware of a guideline but do not follow it</td>
<td>0 (0.0)</td>
<td>5 (27.8)</td>
<td>2 (9.5)</td>
<td></td>
</tr>
<tr>
<td>No, I am not aware of any such guidelines</td>
<td>28 (77.8)</td>
<td>11 (61.1)</td>
<td>11 (52.4)</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) N (% by total MDM held  
\(^b\) N (% by columns
4.5 Knowledge and practice regarding the dental management of HNCa patients that will be undergoing HNRT

4.5.1 Commencement of dental treatment

Almost all of the respondents would commence dental treatment at least 2 weeks before radiotherapy started. Only a small number of respondents would do it after radiotherapy finished and no responses were noted for other statements (Table 16).

**Table 16** Commencement of dental treatment by country

<table>
<thead>
<tr>
<th></th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least 2 weeks before radiotherapy</td>
<td>36 (90.0)</td>
<td>34 (97.1)</td>
<td>1.531 (0.364)</td>
</tr>
<tr>
<td>Less than 2 weeks before radiotherapy treatment</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>During the radiation therapy period</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>After radiotherapy treatment</td>
<td>4 (10.0)</td>
<td>1 (2.9)</td>
<td></td>
</tr>
<tr>
<td>It does not matter</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
</tbody>
</table>
4.5.2 Oral complications related to HNRT

Complications of radiotherapy that were ‘often/always’ seen were mucositis and xerostomia. The majority of respondents mentioned that they ‘never/sometimes’ encountered ORN, trismus and candidiasis as complications of radiotherapy treatment. Other complications that had been observed include altered taste (dysgeusia), dysphagia and failure of existing heavily restored teeth or implants (Table 17).

**Table 17** Frequency of HNRT-related oral complications observed by country

<table>
<thead>
<tr>
<th></th>
<th>Malaysia Never/Sometimes</th>
<th>NZ Never/Sometimes</th>
<th>Malaysia Often/Always</th>
<th>NZ Often/Always</th>
<th>χ² value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mucositis</td>
<td>12 (30.0)</td>
<td>9 (25.7)</td>
<td>28 (70.0)</td>
<td>26 (74.3)</td>
<td>0.170 (0.798)</td>
</tr>
<tr>
<td>Xerostomia</td>
<td>9 (22.5)</td>
<td>3 (8.6)</td>
<td>31 (77.5)</td>
<td>32 (91.4)</td>
<td>2.695 (0.124)</td>
</tr>
<tr>
<td>Caries/radiation caries</td>
<td>19 (47.5)</td>
<td>11 (31.4)</td>
<td>21 (52.5)</td>
<td>24 (68.6)</td>
<td>2.009 (0.237)</td>
</tr>
<tr>
<td>Trismus</td>
<td>31 (77.5)</td>
<td>23 (65.7)</td>
<td>9 (22.5)</td>
<td>12 (34.3)</td>
<td>1.286 (0.308)</td>
</tr>
<tr>
<td>Osteoradio- necrosis</td>
<td>37 (92.5)</td>
<td>32 (91.4)</td>
<td>3 (7.5)</td>
<td>3 (4.6)</td>
<td>0.029 (1.000)</td>
</tr>
<tr>
<td>Candidiasis</td>
<td>28 (70.0)</td>
<td>24 (68.6)</td>
<td>12 (30.0)</td>
<td>11 (31.4)</td>
<td>0.018 (1.000)</td>
</tr>
<tr>
<td>Other condition</td>
<td>2 (5)</td>
<td>1 (2.3)</td>
<td>0 (0.0)</td>
<td>3 (8.6)</td>
<td>3.000 (0.400)</td>
</tr>
</tbody>
</table>
4.5.3 Management or advice provided during pre-radiation dental assessment

The majority of respondents in both countries would ‘often/always’ provide advice regarding oral hygiene practice (OHP), diet, lifestyle changes such as smoking cessation and reduced alcohol intake, side effects of HNRT, the importance of regular dental recalls and regular fluoride use. Almost all of the respondents from both countries ‘never/sometimes’ fabricated fluoride trays or mucosal guards/radiation stents (Table 18).

Other types of advice provided by the Malaysian respondents were the recommendation to increase water consumption due to dry mouth, use a super soft toothbrush during periods of mucositis and information about types of dental products to use or avoid during and post HNRT. The New Zealand respondents gave additional advice that included information on ways to manage xerostomia, dry mouth products (oral lubricants and saliva substitutes) and chlorhexidine mouthwash usage when required. Specific advice related to treatment planning was also described where appropriate, for instance antibiotic cover for invasive dental treatment, steroid cover and medication changes to manage bleeding risk. Some of the patients were provided with a written booklet about HNRT.
<table>
<thead>
<tr>
<th>Management or advice provided by country</th>
<th>Never/Sometimes</th>
<th>Often/Always</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Malaysia</strong></td>
<td><strong>NZ</strong></td>
<td><strong>Malaysia</strong></td>
<td><strong>NZ</strong></td>
</tr>
<tr>
<td>Evaluation and reinforcement of OHP</td>
<td>1 (2.5)</td>
<td>2 (5.7)</td>
<td>39 (97.5)</td>
</tr>
<tr>
<td>Diet analysis and advice</td>
<td>15 (37.5)</td>
<td>7 (20.0)</td>
<td>25 (62.5)</td>
</tr>
<tr>
<td>Advice on lifestyle</td>
<td>7 (17.5)</td>
<td>5 (14.3)</td>
<td>33 (82.5)</td>
</tr>
<tr>
<td>Side effect of radiation therapy</td>
<td>2 (5.0)</td>
<td>2 (5.7)</td>
<td>38 (95.0)</td>
</tr>
<tr>
<td>Importance of regular dental recall</td>
<td>1 (2.5)</td>
<td>3 (8.6)</td>
<td>39 (97.5)</td>
</tr>
<tr>
<td>Regular fluoride use</td>
<td>6 (15.0)</td>
<td>2 (5.7)</td>
<td>34 (85.0)</td>
</tr>
<tr>
<td>Fabrication of fluoride trays</td>
<td>31 (77.5)</td>
<td>29 (82.9)</td>
<td>9 (22.5)</td>
</tr>
<tr>
<td>Fabrication of mucosal guards/ radiation stent</td>
<td>38 (95.0)</td>
<td>32 (91.4)</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>Others</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (2.5)</td>
</tr>
</tbody>
</table>
Table 19 refers to the management of xerostomia and caries/radiation caries to prevent complications. Respondents that observed caries/radiation caries among their HNCa patients previously, were more likely to provide fluoride trays for at-home use for their future patients. However, there was no relationship noted between the frequency of complications observed (xerostomia and caries/radiation caries) with others preventative management provided by the respondents.

Table 19 Regression model for complications (caries/radiation caries, xerostomia) and preventative management

<table>
<thead>
<tr>
<th></th>
<th>Xerostomia</th>
<th></th>
<th>Caries/radiation caries</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficients</td>
<td>p value</td>
<td>Coefficients</td>
<td>p value</td>
</tr>
<tr>
<td>Evaluation and reinforcement of OHP</td>
<td>0.350</td>
<td>0.190</td>
<td>0.446</td>
<td>0.109</td>
</tr>
<tr>
<td>Diet analysis and advice</td>
<td>0.070</td>
<td>0.555</td>
<td>0.048</td>
<td>0.696</td>
</tr>
<tr>
<td>Importance of regular dental recall</td>
<td>0.137</td>
<td>0.586</td>
<td>0.034</td>
<td>0.896</td>
</tr>
<tr>
<td>Regular fluoride use</td>
<td>0.282</td>
<td>0.115</td>
<td>0.017</td>
<td>0.928</td>
</tr>
<tr>
<td>Fabrication of fluoride trays</td>
<td>0.191</td>
<td>0.059</td>
<td>0.228</td>
<td>0.030*</td>
</tr>
</tbody>
</table>

*p <0.05
Respondents who used any clinical guideline in managing these patients were more likely to evaluate and reinforced patient’s oral hygiene practice. Apart from that, there was no relationship between the usage of guidelines for managing the dental needs of these patients and the types of advice or management provided by the dentists. The management provided was similar whether the respondents used any guidelines or not (Table 20).

**Table 20** Regression model for usage of clinical guideline and preventative management

<table>
<thead>
<tr>
<th>Usage of clinical guidelines</th>
<th>Coefficients</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation and reinforcement of OHP</td>
<td>0.409</td>
<td>0.010*</td>
</tr>
<tr>
<td>Diet analysis and advice</td>
<td>0.006</td>
<td>0.937</td>
</tr>
<tr>
<td>Advice on lifestyle changes</td>
<td>0.012</td>
<td>0.882</td>
</tr>
<tr>
<td>Side effects of radiation therapy</td>
<td>0.165</td>
<td>0.170</td>
</tr>
<tr>
<td>Importance of regular dental recall</td>
<td>0.113</td>
<td>0.493</td>
</tr>
<tr>
<td>Regular fluoride use</td>
<td>0.183</td>
<td>0.074</td>
</tr>
<tr>
<td>Fabrication of fluoride trays</td>
<td>0.043</td>
<td>0.496</td>
</tr>
<tr>
<td>Fabrication of mucosal guards</td>
<td>0.041</td>
<td>0.641</td>
</tr>
</tbody>
</table>

*p <0.05
4.6 Perceived adequacy of training

There were contradictory responses regarding the perceived adequacy of undergraduate training between the two countries and there was a statistically significant difference between them. More than half of the Malaysian respondents (65.0%) mentioned that they had adequate undergraduate training in this field while three-quarters of the New Zealand respondents (82.9%) felt they had inadequate undergraduate training. The majority of the consultants/specialists and specialist trainees responded that they had adequate postgraduate training regarding the management of oral health in patients receiving head and neck radiotherapy.

Two-thirds of the respondents from both countries stated that they had not attended any radiotherapy-related courses in the past three years. Most of them mentioned that they would like to attend such courses or have further training in relation to this topic (Table 21).
Table 21 Perceived adequacy of training and training needs by country

<table>
<thead>
<tr>
<th></th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>χ² value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate undergraduate training</td>
<td></td>
<td></td>
<td>17.477 (&lt;0.001)*</td>
</tr>
<tr>
<td>Yes</td>
<td>26 (65.0)</td>
<td>6 (17.1)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>14 (35.0)</td>
<td>29 (82.9)</td>
<td></td>
</tr>
<tr>
<td>Adequate postgraduate training (if</td>
<td></td>
<td></td>
<td>1.871 (0.223)</td>
</tr>
<tr>
<td>applicable)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11 (91.7)</td>
<td>14 (70.0)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1 (8.3)</td>
<td>6 (30.0)</td>
<td></td>
</tr>
<tr>
<td>Have attended related course in last</td>
<td></td>
<td></td>
<td>1.286 (0.308)</td>
</tr>
<tr>
<td>3 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>9 (22.5)</td>
<td>12 (34.3)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>31 (77.5)</td>
<td>23 (65.7)</td>
<td></td>
</tr>
<tr>
<td>Need to attend courses</td>
<td></td>
<td></td>
<td>1.305 (0.282)</td>
</tr>
<tr>
<td>Yes</td>
<td>33 (82.5)</td>
<td>25 (71.4)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>7 (17.5)</td>
<td>10 (28.6)</td>
<td></td>
</tr>
</tbody>
</table>

*p <0.001
N(%) within consultant/specialist and specialist trainee

Fourteen respondents from Malaysia (35%) and 29 from New Zealand (82.9%) thought their undergraduate training in management of radiotherapy-related oral problems was inadequate.

For postgraduate training, there was one Malaysian respondent and six New Zealand respondents. More than half of the highly experienced dentists in New Zealand felt that they had inadequate undergraduate and postgraduate training in this field. There was a similar distribution related to perceived inadequacy of training in dentists with low and moderate levels of work experience between these two countries. A statistically significant difference was observed for inadequate undergraduate training between those two countries (Table 22).
Table 22 Association between perceived adequacies of training with level of work experience by country

<table>
<thead>
<tr>
<th>Level of work experience</th>
<th>Low</th>
<th>Moderate</th>
<th>High (%)</th>
<th>Low</th>
<th>Moderate</th>
<th>High (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
<td>NZ</td>
<td>Malaysia</td>
<td>NZ</td>
<td>Malaysia</td>
<td>NZ</td>
</tr>
<tr>
<td>Inadequate undergraduate training</td>
<td>6 (42.9)</td>
<td>7 (24.1)</td>
<td>6 (42.9)</td>
<td>7 (24.1)</td>
<td>2 (14.3)</td>
<td>15 (51.7)</td>
</tr>
<tr>
<td>Inadequate postgraduate training (if applicable)</td>
<td>0 (0.0)</td>
<td>1 (16.7)</td>
<td>1 (100)</td>
<td>1 (14.3)</td>
<td>0 (0.00)</td>
<td>4 (66.6)</td>
</tr>
</tbody>
</table>

*p <0.05
Analysed with Fisher’s exact test
N (%) within inadequacy of undergraduate or postgraduate training
4.7 Barriers faced in managing HNCa patients prior to radiotherapy treatment and suggestions for improvement

The majority of respondents from both countries noted that the main barrier to manage the dental needs of patients who will be receiving radiotherapy was lack of clinician’s time. The problems faced by respondents in both countries were similar except for lack of public health funding for dental care post-radiotherapy which was significantly more of a problem in New Zealand (Table 23). Other problems mentioned include lack of awareness from the medical team, lack of patient awareness, late referrals, low quality of referrals and lack of communication with other specialties. This will be discussed further in section 4.8.6.

More than half of the respondents recommended further training as one of the main suggestions for improvement. They also recommended having some time released from other duties to enhance the provision of care provided to this particular group of special needs patients. Other suggestions include educating the medical team in relation to early and quality referrals, improved patient education regarding the importance of dental care post-radiotherapy and better communication between health professionals.

Table 23 Prevalence of barriers faced and suggestions for improvement by country

<table>
<thead>
<tr>
<th>Problems faced</th>
<th>Malaysia N (%)</th>
<th>New Zealand N (%)</th>
<th>$\chi^2$ value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of time</td>
<td>27 (67.5)</td>
<td>23 (65.7)</td>
<td>0.027 (1.000)</td>
</tr>
<tr>
<td>Lack of funding</td>
<td>4 (10.0)</td>
<td>12 (34.3)</td>
<td>6.560 (0.013)*</td>
</tr>
<tr>
<td>Lack of appropriate facilities</td>
<td>7 (17.5)</td>
<td>4 (11.4)</td>
<td>0.550 (0.528)</td>
</tr>
<tr>
<td>Others</td>
<td>16 (40.0)</td>
<td>11 (31.4)</td>
<td>0.595 (0.478)</td>
</tr>
<tr>
<td>Suggestions for improvement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Further training</td>
<td>27 (67.5)</td>
<td>18 (51.4)</td>
<td>2.009 (0.167)</td>
</tr>
<tr>
<td>Financial support</td>
<td>9 (22.5)</td>
<td>6 (17.1)</td>
<td>0.335 (0.773)</td>
</tr>
<tr>
<td>Time being released from other duties</td>
<td>13 (32.5)</td>
<td>17 (48.6)</td>
<td>2.009 (0.167)</td>
</tr>
<tr>
<td>Others</td>
<td>7 (17.5)</td>
<td>8 (22.9)</td>
<td>0.335 (0.579)</td>
</tr>
</tbody>
</table>

*p <0.05
51.1% of dentists with little work experience suggested further training as their main recommendation to enhance the delivery of care and this was statistically significant. The moderately and highly experienced dentists preferred to have more time or being released from other duties to improve patient’s care (Table 24).

**Table 24** Suggestions to enhance care according to working experience as a dentist

<table>
<thead>
<tr>
<th>Working experience (as a dentist)</th>
<th>Low N (%)</th>
<th>Moderate N (%)</th>
<th>High N (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Further training</td>
<td>23 (51.1)</td>
<td>15 (33.3)</td>
<td>7 (15.6)</td>
<td>0.001*</td>
</tr>
<tr>
<td>Financial support</td>
<td>3 (20.0)</td>
<td>8 (53.3)</td>
<td>4 (26.7)</td>
<td>0.332</td>
</tr>
<tr>
<td>Time/being released from other duties</td>
<td>10 (33.3)</td>
<td>9 (30.0)</td>
<td>11 (36.7)</td>
<td>0.238</td>
</tr>
<tr>
<td>Others(^a)</td>
<td>2 (13.3)</td>
<td>6 (40.0)</td>
<td>7 (46.7)</td>
<td>0.071</td>
</tr>
</tbody>
</table>

\(^*p < 0.05\)

\(^a\)Refer section 4.8

N (%) by rows
Analysed with Fisher’s exact test
4.8 Ways to improve the delivery of dental care to head and neck cancer patients that will be undergoing radiotherapy treatment.

This was an open-ended question in the survey that added a qualitative element to the questionnaire. It invited respondents to offer comments and suggestions with regards to the research itself or to the improvement in provision of dental care for radiotherapy patients. The analysis of this question resulted in the emergence of multiple issues which were further classified into health professional factors, patient factors, referral issues, management issues, guideline issues and general issues.

4.8.1 Health professional issues

4.8.1.1 Educating the health professionals

Respondents mentioned that it is crucial to educate the medical team regarding the importance of dental assessment as part of patients’ overall care. The target group should be radiation oncologists and ORL specialists. Involvement of other health professionals is encouraged. This will also affect the quality of referrals made by the medical team. For example, one participant mentioned that “all teams involved in managing HNCa patients should be exposed in managing cancer patients holistically”.

Dentists should be well-trained to manage the dental issues that might rise post-radiotherapy. In order to achieve this, good clinical acumen is needed to predict the dental outcomes during pre-radiation dental assessment. The need to “raise awareness among the dentist/medical team regarding the importance of pre radiotherapy and post radiotherapy follow up and preventive management” was noted. Regular dental recalls after radiotherapy were often forgotten. Regular recalls will help patients with any dental issues, manage dental complications related to radiotherapy and detect dental problems as early as possible.
Suggestions such as incorporating this topic into the undergraduate dental curriculum and into relevant postgraduate speciality dental curricula were also highlighted. Respondents noted that there was inadequate undergraduate training to prepare dentists to manage the dental needs of HNCa patients. For example, one of the respondents mentioned that “further undergraduate training is needed to improve the management of these patients”. However, theory should coincide with practical care. Hospital-based dental clinics in small cities might be lacking in the number of HNCa patients seen when compared to the major centres. As one respondent stated, “provincial hospitals may not provide adequate patient for clinical experience in managing these patients”. An insight from this particular respondent summarized this particular point: “inadequate undergraduate training maybe due to majority of graduates will be working in private sector and will not manage these patients”. The rise of HNCa prevalence worldwide indicates that there will be an increase in number of HNCa patients needing pre-radiation dental assessment and treatments.

4.8.1.2 Improve communication between health professionals

There were instances where patients had to be seen by a local hospital-based dentist prior to their radiotherapy treatment or return to their care after completion of radiotherapy. Good communication should be established between the dentist in the main cancer centre and the local dentist. Enhancement of communication between dentists and radiation oncologists, ORL surgeons and other medical professionals is also important. This will lead to crucial information sharing thus improving patient’s care. “Improve communications between GDP and hospital dentist/specialist” will established good post-radiotherapy care especially after patient is being discharged from the hospital-based dentistry.
4.8.2 Patient factors

Respondents noted that sometimes the delivery of care was complicated by patient factors. Lack of patient awareness, lack of self-dental care and refusal of care can be challenging. For example, one respondent mentioned that “patient education is important. It will be a long term commitment to oral hygiene care post radiotherapy and dental recall. Oral hygiene is easily forgotten among the chaos, but long term complications can be debilitating”.

Patient education and awareness is important especially the side effects of radiotherapy on dental environment and how they can minimize these complications. One of the respondents recommended there be “enhanced patient awareness such as the importance of dental treatment before radiotherapy, follow instructions and attend dental appointments”. Information should be given in a simple manner and proper way because it can be “quite overwhelming for patients, need tactful delivery of information”. Difficulties arise when extractions were indicated and patient did not expect it.

4.8.3 Referral issues

The need for timely referrals and good quality referrals was a key issue identified in this research project. Respondents emphasized the need to “raise awareness among radiation oncologists and medical team to refer patients” to the dentists before HNRT. The majority of the respondents mentioned that they could not deliver optimal dental care due to late referrals. There was not enough time between receipt of the referral and commencement of radiotherapy treatment. One respondent mentioned that there was “limited time to stabilize patients prior to radiotherapy (higher risk for post op complications)”. This was mainly related to the healing period if teeth were indicated for extractions. The options available were either to delay radiotherapy
treatment or treat the patient after radiotherapy finished. Both can impose debilitating consequences on the patients.

Good quality referrals were also crucial. The majority of the respondents noted that important information was often not included. Radiation information such as commencement date, type, location and dosage was not readily available. One respondent suggested to “have a standardised info from referring ENT/oncologist regarding the radiotherapy dosimetry”. This information would determine the types of dental treatments that will be provided.

4.8.4 Management issues

Head and neck cancer patients should be managed holistically. MDM discussions for larger centres or maybe combined clinics for small centres will enhance the delivery of care. For example, one of the respondents mentioned that “if radiotherapy is indicated, teeth can be removed during tumour surgery which can reduce waiting time for radiotherapy”. There were concerns as to which dentist/specialist was supposed to see these patients and continue with the dental care post-radiotherapy. Most patients would be seen by hospital-based dentists or OMS/OMFS. There were recommendations that HNCa patients should be seen by the Special Needs Dentist if possible. For example, one respondent noted that “all HNCA patients should be referred to a Special Needs Dentist. SND specialist should be included in MDT clinic/Meeting”. Consistency and continuation of care is the aim when providing treatment for HNRT patients. One respondent requested “better access for electronic medical records- radiation dosimetry” so that treatment can be provided in a timely manner.
4.8.5 Clinical guideline issues

Absence of clinical guidelines can affect the planning of dental care. Most of the treatments provided were based on experience, rather than evidence-based. A national guideline for one’s particular country would be beneficial. One of the respondents recommended that “there should be a Clinical Practice Guideline from Ministry of Health, then dissemination of guideline and knowledge to all dentists, especially hospital-based dentists”. Respondents in certain facilities commented that they needed “more clear guideline/policies at Dental School”.

4.8.6 General issues

Some unclassified comments or suggestions were placed under the general issues heading. Lack of funding has effects on human resources and the ability to provide comprehensive care for these patients. For example, one of the respondents mentioned “lack of funding- one specialist maxillofacial prosthodontist for one day/week is not sufficient for complex obturator cases”. Another respondent stated that “implants are not funded for rehab”.

As for the research itself, one of the respondents commented that this is “beneficial research in improving dental care among HNCa patients”. Future research related to this topic was welcomed. One of the respondents suggested doing a “comparison study of knowledge and awareness between dentist and medical personnel” of pre-radiation dental assessment. Another respondent mentioned that they “did audit outcomes of ORN and the incidence was low. Interested to use PENTOCLO (pentoxifylline-tocopherol-clodronate) protocol as an alternative to HBO (hyperbaric oxygen) for prevention of ORN (limited evidence) and welcomes collaboration between centres”.

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Finally, a positive comment from this respondent highlighted that not all is bad for HNRT patients that need dental care: “doing well in our centre. Good referral pathways & communication. Dedicated time slots and good follow up”.

4.9 Summary

Results showed that the socio-demographic features of the respondents were different between Malaysia and New Zealand in terms of their current position and work experience. Most of the pre-radiation dental assessment referrals came from radiation oncologists but radiation information was rarely provided upon referral. Multidisciplinary meetings were usually held at hospitals located in major cities. There was a difference between these two countries regarding involvement of health practitioners in MDM. New Zealand had more diverse groups of health professionals compared to Malaysia. Almost half of the New Zealand respondents used some form of clinical guidelines for pre-radiation dental assessment while most of the Malaysian respondents noted that they were not aware of any such guidelines. But there were a variety of guidelines used.

The most common radiotherapy-related oral complications encountered by the respondents were mucositis and xerostomia. Trismus and ORN were rarely seen. The most common management or advice provided was evaluation and reinforcement of OHP, emphasising the importance of regular recall and regular fluoride use. Fluoride trays and mucosal guards/radiation stent were rarely fabricated. These results were similar in both countries.

The majority of the New Zealand respondents mentioned that they had inadequate undergraduate training in relation to pre-radiation dental assessment of HNCa patients. But this was more prominent among the dentists/specialists that had graduated more than 15 years ago. Respondents in both countries were keen to attend any related courses pertaining to this topic.
The respondents mentioned that the barriers that they faced in providing dental care for these patients included late referral which led to inadequate time to provide optimum dental care, poor quality of referral, lack of clinician’s knowledge in managing these patients and unavailability of guidelines and protocols. Patient factors such as lack of awareness and refusal of care can also complicate dental care.
5. DISCUSSION

5.1 Overview

The aim of this research was to analyse the current practice of hospital-based dentists in managing the dental needs of HNCa patients that will be undergoing radiotherapy treatment. It was a comparison study between Malaysia and New Zealand. These two countries were chosen because of the variation in incidence and aetiological factors for HNCa. It was also to simplify the survey process since we have contacts in both countries.

The analysis of the data identified areas which required more in-depth discussion and research in relation to the pre-radiotherapy dental management of HNCa patients. The main area of concern was the dentists’ knowledge and practices regarding oral complications of HNRT and suitable treatments of dental diseases for this group of patients. Challenges were highlighted and suggestions were offered in order to enhance patients’ care. The discussion section will highlight methodological issues, findings of our research, the significance of these results and future research.

5.2 Methodological issues

5.2.1 Study design

This research was a cross-national study related to topics surrounding pre-radiation dental assessment for HNCa patients. We incorporated a qualitative element into this questionnaire to capture respondents’ thoughts on issues related to managing the dental needs of HNRT patients and the research itself. There might be topics that we never thought about, and through open-ended questions, we hoped additional ideas and concepts would be suggested.
5.2.2 Response rate

The response rate by country was 80% for Malaysia and 70% for New Zealand. This number is comparable to the wider sample population of hospital specialists and dentists and also other studies in the field. Thus, it provides a representative sample for this study. The three-wave mailing/emailing system helped to increase the response rate. No monetary incentives were offered. This study highlighted workforce differences in each country, reflected by responses in the category ‘current position’. The majority of the respondents were ‘specialist/consultant’ in New Zealand and ‘dental officer’ in Malaysia. This coincided with the level of work experience of respondents. Since this questionnaire reflected on knowledge and practice, there is the possibility of significant differences between the answers for these two countries.

We have to acknowledge the differences in terminology and pathways of care for Malaysia and New Zealand during questionnaire development. Fortunately, the majority of the questionnaire’s content was similar except for certain terminology such as the professional position of dental and medical practitioners. This topic will be discussed further under the next heading.

5.3 Defining terms and classifications in results

The variable for working hours at hospital-based settings were categorically classified into full time or part time, based on the answers provided. In order to do this, we followed the definition of full time working hours in Malaysia and in New Zealand. According to Section 2(1) and 60A, Malaysia Employment Act 1955 (amendment 2012), fulltime employment working hours are 8 hours per day or 48 hours per week. A part time employee has working hours between 30% up to 70% of fulltime working hours. In short, part time means working less than 34 hours less per week. Thus, for this
study, working for more than 34 hours per week was considered to be full time employment for Malaysian respondents. In New Zealand, employment legislation does not define what full-time or part-time work hours is, but full-time work is often considered to be around 35 to 40 hours a week (Employment New Zealand, 2017). For statistical purposes, Statistics New Zealand defines full-time as working 30 hours or more per week. For the purpose of this study, we considered working 30 hours or more per week was full-time employment in New Zealand. The level of working experience was categorically classified based on the researcher’s own classification to simplify data analysis and results interpretation. It depended on the number of working years. It was categorised into low (1 to 5 years), moderate (6-15 years) and highly-experienced (16 years and above).

Some answers had different terminology between countries but were similar in terms of definition and job scope. This applied to the answers for question 3 (current position) and question 10 (referrals from health practitioners). For instance, first year house surgeon and general dentist in New Zealand were replaced with FYDO and dental officer in Malaysia respectively for Question 3. As for Question 10, GP in New Zealand was substituted with medical officer in Malaysia.

5.4 Overview of the healthcare system in Malaysia and New Zealand

An overview of healthcare system in Malaysia and New Zealand will provide a better understanding of the background to this study. The policies of the healthcare systems are likely to affect the dental management and outcomes for HNCa patients. There are two types of medical healthcare systems in Malaysia and New Zealand, public and private health services. The path of referral is generally the same; from primary healthcare to secondary or tertiary hospitals. Dental management for HNCa patients is usually provided by hospital-based dentists in both countries. The role of GDP in primary settings for this group of patients is still debatable due to the complexity of
the treatment needs such as determining the extraction needs in relation to the radiotherapy dosimetry and ORN risk and obturators fabrication if needed. Teeth can also be extracted during tumour surgery under general anaesthesia to reduce waiting time for radiotherapy treatment and consequently minimize apprehension towards dental treatments.

### 5.4.1 Healthcare system in Malaysia

Malaysia practices the universal health coverage. Healthcare is heavily subsidized for Malaysian citizens and permanent residents. As a result, healthcare can either be inexpensive or free of charge. Majority of Malaysians rely heavily on the public healthcare system. Primary healthcare is largely provided by public health care clinics. Private medical services, either hospital or general practices mainly play a supporting role for the public healthcare system. Public healthcare is widely available throughout the country. Currently, there are 408 public hospitals and 934 public health clinics in Malaysia serving a population of around 31 million people (Malaysian Ministry of Health, 2017). The dental healthcare system is quite similar in terms of the general scope and funding. Most dental healthcare in Malaysia is provided by dental public clinics all over Malaysia. Hospital-based dentistry is only available in certain number of hospitals (around 10%). Private dental services act as a support for public dental healthcare.

The Defence and Higher Education Ministries also run their own hospitals. They provide both medical and dental care at their vicinity. Currently, there are three military hospitals and four university hospitals in Malaysia. The military hospitals provide healthcare to the army and their immediate families while the university hospitals are open to the public and provide a teaching and service environment.
5.4.2 Healthcare system in New Zealand

In New Zealand, primary healthcare is usually in a private setting while hospital care can either be privately or publicly funded in contrast with Malaysia. The District Health Boards (DHB) which are entities under the Ministry of Health, have service agreements with DHB provider arms and also with the private and Non-government Organization providers. Primary health care relates to the professional health care provided in the community. The health personnel involved are GP, practice nurse, pharmacist or other health professional working within a general practice. It is recommended that everyone in New Zealand enrols with a GP. As of April 2014, there were 32 primary health organisations and 1029 GPs in New Zealand (New Zealand Ministry of Health, 2017).

There are 20 DHBs in New Zealand with 40 public hospitals across the whole country. With minor exceptions, hospital treatment is free for those eligible for health care services. According to the New Zealand Ministry of Health, government funding in relation to health and disability services means that eligible people may receive free inpatient and outpatient public hospital services, subsidies on prescription items and a range of support services for people with disabilities in the community.

Dental services are not part of the free public health system. It is only free for children and adolescents under 18 years old. Dental care for adults is provided by oral health care practitioners in private practices. There is a limited range of dental services funded for some adults. This include adults with special medical needs or disabilities that make them unable to access normal dental services, or who require dental treatment as part of other treatment (such as for HNCa). They can receive free hospital dental services. People on low incomes who have a Community Services Card may be able to get funded emergency dental care, such as pain relief or extractions. These services are provided at hospital-based dental settings or by dentists contracted by the DHB. There is the possibility that patients still need to pay some of the treatment cost.
The Faculty of Dentistry, University of Otago is considered to be a separate entity with regards to this arrangement. It is under the rules and regulations of the University of Otago, but it also works together with the Southern DHB, using Dunedin Public Hospital. The management of HNCa patients in Otago are mainly under the jurisdiction of SDHB. They partner with the Faculty of Dentistry for management of the dental aspects for these patients. Other DHBs have a hospital-based dental setting which accepts referrals from the MDM setting, oncology department and ORL department to manage the dental needs of HNCa patients.

The difference in the dental management of HNRT patients between Malaysia and New Zealand is prominent after patients are discharged from the hospital dental service. Is it widely known that HNRT patients need regular dental recalls because they are considered as a high risk group. In Malaysia, patients have the option to continue follow up with the public or private dental clinic. Whereas in New Zealand, a patient has to see a GDP for routine check-ups upon discharge. The cost of post-radiotherapy dental recalls and treatment are more apparent in New Zealand compared to Malaysia.

5.5 Findings

5.5.1 Pre-radiation dental assessment

The aim of pre-radiation dental assessment is to reduce oral complications related to HNRT. In the United Kingdom, up to a third of the HNCa patients in the acute care trusts are at risk of suboptimal dental health before starting cancer treatment (Lawrence et al., 2013). It is recommended that a proforma for assessing HNCa patients should include “dental assessment before radiotherapy” (Lawrence et al., 2013). This might increase referrals to the dentist consequently reducing dental complications related to radiotherapy.
Pre-radiation dental assessment relies heavily on referrals from the medical personnel, mainly radiation oncologists as confirmed by the current study. This is really helpful because radiation information can be provided upon referral for dental assessment. However, our findings noted that only a small number of referrals ‘always’ provided the information; 15.4% (Malaysia) and 41.9% (New Zealand). There were quite a significant number of radiation oncologists who never provided any radiation information during referrals.

The majority of the respondents mentioned that they could not deliver the optimum dental care due to late referrals. There was not enough time between referral receipt and commencement of radiotherapy treatment. Good quality referrals were also crucial. The majority of the respondents noted that important information such as commencement date of radiotherapy and radiation dosimetry usually was not included. Without this information, it was difficult to plan dental treatment and delivery of care was delayed. Efficient referrals can be improved by adopting the risk-adapted dental care (RaDC) (Studer et al., 2011) and Dentalmaps (Thariat et al., 2012). Both can provide detailed dosimetry information which is very helpful in managing the dental needs of HNCa patients.

Previous studies looked into the types of radiographs that should be taken during the dental assessment. An OPG is considered to be the optimal baseline radiograph for this group of patients. It is a rapid, convenient and simple method to demonstrate a patient’s general dental condition. Periodontal disease, impacted wisdom teeth, endodontically treated teeth and bony abnormalities can be easily detected on a single film (Walsh, 2010). It can also be used to help patients’ understand their dental condition. The current study showed that more than two-thirds of the respondents often/always took an OPG during the pre-radiation dental assessment. The frequency of taking other radiographs such as IOPAs and PBWs was less compared to OPG. There was a difference in the frequency of taking each type of radiographs between Malaysia and New Zealand which may be due to differences in treatment philosophies, resources or guidelines that has been used.
5.5.2 Multidisciplinary meetings for head and neck cancer patients

Multidisciplinary team (MDT) care is considered as best practice for management of HNCa patients. MDM improved disease staging, encouraged allied health input and coordinated care (Friedland et al., 2011). Survival rate were significantly higher in OSCC patients who had been managed through a MDT care group compared to the non-MDT care group (Liao et al., 2016). However, further studies revealed that there was only minimal evidence that showed MDT care improves survival outcomes or local tumour control. It is unclear if MDT has an impact in patient experience or quality of life. The research demonstrated a limited degree of support for the positive impact of MDT meetings in oncology settings. The authors recommended that it was more sensible and cost effective to discuss particularly difficult or controversial cases, rather than the universal inclusion of all patients for MDT discussion (Pillay et al., 2016). From the dental point of view, it is noted that pre-treatment dental assessment and OPG imaging were performed more frequently in the MDT setting. This leads to comprehensive preventative dental education and extractions to reduce ORN risk. Adherence to dental recalls was enforced which led to a direct impact on patients’ quality of life post-radiotherapy treatment (Kelly et al., 2013).

In this study, more than half of the respondents in both countries stated that MDM were available at their centres. It is postulated that these respondents were involved with MDM. MDM were mostly held at hospitals located in major cities and were more likely to have involvement of multiple specialities. With exception of radiation oncologists, ORL surgeons and dental practitioners, other allied health practitioners were distinctly more involved in New Zealand settings compared to Malaysia. This may be due to the greater availability of allied health practitioners in New Zealand which allows them to follow the protocols regarding the types of health practitioners that should be involved in MDM. However, there was not any hard and fast rule concerning the type of health practitioners that should be involved with MDM. 37.3% of the respondents that were not involved with MDM were more likely not to use any guidelines or were not aware of such guidelines. The number of health practitioners/
specialities involved with MDM did not have any effect on compliance of the dentists towards using any guidelines.

Focusing on the involvement of dental health professionals in MDM, a study was done in the United Kingdom to identify patient and carer unmet needs during consultation and review clinics. The dental ‘support services’ readily available at the time of consultation were as follows; dentist (44%), Oral Rehabilitation consultant (27%) and dental hygienist (26%) (Rogers et al., 2011). This showed more than half of the MDM did not have dental personnel readily available for consultation. The current study did not reflect readily available support services such as dentist and hygienist at the time of consultations or during MDM in both countries. Multiple guidelines have listed dentists as an integral part of the MDM team but it is questionable how often we as dentists are involved with MDM.

Compared to other cancer-related management, majority of the dental treatments can be provided by any general dental practitioner in the private settings or hospital-based settings all over the country. It is not restricted only to the main cancer centre or major hospitals. This will be more cost effective and minimize the barriers to access. For patients that are at risk of specific complications, it is best to manage them at a tertiary care centre. It is recommended that hospital-based dentists should be involved in MDM when it is available at their centres to be acquainted with the general overview of the HNCa patients. If it is decided to refer these patients to their local dentist, all the important information such as radiotherapy regime and dosimetry should be conveyed to the dentists accepting these patients. This will save patients’ time, money and improve post-radiotherapy reviews.
5.5.3 Commencement of dental treatment for HNRT patients

Removing oral foci that might cause problems during and after radiotherapy should be a priority when managing this group of patients. This study showed that almost all of the respondents would commence dental treatment at least two weeks before starting radiotherapy treatment. Only a small number of respondents would start dental treatment after radiotherapy. This decision probably related to multiple factors such as types of treatment needed (scaling, restorations vs extractions) and adequate time to complete needed care before starting radiotherapy. Dentists will aim to avoid delays to commencement of radiotherapy treatment due to incomplete dental treatment. There are still controversies regarding extractions post-radiotherapy and management is decided on a case-by-case basis. Therefore, the options are either extractions prior to radiotherapy treatment or prescribing pentoxifylline and vitamin E if extractions are planned after radiotherapy treatment has started.

Extractions of compromised teeth should be done at least two weeks before the start of radiotherapy (Schiødt and Hermund, 2002). This is to allow good wound healing and reduce the risk of ORN. Other non-urgent treatments such as scaling and restorations can be completed after patient is finished with radiotherapy treatment. Previous study mentioned that 74% of dentists saw patients for pre-radiation evaluation and 68% reported treating patients during HNRT (Patel et al., 2012). This study revealed that almost all of the respondents would commence treatment at least two weeks prior to the radiotherapy treatment. There were a small number of respondents that will commence treatment after radiotherapy treatment but the treatment modalities were not specified.

5.5.4 Clinical guidelines for pre-radiation dental assessment in HNCa

The need to develop evidence-based clinical guidelines for managing the dental needs of patients with HNCa is becoming more prominent. Our older population are retaining
more of their natural teeth, compared to previous generations. Globally, there has been an increase in the incidence of head and neck cancer in young adults (less than 45 years old) (Hussein et al., 2017). This poses an increased threat of dental complications post-radiotherapy.

Management of the dental needs were mainly based on clinical experience of individual clinicians rather than evidence-based guidelines. There is not any national accepted oral care protocols for cancer patients based upon research evidence (Barker et al., 2005). The protocols and guidelines have been discussed in section 2.8. Most of these national guidelines state the importance of the involvement of dental personnel as part of the MDM team. The Cancer Council of Australia specifically mentioned that Special Needs dentists should assess and be involved with the planning, treatment and follow-up of patients that are likely to have surgery or radiation to the mouth and jaws. Dental issues were not precisely addressed in majority of the national guidelines. Some of the guidelines outlined the recommended dental treatment and management but it was rarely a comprehensive list. Regular revision of guidelines is also crucial to make sure that the contents are up to date.

As shown by our study, the majority of the Malaysian respondents (85%) were not aware of any such guidelines compared to New Zealand respondents (45.7%). Although 48.6% of the New Zealand respondents used some sort of guidelines, it was actually different for each centre. These included national guidelines from New Zealand and other countries, published articles, consensus statement and hospital protocols. The robustness of the content is something that we should think through. It may either be general recommendations for managing the dental needs or specific treatment of oral foci. The decision to retain or extract a tooth is multifactorial. It involves the patient’s general condition, comorbidities, motivation towards maintaining good oral health, tumour diagnosis, the dosimetry of radiation therapy and clinician’s knowledge and skills regarding this issue (Ben-David et al., 2007; Studer et al., 2011). The guidelines used by our respondents advocate preventative management such as fluoride regime and fabrication of fluoride trays. Few of the
resources supplied information on management of dry mouth and trismus. National guidelines are more general compared to journal articles. However, The Royal College of Surgeons of England / The British Society for Disability and Oral Health (2012) has developed a specific and comprehensive national guideline for the management of oral conditions in oncology patients requiring radiotherapy, chemotherapy and/or bone marrow transplantation.

Most of these resources mentioned the importance of preventative treatments, dry mouth management and extractions. Ben-David et. al (2007) and Buglione et. al (2016) had outlined the types of tooth that needs to be extracted before starting radiotherapy treatment. It included teeth with non-restorable caries or caries that extended to the gum line, teeth with large, compromised restorations with significant periodontal attachment loss (pocketing >5 mm), and those with severe erosion or abrasion if they were in the parts of the jaws expected to receive a high dose (the posterior mandible and maxilla ipsilateral to the tumour and the posterior mandible contralateral to the tumour). Studer et. al (2011) mentioned that dental treatments depended on whether the problem was in a high risk area, intermediate- or low-risk area or an area with no radiation-specific risk. These risk areas would be marked by the radiation oncologist before referral being made to the dentist. It was comprehensive and presented in a table format which is user friendly.

A task force in Italy had produced a consensus particularly relating to those statements with limited evidence available. The topics covered were management of dental pathologies and ORN (Buglione et al., 2016), mucositis (De Sanctis et al., 2016) and xerostomia and trismus (Buglione et al., 2016). Definition, risk factors, assessment scale and dental treatment before, during and after radiotherapy were discussed in detail. The task force consisted of radiation oncologists, oncology physicians, oral care physicians, radiologists, and nurses. They discussed ways to minimize risk of ORN when considering extractions. Schuurhuis et al. (2015) had also identified significant oral foci of infection that should be either effectively treated or removed starting HNRT. Both papers specifically mentioned the types of oral foci that may be associated with
doubtful prognosis or were at risk of dental disease in the future (Figure 1 and Table 2). This can help dentists with the decision making and treatment planning for HNCa patients undergoing radiotherapy.

Most of the resources provided specific fluoride regimes such as usage of high fluoride toothpaste (5000 ppm), fluoride mouthwashes and fluoride gels (1.1% neutral sodium fluoride). Remineralising products such as casein phosphopeptide–amorphous calcium phosphate (CPP–ACP) was also suggested as part of the preventative management. Management of trismus was only mentioned by some resources. This includes using wooden tongue depressors or a jaw motion rehabilitation system. Management of dry mouth included the use of saliva substitutes or saliva stimulants. Saliva substitute products mentioned were chamomile or sage rinse, Saliva Orthana, Biotene Oral Balance saliva replacement gel and BioXtra. Saliva stimulants include pilocarpine and chewing sugar-free chewing gum. Only two resources gave a comprehensive outline regarding this issue.

The availability of comprehensive published guidelines showed the need to use protocols and guidelines in managing the dental needs of HNCa patients that will be undergoing radiotherapy treatment. The current study highlighted the need for consistent evidence-based guidelines for each country.

This study showed that consultants/specialists used guidelines more often compared to other dentists. GDP/dental officers usually were not aware of any guidelines. Among the consultants/specialists, SND specialists were the people who usually use guidelines in managing this group of patients followed by DPH/MComm graduates. It might be because SND specialists usually manage the dental needs of HNCa patients so it is possible that they were more aware of such guidelines. DPH/MComm graduates may have been involved with developing guidelines. On the other hand, OS/OMF surgeons’ management are more related to tumour resection compared to routine dental treatment. There was no relationship between the usage of guidelines for managing the dental needs of these patients and the types of advice or management provided by
the dentists. The management provided was similar whether the respondents used any guidelines or not.

5.5.5 Knowledge and practice regarding the dental management of HNCa patients that will be undergoing HNRT

Radiotherapy for head and neck cancer can cause significant oral complications as described in Section 2.4. In this study, the distribution of HNRT complications observed by our respondents in both countries was quite similar. Mucositis and xerostomia were the most common complications. The less common complications observed were osteoradionecrosis, trismus and candidiasis as complications of radiotherapy treatment. New Zealand respondents witnessed more caries/radiation caries in their patients compared to the Malaysian respondents. Other complications that had been observed include altered taste (dysgeusia), dysphagia and failing of existing heavily restored teeth or implants.

The majority of the respondents in both countries would ‘often/always’ provide advice regarding oral hygiene practice (OHP), diet, lifestyle changes such as smoking cessation and reduce alcohol intake, side effects of HNRT, the importance of regular dental recalls and regular fluoride use. Providing information and educating the patients and their families about the side effects of radiotherapy treatment is vital for patient compliance and minimize oral complications (Schiødt and Hermund, 2002). The American Academy of Oral Medicine (2016) suggested patient’s participation to enhance their long-term oral health outcomes. Informing patients about the importance of dental recalls and compliance towards dental management post-radiotherapy was advocated along with advice to motivate them and identify if there were any barriers to access such as transportation, lack of health care experts and financial resources.
The use of high fluoride toothpaste (Duraphat 5,000 ppm) and daily alcohol-free fluoride mouthwash is recommended for HNRT patients (Jawad et al., 2015). One study noted that only 23% of dentists recommended topical fluoride therapy or other products/measures for patient starting HNRT (Patel et al., 2012). This includes fluoride products and fluoride trays for home usage. Our study showed 85% of Malaysian respondents and 94.3% of New Zealand respondents ‘often/always’ advised on regular fluoride use but only a small number would fabricate fluoride trays for home use (22.5% Malaysia, 8.6% New Zealand). Respondents that observed more radiation-related dental caries among their HNCa patients were more likely to provide fluoride trays for home use. However, there was no relationship noted between the frequency of complications observed (xerostomia and caries/radiation caries) with others preventative management provided by the respondents.

The New Zealand Guidelines Group (2009) did not recommend home use of fluoride gels because of the risk of ingesting excessive fluoride which may cause gastritis. The Expert Advisory Group agreed that fluoride gels should be professionally applied. Fluoride gels are available in a neutral sodium fluoride preparation and an acidulated phosphate fluoride preparation in New Zealand. In Malaysia, there was not any specific recommendation regarding at-home use of topical fluoride gel and trays. Casein phosphopeptide–amorphous calcium phosphate (CPP–ACP), added to patients daily oral care regimen will improve caries control in hyposalivation patients through increasing the acid resistance of the teeth and controlling cariogenic bacterial activity. Significant decreases in the incidence rates of soft lesions per patient and per root surface in a CPP-ACP group compared with a non-CPP-ACP group has been noted (Katsura et al., 2016).

This study also showed that almost all of the respondents from both countries ‘never/sometimes’ fabricated mucosal guards/radiation stent. Only 5% of Malaysian dentists and 8.6% of NZ dentist ‘often/always’ provide mucosal guards or radiation stents. It coincided with a similar study that found only 11% of the dentists provided
mucosal guards (Patel et al., 2012). There are many types of radiation stents and mucosal guards, depending on clinician’s design as it can be custom-made. Ben-David et. al (2007) used polyvinyl siloxane putty as radiation guards and a 5-mm separation was intended between the metallic restorations and the soft tissue. Other appliance includes a mouth opener appliance. It is used to open patient’s mouth during external beam radiotherapy using linear accelerator to avoid exposure of the oral cavity. It is made of resin and disposable. It is cheap, easy to produce and easily cleaned. Fabrication of a mouth piece to reposition the patient during IMRT is also beneficial. The mouth piece will immobilize the patient’s head therefore decreasing head and neck rotation, flexion and extension. It can be made of thermoplastic splinting material and tray. Fabrication of a space retainer/spacer can prevent backscatter of amalgam restorations on CT scan images which can lead to incorrect radiotherapy treatment planning. It is made using a soft-type thermoflex material (Matsuzaki et al., 2017).

Other types of advice provided were techniques of managing xerostomia, usage of a super soft toothbrush during the mucositis period, types of dental products to be used or avoid (such as alcohol mouthwashes) during and post HNRT and chlorhexidine mouthwash usage when required. Management of dry mouth includes frequent sipping of water, chewing sugar free gum and usage of oral lubricants, mouthwash and toothpaste specifically for dry mouth. A range of products include Oral 7 products, Biotene products and GC Dry mouth gel. Specific advice related to the treatment plan was also discussed where applicable; antibiotic cover for invasive dental treatment, steroid cover and medication changes to manage bleeding risk. Some of the patients were provided with a written booklet about HNRT and dental contact information.

There were not any statements regarding management related to mucositis in this study. Mucositis happened during radiotherapy treatment and we hypothesized that it was usually managed by the oncology nurse. Management of mucositis involved pre-radiotherapy prevention modalities and monitoring progression of mucositis during the radiotherapy period as suggested by a recent consensus statement (De Sanctis et al., 2016). Previous studies stated multiple prevention and treatment strategies for
managing mucositis (Lalla et al., 2015; De Sanctis et al., 2016). Prevention of mucositis before commencement of radiotherapy involved reinforcement of oral hygiene practice and professional plaque debridement or scaling to control periodontal disease. Advocating the use of a soft toothbrush and interproximal cleaning is also important. During the radiotherapy treatment period, it is advisable to re-evaluate the patient’s oral hygiene and assess mucositis progression. The use of non-alcohol mouthwash during this period is important, especially when patients are unable to brush due to pain. Saline or sodium bicarbonate mouthwash can also be used to maintain oral cleanliness. There is the possibility that benzydamine mouthwashes can be used to prevent radiation-induced mucositis in HNCa receiving moderate-dose radiation therapy (up to 50 Gy) without chemotherapy (Epstein et al., 2001). A randomized double-blind study was done which revealed a reduction of erythema and ulceration in the benzydamine group compared to the placebo group in patients treated with a radiotherapy cumulative dose of 50 Gy (Epstein et al., 2001).

There is lack of evidence saying that one type of mouthwash is superior to the other. MASCC/ISOO had additional recommendations for the management of mucositis. The panel suggested that 0.2% morphine mouthwash might provide pain relief secondary to oral mucositis in HNCa patients receiving chemoradiation therapy. They also recommended that oral zinc supplements administered orally may be beneficial to prevent oral mucositis in oral cancer patients receiving radiation therapy or chemoradiation therapy.

The consensus statement also discussed the practices that are not recommended for prevention and management of oral mucositis in HNRT patients. Cryotherapy is not recommended during (chemo) radiation even though it was found to be beneficial in patients receiving bolus 5-fluorouracil or high dose melphalan. It can cause decrease in tissue oxygenation. Amifostine is not recommended in patients receiving chemoradiotherapy for HNCa because it has many side effects and is also expensive. The following topical agents are not recommended for mucositis prevention and treatment; barrier agents (sucralfate, GelClair, MuGard and Mucotrol), allopurinol gel,
chlorhexidine mouthwash, povidone-iodine, triclosan mouth washes, iseganan mouth washes, aloe vera, Granulocyte macrophage colony-stimulating factor, pure natural honey, Misoprostol and Prostaglandin E2, antibiotic and antifungal pastilles. Systemic continuous practice of steroidal therapy for mucositis prevention/treatment is not recommended. The consensus stated that there is no recommendation regarding the use of Low Level Laser Therapy to reduce mucositis.

This study did not reveal any findings regarding mucositis management in terms of advice, prevention and treatment modalities from any of the respondents. Even though mucositis is the most common and acute side effect of radiotherapy and the protocols for management of mucositis are well established, it is possible that the result of this study may support the hypothesis that mucositis was usually managed by the oncology nurse rather than the dental team.

Although there was a low incidence of trismus reported in this study, trismus may be managed by daily mouth exercises. The easiest and cheapest way of doing jaw exercise is using increasing numbers of wooden tongue depressors as a bite block. There are also devices readily available to help with the management of trismus such as TheraBite Jaw Motion Rehab System and OraStretch Press Jaw Motion Rehab System. Both are handheld devices and proven to be more effective than using wooden tongue depressors. The kit consisted of the device, a patient log, foam bite pads and measuring scales. It can be used by both dentate and edentulous patients. The device uses passive motion to stretch the user’s jaw, joint and facial tissues for increased mobility, flexibility, and function. Patients can gain 1-2mm increase of opening per week. Management of trismus relies heavily on the patient’s commitment and compliance towards treatment. The importance of dental recalls after radiotherapy treatment should be emphasized during these assessments. It is a lifelong commitment to minimise HNRT side effects on oral environment.

During the pre-radiation dental assessment, it is prudent to discuss ORN risk and ways to minimize it. A small percentage of the respondents stated that they had
encountered patients with ORN previously. ORN is not only caused by extractions after commencement of radiotherapy, but it can also be due to traumatic injury from sharp teeth edges or ill-fitting dentures. ORN can also be spontaneous. The theory of pathogenesis of ORN by Marx (1983) described ORN as the result of tissue hypoxia, hypocellularity and hypovascularity. The hyperbaric oxygen therapy (HBOT) discussed the concept of creating different oxygen gradient between blood and tissue by increasing the oxygen level in the blood. Consequently, it will enhance the diffusion of oxygen into hypoxic tissue. The increased oxygen supply stimulates fibroblast proliferation, angiogenesis and collagen formation. The usage of HBO as a preventive measure and also treatment modalities of ORN is still controversial and inconclusive. It is usually promoted as an adjunctive therapy in management to ORN. A systematic review of 19 articles revealed that while prophylactic HBO therapy appeared to reduce the risk of developing ORN after tooth extractions, the conclusions were ‘based on weak evidence’ (Nabil and Samman, 2011). Another recent study recommended that HBOT can be used for stage I and II ORN and for selected cases of stage III ORN (Dieleman et al., 2017). Other factors that should be considered when proposing the usage of HBO is high treatment cost, the burden of time and logistics and also disruption to patient’s daily routine (Ceponis et al., 2017).

Delanian and Lefaix (2004) proposed a new theory for the pathogenesis of ORN. They stated that bone damaged by radiation is mainly the result of radiation-induced fibrosis. This led to the development of a double or triple-drug therapy to reduce radiation-induced fibrosis and bone destruction and to stimulate osteogenesis via an antioxidant pathway. Treatment with pentoxifylline combined with tocopherol with/without clodronate led to complete recovery in most patients at 6 months. Pentoxifylline and tocopherol (Vitamin E), in combination, can work synergistically to regress ORN and when used prophylactically, reduced the incidence of post-extraction ORN from 5% to 1.2% (Patel et. al, 2016). The patient has to start taking the regime one month before extraction and continue until healing is complete or another option is to start three months before extraction and continue for three months post extraction. A combination of pentoxifylline, tocopherol/vitamin E, and clodronate
known as PENTOCLO protocol has shown promise in the treatment of refractory ORN despite the lack of a prospective randomised controlled trial (Lyons and Brennan, 2017).

In summary, there are multiple published protocols regarding the prevention and management of oral complications related to HNRT. The consensus statements by the Italian task force as discussed in section 5.5.4 are considered as the most contemporary and comprehensive protocols which bring together recommendations of various guidelines/protocols. The consensus statements are accepted by most international authorities. These consensus statements should serve well as a basis for ongoing development of guidelines and protocols.

5.5.6 Adequacy of dental training

In this study, we specifically asked whether respondents felt that their undergraduate and postgraduate training (if applicable) was adequate to manage HNCa patients that would be undergoing radiotherapy treatment. Our results showed that there were different responses regarding adequacy of undergraduate training between the two countries. 65% of Malaysian respondents mentioned that they had adequate undergraduate training while only 17.1% of the New Zealand respondents gave the same response. The majority of the consultants/specialists and specialist trainees responded that they had adequate postgraduate training. There was an association between the level of training and the level of work experience. 51.7% of New Zealand respondents with extensive work experience (more than 15 years) mentioned that they did not have adequate undergraduate training compared to only 14.3% of Malaysian respondents from the same group. This suggested that the undergraduate training of more than 15 years ago was inadequate. The total percentage of perceived inadequate undergraduate training for the group with low to moderate work experience was 85.8% (Malaysia) and 48.2% (New Zealand).
It is possible that this subject is not the main focus of the dental curricula. Inclusion of topics such as side effects of HNRT on the oral environment, preventive management and management of HNRT complications in the oral cavity will empower future dentists in managing the dental needs of HNCa patients. This will improve access to care and benefit the patients in multiple aspects. Hospital-based dentists will be expected to treat complex patients and act as a support system for the general dental practitioner in managing HNCa patients.

The socio-demographic profile of this study showed that there were more New Zealand respondents with a high level of work experience involved with this study compared to Malaysian respondents. The majority of Malaysian respondents had a low to moderate level of work experience. Interestingly, the majority of the older generation of dentists/specialists in New Zealand felt that they had inadequate undergraduate training compared to Malaysia where the same responses were more common in the younger generation. It is possible that the less experienced clinicians have not been exposed to enough cases to judge whether the training was adequate. However, it has to be acknowledged that nearly half (48.2%) of New Zealand’s younger generation of dentists felt that they had inadequate undergraduate training in this area. We did not ask respondents which university they graduated from but the majority of New Zealand dentists were assumed to have graduated from the University of Otago, which is the only dental school in New Zealand. In Malaysia, the dental graduates were more diverse as they might be a graduate of local or international dental school. There are nine institutions that offer dental degree courses in Malaysia alone. Multiple literature reviews have recommended re-evaluation of current undergraduate curricula and organization of postgraduate courses to incorporate more information about the dental management of oncology patients pre-, peri- and post-radiotherapy (Güneri et al., 2008; Alpöz et al., 2013).

More than half of the respondents recommended further training as one of the main suggestions for improvement, particularly by younger dentists and dentists with limited work experience. Continuing education for dentists regarding the dental
management of these patients can be valuable (Alpoz et. al 2013; Patel et. al 2012). From our study, two-thirds of the respondents from both countries stated that they had not attended any related courses in the past three years. 82.5% of Malaysian respondents and 71.4% of New Zealand respondents felt that they needed to attend courses or have further training with regards to this topic. Oral complications can be efficiently managed if the dental health professional constantly updates their knowledge related to this subject. It should focus on cancer therapy, its oral complications and prevention and management options (Hancock et al., 2003). It is uncertain if such courses are available in both countries.

5.5.7 Barriers in providing dental care for HNCa patients that will be undergoing radiotherapy treatment

Previous studies have noted that inadequate time to provide dental treatment before starting HNRT is the barrier to effective treatment (81%) while lack of training/knowledge required to adequately treated the patients only scored 10% (Patel et al., 2012). The majority of the respondents from both countries noted that the main barrier in managing the dental needs of these patients was lack of time. The moderate and highly experienced group of dentists preferred to have more time allocated or to be released from other duties to enhance the provision of care provided to this particular group of patients. Lack of time may also mean inadequate time to make sure that patients are orally fit before undergoing radiotherapy due to late referrals.

The problems faced by respondents in both countries were similar except for lack of funding which was more prominent in New Zealand. Apart from the issues that has been stated before such as lack of clinical guidelines, inadequate training of dentists or specialists, late referrals and low quality of referrals from the medical team, we managed to identify other obstacles in managing this group of patients. These were lack of time, lack of awareness from the medical team and poor communication between health personnel.
We hypothesise that lack of awareness among the medical teams regarding the importance of dental management for these patients was the cause for late referrals and low quality of referrals. A study in the United States noted that 25% of radiation oncologists reported inadequate knowledge of how to treat patients with oral health complications due to head and neck radiotherapy and 67% of the radiation oncologists were keen to attend continuous education in this topic (Patel et al., 2012). The current study indicated that there was a need for continuing education for radiation oncologists regarding effective oral and dental management of patients receiving radiotherapy to the head and neck region. Educating the medical team in relation to early and quality referrals will also give positive impacts on patient’s pathway of care. The target group should be radiation oncologists and ORL specialists, but should also include other groups of health professionals such as oncology nurse and head and neck cancer coordinator.

Lack of patient awareness, lack of self-dental care and refusal of care can be challenging. Lack of patient awareness regarding the importance of dental care may lead to non-attendance to dental appointment before or after radiotherapy treatment. This current study suggested that we should improve patient education in relation to the importance of dental care post-radiotherapy. The use of a log book to maintain continuity of information in cancer care should be considered (van Wersch et. al, 1997). The logbook can convey information to patients about the overall management of HNCa. Information should include the importance of good oral health and related advice on the management of radiotherapy-related oral complications and the need for frequent recalls. Optimistically, this may improve patient’s adherence to care.

Lack of communication between dentists, radiation oncologists and their patients might cause lack of coordination of care and treatment delay (Lawrence et al., 2013). When HNCa patients required treatment from multiple disciplines only 35% of visits were coordinated with other specialties that were also providing care (Fletcher et. al, 1984). There might be circumstances where patients had to be seen by a local hospital-
based dentist prior to their radiotherapy treatment or return to care after completion of radiotherapy. Patients could also be dentally managed at one centre pre-radiotherapy and by another centre post-radiotherapy. If this is the case, good communication should be established between the dentist in the main cancer centre and the local dentist.

5.5.8 Future research

Future research in relation to dental management of head and neck cancer patients should include audits investigating ways to improve the delivery of care. Examples of questions that need to be explored include assessing the number of HNCa patients referred for dental assessments prior to radiotherapy, radiation information that is being provided upon referral and prevalence of HNCa patients attending dental follow up post radiotherapy. General research topics could include comparison studies of knowledge and awareness between dentist and medical personnel regarding pre-radiation dental assessment, validation of available dental assessment tools used for pre-radiation dental assessment and evaluation of the dental curricula regarding dental management of HNRT patients. Specific research topic may be related to the dental treatment provided for these patients such as comparison of different fluoride treatment regimes, fabrication and compliance of radiation stents/mucosal barriers usage and use of the PENTOCLO protocol as an alternative to hyperbaric oxygen for prevention of ORN.
6. CONCLUSION

This research project provided an overview of how dental care for patients treated with radiotherapy for HNCa was carried out. The study demonstrated that there were significant differences between the two countries in certain area of management. Surprisingly, some of the practices and outcomes were remarkably similar. Despite the strong need for clinical guidelines in managing the dental needs of these patients, there was no failure of service provisions. This research indicated that some dentists working in the field perceived gaps in their knowledge and in decision making when planning dental treatment for HNCa patients who will be undergoing radiotherapy. Thus, the findings can be incorporated into undergraduate and postgraduate programmes and orientation programmes for dental house surgeons, registrars, dental officers and those undertaking hospital attachments. It will also be used to provide continuing dental education for general and specialist dental practitioners. It is anticipated that it will lead to the development of a comprehensive national protocol to manage the patients’ dental needs, particularly in terms of workflow interactions between radiation oncologists, oral and maxillofacial surgeons, special care dentists and other members of the dental care team. Improvement in communication between patients and health professionals will enhance the delivery of care. Our role as dental professionals should also include educating patients and the medical team, especially radiation oncologists regarding the importance of optimum oral health for this group of patients.
7. REFERENCES


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Malaysian Oncological Society (personal communication, 19 August 2015).


8. APPENDICES

8.1 Maori Consultation

NGAI TAHU RESEARCH CONSULTATION COMMITTEE
TE KOMITI RAKAHAU EI KAI TAHU

Tuesday, 18 August 2015.

Dr. Adlin Suhaimi,
Faculty of Dentistry - Department of Oral Diagnostic and Surgical Sciences,
DUNEDIN.

Te Ata Ko Dr. Adlin Suhaimi,

Awareness of pre-radiation dental assessment of head and neck cancer among dentist in
Malaysia and New Zealand

The Ngai Tahu Research Consultation Committee (the committee) met on Tuesday, 18
August 2015 to discuss your research proposition.

By way of introduction, this response from The Committee is provided as part of the
Memorandum of Understanding between Te Rūnanga o Ngai Tahu and the University. In the
statement of principles of the memorandum it states “Ngai Tahu acknowledges that the
consultation process outlined in this policy provides no power of veto by Ngai Tahu to research
undertaken at the University of Otago”. As such, this response is not “approval” or “mandate”
for the research, rather it is a mandated response from a Ngai Tahu appointed committee. This
process is part of a number of requirements for researchers to undertake and does not cover
other issues relating to ethics, including methodology they are separate requirements with
other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee bases
consultation on that defined by Justice McGechan:

“Consultation does not mean negotiation or agreement. It means: setting out a proposal not
fully decided upon; adequately informing a party about relevant information upon which the
proposal is based; listening to what the others have to say with an open mind (in that there is
room to be persuaded against the proposal); undertaking that task in a genuine and not
cosmetic manner. Reaching a decision that may or may not alter the original proposal.”

The Committee considers the research to be of importance to Māori health.
As this study involves human participants, the Committee strongly encourage that ethnicity
data be collected as part of the research project. That is the questions on self-identified
ethnicity and descent, these questions are contained in the latest census.
The Committee suggests dissemination of the findings to relevant Māori health organisations,
for example the National Māori Organisation for Dental Health, Oranga Nō he and to
Professor John Broughton and Mr Malcolm Daker, who are involved in Māori Dental
Health, University of Otago.

We wish you every success in your research and the committee also requests a copy of the
research findings.

This letter of suggestion, recommendation and advice is current for an 18 month period from
Tuesday, 18 August 2015 to 18 February 2017.

The Ngai Tahu Research Consultation Committee has membership from:
Te Rūnanga o Otago Incorporated
Kia Mauta: Rūnanga ki Pukekoheki
Te Rūnanga o Muriuki

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Nahaku noa, nā

Mark Brunton
Kawhakahaere Rangahau Māori
Research Manager Māori
Research Division
Te Whare Wānanga o Otago
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Email: mark.brunton@otago.ac.nz
Web: www.otago.ac.nz

The Ngāi Tahu Research Consultation Committee has membership from:

Te Rūnanga o Ōhinegouhua
Kaiti Wairua Rūnanga ki Puketumutumu
Te Rūnanga o Moeraki
8.2 Malaysian Institutional Approval

Oral Health Division
Ministry of Health Malaysia
Level 5, Block E10, Parcel E, Precint 1
Federal Government Administrative Centre
62590 Putrajaya, Malaysia

Tel: 03-88833888 (OPERATOR)
03-88834215
03-88834216
Fax: 03-88886133
e-mail: ohd@moh.gov.my

Your ref. :
Our ref. :
Date : 26 July 2016

Adlin Aslina binti Suhaimi
DClinDent (Special Needs Dentistry) candidate
Faculty of Dentistry
University of Otago
PO Box 647
Dunedin 9054, New Zealand

Dear Dr,

RESEARCH PROJECT: AWARENESS OF PRE-RADIATION DENTAL ASSESSMENT OF HEAD AND NECK CANCER PATIENTS AMONG DENTISTS IN MALAYSIA AND NEW ZEALAND

I refer to letter dated 30 June 2016 from the University of Otago, New Zealand on the above subject.

2. Please be informed that this Division has no objection to the conduct of the above research in the Ministry of Health Malaysia, subject to the following conditions:
   - This research project must be registered with the National Medical Research Register (NMRR) in the Ministry of Health Malaysia (please visit website www.nmrr.gov.my).
   - Approval from the Medical Ethics Committee in the Ministry of Health Malaysia, if advised upon registration of your project with NMRR.
   - The collection of primary data among Dental Officers in the Ministry of Health Malaysia shall be conducted by your goodself.
   - Your research report should not adversely contravene existing policies on service delivery.
   - Upon completion of your research, a copy of your research report must be submitted to this Division.

3. Importantly, due to the sensitive nature of your research project, please also abide by the attached circular ‘Pekerjaan Am Bl. 3 Tahun 1999 – Peraturan-Peraturan Bagi Menjalankan Penyelidikan di Malaysia’. You are advised to visit the Malaysian Economic Planning Unit (EPU) website for further details.

Your attention in this matter is most appreciated.

Thank you.

Yours sincerely,

(DR. NOOR ALIYAH BINTI ISMAIL)
Principal Director of Oral Health
Ministry of Health Malaysia

(Please quote this reference in any correspondence)
8.3 Ethical Approval (Malaysia)

Ref No : (06) KKM/NIHSEC/P16-1171
Date : 3rd August 2016

ADLIN ASLINA BINTI SUHAIMI
UNIVERSITY OF OTAGO

Siri/Madam,

NMRR-16-1187-30740 (IIR)
Awareness of pre-radiation dental assessment of head and neck cancer patients among dentists in Malaysia and New Zealand

STUDY SITE:
ORAL HEALTH DIVISION

This letter is made in reference to the matter above.

2. The Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia (MOH) has no ethical issues with the study. We take note that the study does not require any clinical intervention and involves questionnaire for data collection.

3. All records and data are to be kept strictly CONFIDENTIAL and can only be used for this study. All precaution are be taken to maintain data confidentiality.

4. Permission from the District Health officer/Hospital Administrator and all relevant heads of departments/units where the study will be carried out must be obtained prior to the study. You are required to follow and comply with this decision. Kindly please refer to the guidelines by National Institute of Health for conducting research in Ministry of Health Institutions and Facilities (amendment 01/2015) and Appendix 5 as a template letter to seek this permission.

5. Please be informed that this approval is valid until the completion of the study. If there are any changes or amendments in the study documents that may increase the risk significantly to the subject/patient/respondent, please inform to MREC immediately via email to mrecnr@nih.gov.my. Study Final Report should be sent to the MREC upon study completion. The form can be obtained from the Medical Research Ethics Committee (MREC) website (http://www.nih.gov.my/mrec).

6. Please take note that the reference number for this letter must be stated in all correspondence related to this study to facilitate the administrative process.
Decision by Medical Research & Ethics Committee:
(✓) Approved
(   ) Disapproved

Date of Approval: 3rd August 2016

Thank you.

Yours sincerely,

DATO' DR CHANG KIAN MENG
Chairman
Medical Research & Ethics Committee
Ministry of Health Malaysia
8.4 Ethical Approval (New Zealand)

Professor A. Rich
Sir John Walsh Research Institute
Department of Oral Diagnostic and Surgical Sciences
Faculty of Dentistry

23 August 2016

Dear Professor Rich,

I am again writing to you concerning your proposal entitled “Awareness of pre-radiation dental assessment of head and neck cancer patients among dentists in Malaysia and New Zealand”, Ethics Committee reference number H16/068.

Thank you for your email of 22nd August 2016 with letter attached from Adlin Suhaimi, student researcher, alongside the revised documentation, addressing the issues raised by the Committee.

On the basis of this response, I am pleased to confirm that the proposal now has full ethical approval to proceed.

The standard conditions of approval for all human research projects reviewed and approved by the Committee are the following:

Conduct the research project strictly in accordance with the research proposal submitted and granted ethics approval, including any amendments required to be made to the proposal by the Human Research Ethics Committee.

Inform the Human Research Ethics Committee immediately of anything which may warrant review of ethics approval of the research project, including: serious or unexpected adverse effects on participants; unforeseen events that might affect continued ethical acceptability of the project; and a written report about these matters must be submitted to the Academic Committees Office by no later than the next working day after recognition of an adverse occurrence/event. Please note that in cases of adverse events an incident report should also be made to the Health and Safety Office:

http://www.otago.ac.nz/healthandsafety/index.html

Advise the Committee in writing as soon as practicable if the research project is discontinued.
Make no change to the project as approved in its entirety by the Committee, including any wording in any document approved as part of the project, without prior written approval of the Committee for any change. If you are applying for an amendment to your approved research, please email your request to the Academic Committees Office:

gary.witte@otago.ac.nz
jo.farrondediaz@otago.ac.nz

Approval is for up to three years from the date of this letter. If this project has not been completed within three years from the date of this letter, re-approval or an extension of approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.

The Human Ethics Committee (Health) asks for a Final Report to be provided upon completion of the study. The Final Report template can be found on the Human Ethics Web Page http://www.otago.ac.nz/council/committees/committees/HumanEthicsCommittees.html

Yours sincerely,

[Signature]

Mr Gary Witte
Manager, Academic Committees
Tel: 479 8256
Email: gary.witte@otago.ac.nz

cc. Professor R D Cannon Director Sir John Walsh Research Institute
PARTICIPANT INFORMATION SHEET

| Study title: | Awareness of pre-radiation dental assessment of head and neck cancer among dentists in Malaysia and New Zealand |
| Principal investigator: | Name: Professor Alison Rich | Contact phone number: 03 4795686 |
| | Department: Sir John Walsh Research Institute |

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request. Completion of the form indicates consent to participate in the study.

Aim of the project
The purpose of this project is to investigate the practices of dentists when treating head and neck cancer patients who are about to undergo radiotherapy.

What types of participants are being sought?
We are seeking dentists who are working in a hospital setting in New Zealand and Malaysia, including general dentist and specialist.

What will participants be asked to do?
Should you agree to take part in this project, you will be asked to answer a questionnaire which should take approximately 10 minutes to complete. Your responses will remain anonymous.
What data or information will be collected and what use will be made of it?
The data collected may contain some personal information such as your position and specialisation. Your confidentiality will be maintained at all times and no information that might identify you will be used in any reports from this research.

Data collected will be securely stored and will only be accessed by the research team at Otago University. Data obtained as a result of the research will be retained for at least 5 years in secure storage. Any personal information held on the participants may be destroyed at the completion of the research even though the data derived from the research will, in most cases, be kept for much longer or possibly indefinitely.

The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand). Should you be interested in the results of this study, we will send you a copy of the results on conclusion of the study.

This project is being undertaken as part of Adlin Suhaimi’s requirements for the Doctor of Clinical Dentistry (DClinDent) course.

Any questions?
If you have any questions now or in the future, please feel free to contact either:

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Department</th>
<th>Contact phone number</th>
</tr>
</thead>
</table>
| Professor Alison Rich | Principal Investigator   | Sir John Walsh Research Institute             | 03 4795686  
alison.rich@otago.ac.nz             |
| Adlin Suhaimi   | Student Investigator      | Sir John Walsh Research Institute             | 03 4797046  
suhad145@student.otago.ac.nz             |

This study has been approved by the University of Otago Human Ethics Committee (Health) H16/068. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (phone +64 3 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
8.6 Research Questionnaire (Malaysia)

RESEARCH QUESTIONNAIRE (MALAYSIA)

Pre-Radiation Dental Assessment of Head and Neck Cancer Patients

Instructions: Please answer the following questions, tick in the circles or write on the lines when applicable.

1. What is your sex?
   - Male
   - Female

2. What is your ethnicity?
   - Malay
   - Indigenous (please specify): ________________________
   - Chinese
   - Others (please specify): ________________________
   - Indian

3. What is your current position?
   - Consultant/specialist (please specify): ________________________________
   - Specialist trainee (please specify): ________________________________
   - Dental officer
   - First year dental officer
   - Other (please specify): ________________________________

4. Where do you currently practise dentistry?
   - Country: ____________________________________________
   - City: ____________________________________________
   - Department: ____________________________________________

5a. How long have you worked as a dentist? ________ years
   
   b. How long have you worked in hospital-based dental practise? ________ years

6. How many hours per week do you currently work in hospital-based dental practise? ________ hours

7. Please estimate the average number of head and neck cancer patients that you see prior to them undergoing radiotherapy per year. ________ (number)

8. Do you routinely take radiographs during these assessments?

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<tr>
<th></th>
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<td>Others:</td>
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</tbody>
</table>
9. Does your schedule allow for regular or fixed timeslots for assessment of these patients?
   - Yes
   - No
   - I am unsure

10. Who refers these patients to your centre for pre-radiation dental assessment? (Tick all that apply)
   - Radiation oncologist
   - Medical officer
   - General dental practitioners
   - Others (please specify):________________________

11. In cases where a patient was referred by a radiation oncologist, how frequently do you receive the information regarding the location, types and dosage of radiation that they might use?

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12a. Are multidisciplinary clinics/meetings held at your centre to discuss the overall treatment plans for head and neck cancer patients?

   - Yes
   - No
   - I am unsure

   b. If yes, what other health practitioners are involved in these sessions? (You may tick more than one)
   - Radiation oncologist
   - Otorhinolaryngologist (ORL)
   - Oral surgeon/ Oral maxillofacial surgeon
   - Dentist
   - Dietician
   - Audiologist/speech therapist
   - Clinical specialist nurse
   - Head and neck cancer co-ordinator
   - Others (please specify):________________________
   - Not Applicable

13. Do you follow a clinical guideline for pre-radiation dental screening of head and neck cancer patients?

   - Yes (Please specify the guideline you follow)
     - Title/Author/Year:_________________________________________
   - No, I am aware of a guideline but do not follow it
     - (Please specify reason):_____________________________________
   - No, I am not aware of any such guidelines
14. When would you normally commence dental treatment of a patient receiving radiotherapy?  
- At least 2 weeks before radiation therapy  
- Less than 2 weeks before radiation therapy  
- During the radiation therapy period  
- After radiation therapy is completed  
- It does not matter  

15. In your experience, at what frequency do the following oral complications arise following radiation therapy to the head and neck?  

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16. What management or advice do you provide during pre-radiation dental assessment for these patients?  

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<td>i) Other advice (please specify):</td>
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</table>

118
17. Please tick the statement(s) below that apply to you. (You may select more than one)

- **a)** I received adequate **undergraduate** training for providing appropriate dental care to head and neck radiation therapy patients
- **b)** I received adequate **postgraduate** training for providing appropriate dental care to head and neck radiation therapy patients
- **c)** I need to attend courses to update my knowledge of appropriate dental care for head and neck radiation therapy patients
- **d)** I have attended a continuing education course on pre-radiation dental assessment of head and neck cancer patient in the last 3 years

18. In your opinion, what are the obstacles/problems that you face in providing dental treatment for patients about to receive radiation therapy? (You may tick more than one)
- Lack of time
- Lack of funding
- Lack of appropriate facilities
- Other (please specify): ________________________________

19. In your opinion, what steps could be taken to enhance your ability to provide appropriate and timely dental treatment for patients about to receive radiation therapy? (You may tick more than one)
- Further training
- Financial support
- Time/being released from other duties
- Other (please specify): ________________________________

20. Please use the space below to write any further comments/suggestions you may have regarding this research, or ways to improve the delivery of dental care to head and neck cancer patients that are about to receive radiation therapy.

___________________________________________________________________________________________
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Please place this questionnaire in the reply-paid envelope and return to the investigators. Thank you.
Research Questionnaire (New Zealand)

RESEARCH QUESTIONNAIRE (New Zealand)
Pre-Radiation Dental Assessment of Head and Neck Cancer Patients

Instructions: Please answer the following questions, tick in the circles or write on the lines when applicable.

1. What is your sex?
   - Male
   - Female

2. What is your ethnicity? (Please tick all that apply to you)
   - European
   - Samoan
   - Tokelauan
   - Indian
   - New Zealand European
   - Cook Island Maori
   - Other Pacific People
   - Asian
   - Other Asian
   - Other European
   - Tongan
   - Other Indian
   - Pacific people
   - Niuean
   - Southeast Asian
   - African
   - Others (please specify):______________________________

3. What is your current position?
   - Consultant/specialist (please specify):_______________________________
   - Specialist trainee (please specify):__________________________________
   - General dentist
   - House surgeon
   - Other (please specify):___________________________________________

4. Where do you currently practise dentistry?
   - Country:__________________________________________
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   - Department:________________________________________

5a. How long have you worked as a dentist? ________ years
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9. Does your schedule allow for regular or fixed timeslots for assessment of these patients?
   - Yes
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10. Who refers these patients to your centre for pre-radiation dental assessment? (Tick all that apply)
   - Radiation oncologist
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11. In cases where a patient was referred by a radiation oncologist, how frequently do you receive the information regarding the location, types and dosage of radiation that they might use?
   - Never
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- **e)** I received adequate undergraduate training for providing appropriate dental care to head and neck radiation therapy patients  
  
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