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Treatment modalities of oral cancer

Dental hygiene care of the head and neck cancer patient and survivor

Waterpipe smoking: A "healthy" alternative to cigarettes or a health hazard in disguise?

Oral cancer and biopsy protocol: A primer for the dental hygienist

Communicating effectively with the dental hygiene client about referral and biopsy

Oral cancer screening: Dental hygienists' responsibility, scope of practice, and referral pathway

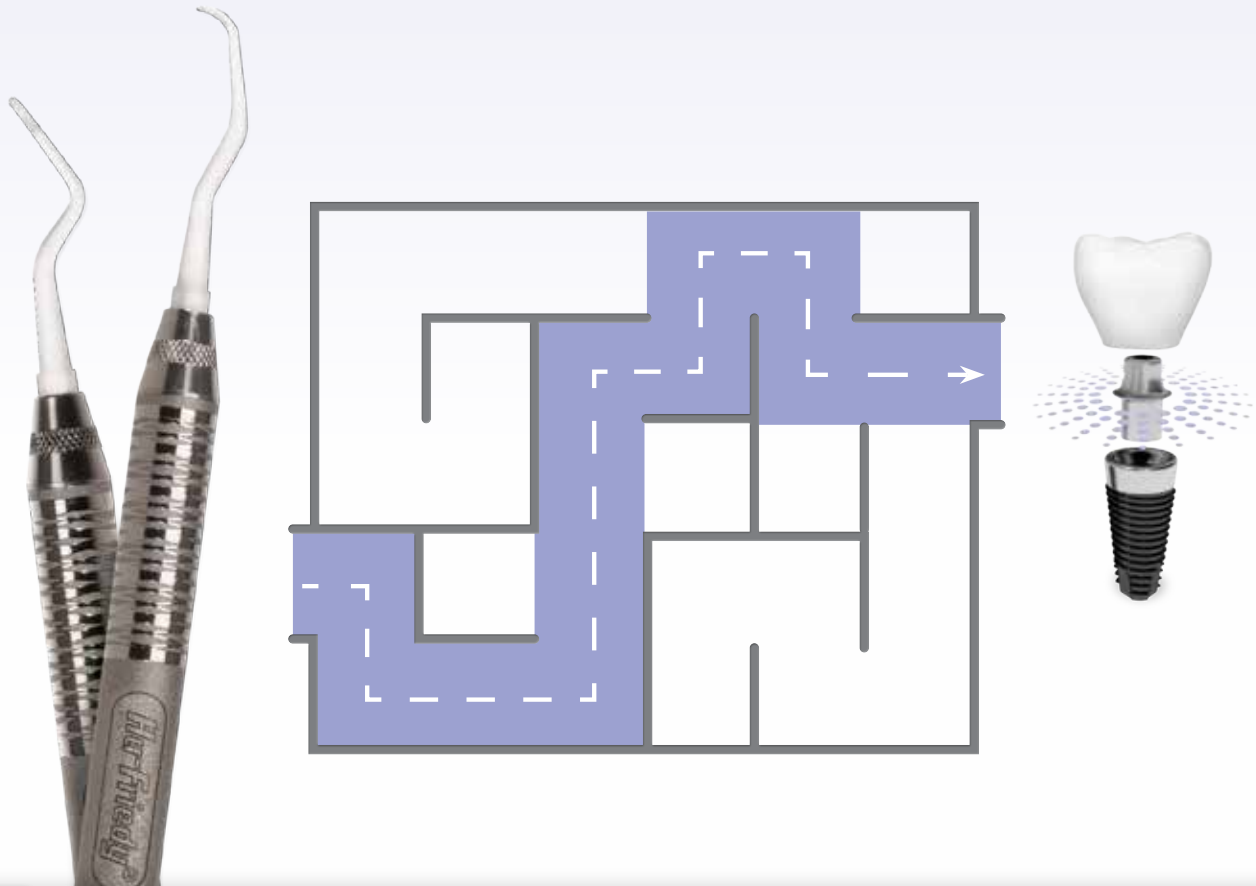
EDITORIALS

Oral cancer and the dental hygienist: Making a difference and saving lives

Dental hygienists: Agents of change for tomorrow's seniors

A dental hygienist's journey through oral cancer treatment

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The *Canadian Journal of Dental Hygiene* is the official peer-reviewed publication of the Canadian Dental Hygienists Association (CDHA). Published in February, May, August, and November, the journal invites submissions of original research, literature reviews, case studies, and short communications of scientific and professional interest to dental hygienists and other oral health professionals. Bilingual Guidelines for Authors are available at www.cdha.ca/cjdh.

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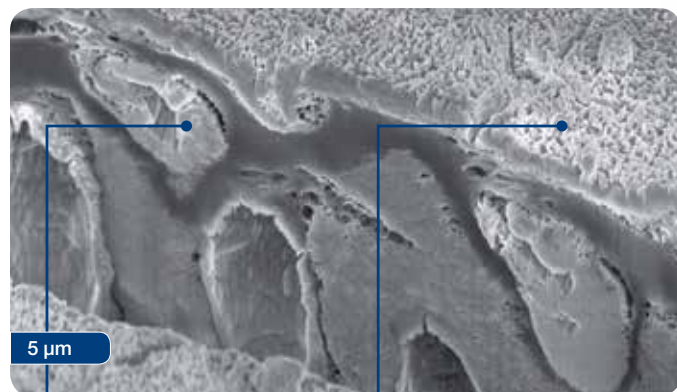
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Oral cancer and the dental hygienist: Making a difference and saving lives

Denise Laronde, PhD, RDH

Is oral cancer a problem? Almost 1,400,000 people worldwide, including 4100 Canadians, were diagnosed with oral and oropharyngeal cancer in 2013.^{1,2} The total burden of the disease is increasing. In British Columbia (BC) alone, the number of oral cancer cases is predicted to increase by 45% from 2013 to 2027.³ The risk factors for oral cancer (including oropharyngeal) also appear to be changing. In the past, the typical oral cancer patient was assumed to be an elderly male smoker. While tobacco and alcohol use are still significant risk factors, the incidence of tobacco-related lesions in the oral cavity is decreasing, as are the rates of other tobacco-related cancers, such as lung cancer. In contrast, HPV-related oropharyngeal cancer (OPC) is increasing in both men and women, with an earlier age of onset.⁴

Why is early detection important? The treatment for oral cancer and OPC can have serious, long-lasting, and very visible effects. The BC Oral Cancer Prevention Program (BC OCPP), a multidisciplinary research team, focuses its research on enhancing early detection to minimize these late effects and to recognize clinical and molecular risk factors to help identify people at risk of oral cancer. The program also believes strongly in increasing professional awareness by developing assessment, triage, and referral pathways to guide the screening and referral process for the clinician. Ajzen's Theory of Planned Behaviour states that behaviour change is influenced by 3 things: beliefs, the opinions of people who are important, and perceived control over the problem.⁵ The BC OCPP focuses on improving dental professionals' perceived control by raising awareness of how to talk to clients about screening and referral and how to integrate screening into daily practice in a timely and efficient manner. The design and validation of new adjunctive screening devices to help in the decision-making process is also an important aspect of BC OCPP research. The BC OCPP is investigating new ways to reach vulnerable populations and those people who can't access screening within typical dental settings. As dental hygiene grows beyond the traditional dental office setting, it will play an invaluable role in reaching these populations.



Denise Laronde

What is the dental hygienist's role? There are many things that we do in our daily dental hygiene practice that have a positive impact on our clients' oral health, systemic health, their appearance, and perhaps even their self-confidence. But there is one specific thing we can do that can save a life—oral cancer screening. (I should probably say oral mucosal screening because we are looking for more than just oral cancer and precancer). Perhaps the most common excuse I hear from dental professionals for why they don't provide oral cancer screening is

that they don't have enough time. Let's face it, not having enough time is probably the number one excuse we give for why we don't do many of the things that we should be doing! When I hear limited time as an excuse for not screening, I mention both the American Dental Association and the British Mouth Cancer Foundation's advocating a 90-second oral cancer examination.^{6,7} I have heard some other interesting excuses over the years, such as "I wrote a report on oral cancer when I was in school. I don't want to think about it anymore" or "we leave that to the medical doctors." It's time to take ownership of a very important part of our scope of practice.

Will we make a difference? I have had the opportunity to speak to many oral cancer and dysplasia patients over the years. There are common questions and comments that have come up, such as "Why didn't my previous dental office see the lesion?", "They told me they were watching it for a couple of years, so why didn't they tell me about it?", "They said it couldn't be cancer because I don't smoke (or I'm too young)," "They told me not to worry about it." It is impossible to answer these questions or respond to the comments adequately. Thankfully it is not always like that. My favourite comment, however, is "my dental hygienist found it." Keep it up.

With its focus on oral cancer, this issue of the journal is designed to educate the dental hygienist on clinically relevant aspects of oral cancer screening, from a new potential risk factor to triage and the referral pathway, biopsy, treatment, and the care of the cancer patient. I am very proud of the dental hygienists who contributed

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articles for this theme issue. They are an impressive group of graduate students, degree completion students, and educators, working hard to improve oral cancer outcomes and care. **Jelena Prelec** reviews three treatment methods for oral and head and neck cancer (p. 13); **Stacey Rhodes-Nesset** provides an overview of the dental hygienist's role in caring for cancer patients and survivors (p. 20); **Ambreen Khan** examines the rise and potential risks of waterpipe smoking (p. 27); **King Yin (Marco) Wu** reviews how biopsies are performed, processed, and diagnosed (p. 34), and offers a complementary piece on discussing referrals and biopsies with dental hygiene clients (p. 40); **Leigha Rock** and **Elaine Takach** discuss oral cancer screening in the context of dental hygienists' responsibilities and scope of practice (p. 42).

In addition, I am honoured to include **Marcia Eaton's** personal reflection in this collection of articles (p. 9). Marci is a dental hygienist and an oral cancer survivor—she is one of us! She is sharing her story, her cancer journey, to remind us that it could happen to anyone. Think about it. Rounding out the issue is an editorial from CDHA President **Mary Bertone** on the role of dental hygienists in improving oral health care for Canada's seniors (p. 7), another important sphere in which dental hygienists can make a difference.

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Dental hygienists: Agents of change for tomorrow's seniors

Mary Bertone, BSc(DH), RDH

On December 11, 2013, I had the privilege of participating in a panel discussion entitled “Oral Health Care: Essential to Healthy Aging and Quality of Life.” The panel discussion, hosted by the University of Manitoba’s Centre on Aging, was attended by oral, social, and health care providers, government officials, instructors and students from a variety of different disciplines, and a number of interested and concerned older adults from the community. Also observing the panel was Dr. Martin Chartier, Assistant Chief Dental Officer of Canada. Joining me on the panel were Dr. Margaret Pilley, BSc(Pharm), DMD, FAGD, representing private practice dentistry, and Dr. Khalida Hai-Santiago, DMD, Oral Health Consultant for Manitoba Health. I was delighted to participate, as the topic of applying oral-overall health connection principles to improving the quality of life of seniors is particularly dear to my heart. With our society’s aging population, never before has this focus been as critical to our dental hygiene profession as it is right now.¹ The panel discussion and the resulting interaction between the panelists and those in attendance affirmed very loudly and clearly that 1) the older adult cohort is here; 2) they are an ever-growing population; and 3) there is a growing deficit between their needs and currently available oral health services.

Yes, the Canadian demographic reality is that our society is getting older. Over the last half of the last century, the proportion of senior citizens in Canada rose from 7.7% of the overall population to 13%, and is expected to increase to 20% by the year 2031.² This cohort faces another unfortunate reality: as people retire, access to dental benefits that they may have enjoyed while employed is likely to diminish or disappear altogether.³ More than half (53%) of the adults between the ages of 60 and 79 do not have any form of dental insurance, compared to 32% in the overall population.⁴ If they are to maintain the same level of oral health, retirees must cover more and more of the costs of their oral care. At the same time, their ability to shoulder this increasing financial burden typically decreases as they age.^{1,3} Something has to give, and far too often that something is adequate oral health care.



Mary Bertone
CDHA President/Présidente de l'ACHD

Les hygiénistes dentaires : des agents de changement pour les aînés de demain

Le 11 décembre 2013, j’ai eu le privilège de participer à une discussion entre spécialistes portant sur « Les soins buccodentaires : Essentiels pour le vieillissement sain et la qualité de vie ». Invitées par le Centre de vieillissement de l’Université du Manitoba, les personnes participantes comprenaient des fournisseurs de soins buccodentaires, sociaux et sanitaires, des fonctionnaires gouvernementaux, des enseignantes et des étudiantes de diverses disciplines ainsi que plusieurs autres adultes âgés, intéressés et concernés, de la communauté. L’observateur de la table ronde était le Dr Martin Chartier, dentiste en chef adjoint du Canada. S’étaient jointe à moi à la table ronde, la D^{re} Margaret Pilley, BSc(Pharm), DMD, FAGD,

représentant la pratique dentaire privée, et la D^{re} Khalida Hai-Santiago, DMD, consultante en santé buccale à Santé du Manitoba. J’étais ravie de participer, car l’application des principes de santé buccodentaire et généraux pour améliorer la qualité de vie des aînés est un sujet précieux à mon cœur. Avec le vieillissement de la population de notre société, ce sujet n’avait jamais été aussi critique pour notre profession d’hygiène dentaire qu’actuellement.¹ La discussion du panel et l’interaction entre les panelistes et l’assistance ont affirmé vigoureusement et clairement la présence et le nombre toujours grandissant des personnes âgées ainsi que la croissance du déficit entre leurs besoins et les services de soins buccodentaires actuellement disponibles.

Oui, la réalité démographique canadienne affirme que notre société vieillit. Au cours du dernier demi-siècle, la proportion de personnes âgées du Canada a augmenté, passant de 7,7 % à 13 % de la population, et l’on prévoit qu’elle atteindra 20 % en 2031.² Cette cohorte fait face à une autre triste réalité : au moment de la retraite, il est fort probable que les prestations d’assurance dentaire dont les gens auraient bénéficié durant leur emploi diminueront ou disparaîtront entièrement.³ Plus de la moitié (53 %) des adultes âgés de 60 à 79 ans n’ont aucune forme d’assurance dentaire, comparativement à 32 % dans l’ensemble de la population.⁴ Pour maintenir le même niveau de santé buccodentaire, les personnes à la retraite doivent assumer de plus en plus le coût de leurs propres soins à cet effet. En outre, leur capacité de soutenir la croissance de ce fardeau financier diminue typiquement en vieillissant.^{1,3} Certaines choses devront changer et, trop souvent, ce sont les soins buccodentaires adéquats.

Les adultes âgés d’aujourd’hui sont beaucoup plus conscients de l’importance de maintenir une bonne santé buccodentaire. Ils sont plus éduqués en ce sens, plus astucieux politiquement et plus

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Today's older adults are much more aware of the importance of maintaining good oral health. They are better educated, more politically astute, and more willing to accept social services than ever before.² This age group is also healthier and more likely to have their own teeth compared to the generations before them.^{1,2,3} However, despite their increased awareness and ability to advocate for themselves, barriers to accessing oral health care for seniors remain.^{1,3} The older adults in attendance at the panel discussion confirmed this reality, expressing frustration over both the ability to pay and, at a very fundamental level, the limited information on what dental services are available to them.

A growing concern is the fact that only 12% of seniors over the age of 65 possess the literacy skills necessary for making basic health-related decisions.⁵ It is critical to consider the literacy issue and to recognize it as another barrier to service, as it has been demonstrated that low literacy has direct and indirect impacts on health.⁶ One senior in attendance echoed this sentiment, calling for oral health-related material to be simple, to-the-point, and accessible through senior services on community websites.

It is important for dental hygienists to be sensitive to the unique aspects of Canada's senior population if we are to serve their needs effectively. Our profession should insist on more opportunities to be involved in community programs for seniors and improved access to preventive health clinics. Interestingly, this panel discussion provided a unique opportunity for interprofessional collaboration. By simply sitting next to someone at the event, one dental hygienist was able to connect with the executive director of an active living seniors' organization. Plans are now in the works for collaborating to provide current oral health information to seniors who are involved with that group.

Partnerships with programming initiatives for seniors support knowledge exchange on oral health concerns among individuals, their caregivers, and policy makers.^{1,3} As is the case with the advent of nurse practitioners in the nursing profession, alternative roles for dental hygienists may emerge to help improve access to care for underserved populations, including seniors.⁷ While it is important for the dental hygiene profession to remain true to its traditional roles and core services, it should also pay attention to these trends and opportunities and become agents for change.

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A dental hygienist's journey through oral cancer treatment

Marcia Eaton, RDH

This was not how it was supposed to be. Life was great. I was five years into my dental hygiene career, had just bought my first home, and had just met the man of my dreams. Then along came cancer.

It all started when I was getting ready for bed one night. Being the studious dental hygienist that I am, I was busy brushing and flossing my teeth when I felt a stinging sensation on the left lateral border of my tongue. Upon further investigation, I noticed a lesion on my tongue that I remembered from my oral pathology class five years earlier. I knew it was not a good thing, but did not assume it to be something life threatening at the time.

It took a week but I finally made the time, or maybe got the courage, to show my employer the sore on my tongue. He took one quick look at it and, the next thing I knew, he referred me to an oral surgeon to have the lesion examined more closely.

The following afternoon I found myself at the oral surgeon's office being told that I was going to have a biopsy done on my tongue. At that point, I was a little more curious about what the sore could be, but still was not thinking of cancer at all. More denial? Maybe. Probably.

Two days later, I was being sedated for the biopsy of my tongue. When I woke up from the procedure, the oral surgeon was there to tell me that everything went well and that he wanted to see me soon to give me the results. The appointment was arranged for the very next day at 5:00 PM—the Friday before Thanksgiving weekend. Unfortunately, at that appointment the oral surgeon had some bad news for me. He told me in the kindest and most caring way possible that I had squamous cell carcinoma of the tongue. Every word he said after that was very difficult to discern. It was like he was on one side of a water-filled tunnel telling me information and I was on the other side straining to hear. Thank goodness for appointment cards with addresses and telephone numbers on them.

The rest of the long weekend was spent trying to figure out “why me?” and “will I live through this?” all the while trying my best to enjoy my 30th birthday and Thanksgiving. There was not a lot of sleep to be had by me or my loved ones but we found the strength to begin this journey together.



Marcia Eaton

The appointment card that I was given by the oral surgeon was for an oral medicine specialist at the Cancer Agency in Vancouver. This would be the first of many steps in my oral cancer treatment journey.

STEP 1: The treatment plan

I first found myself at the oral medicine clinic at the Cancer Agency. This was where I met the oral medicine specialist who, with a kind and gentle voice, let me know what the plans were going to be for my treatment and also what the plans were going to be for the day. He

told me that I had Stage II squamous cell carcinoma of the tongue and that first, there would be surgery. Then, there would be radiation therapy. No chemotherapy was planned as he said “this type of cancer does not respond well to chemotherapy.” The plans for the day were to compile information about the tumour in order to have a baseline for treatment. So, there were photos taken both without and with toluidine blue (very sour-tasting stuff) and measurements taken of the tumour. Brush cytology was also done. I met briefly with the radiation oncologist who was going to follow me through my radiation treatment after surgery. Then I was moved to another part of the building to have a CT scan.

I waited quite a while for my turn for a CT scan. It was busy there, with other people showing the same looks of confusion and fear on their faces as I. All was a blur and I found it hard to breathe. In time, I was able to find my breath again and I was welcomed into the room where the scan was taken. Then I was off to see the surgeon who was going to remove my tumour.

The ENT (ear, nose and throat) surgeon was another doctor on my dream team that had been assembled to make me better. This appointment was short and sweet. The surgeon took one quick look at my tongue and said, “Yep, that’s squamous cell carcinoma,” and was out the door. Before I knew it, that visit was done and I was back at the oral medicine clinic being given my surgery date.

STEP 2: Surgery #1

About one week after the visit with the ENT surgeon, we met again in a surgical suite at Vancouver General Hospital. I

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was already prepped for surgery and asleep when he began a two-and-a-half-hour operation to remove the tumour on my tongue. When I woke up after surgery, the surgeon was at my bedside to let me know how it had gone. He had removed almost half of my tongue. Most of the tumour was at the posterior third of my tongue so he managed to save the tip of my tongue, which was very good news as it would make eating and talking much easier to do. The downside was that he was not sure if he had gotten all of the cancer out. He wanted me to have appointments with him every other week until further notice ... OK. Couldn't argue with that. But it made me anxious to think that there might be more cancer lurking around in my body.

I spent four days recovering in hospital before I was allowed to go home. During that time I was given some exercises to do for my tongue so that my speech would be maintained after healing. I was also given lots and lots of soft foods to eat. That continued on at home. Soft food tastes better at home.

I stayed faithful and attended every appointment booked for me right until Christmastime. All was looking good until I was in the middle of a two-week break in appointments between Christmas and New Year's Day. That was when I started to feel a lump in my neck.

STEP 3: Surgery #2

When I returned in the new year for a monitoring appointment, the lump in my neck was definitely there for all to see. During this appointment, the radiation oncologist was examining me and ordered a fine needle aspiration of the lump in my neck. Strangely, the procedure was not uncomfortable at all. I later learned that no discomfort was a sign that the lump was a cancerous tumour. The cancer had spread to my lymph nodes on the left side of my neck. It was time for a second surgery. All I could think was "Man oh man, here we go again." I wasn't sure if I would have the energy to fight again. But I had to.

The second surgery was performed by the same ENT surgeon and, this time when I woke up, he had a big smile on his face. He let me know that the surgery had gone very well and that only 1 of the 100 or more nodes removed was affected by the cancer. The only concern was that the cancer was not fully encapsulated in the lymph node. This meant that the cancer had grown from the centre of the node towards the outside and had just started to break down the outside layers of the affected lymph node. The cancer might have found its way out of the lymph node slightly. I had a choice here. If I went with no radiation therapy, I had a 50% chance of survival. If I went ahead with radiation therapy, my chance of survival increased to 85%. In spite of the short- and long-term side effects of radiation therapy, I found the choice easy. I went ahead and took the next step in my journey.

STEP 4: Radiation therapy—preparation and treatment

Radiation therapy began six weeks after surgery. Before then,

there were a few things that I had to do to prepare. I needed to have a clear plastic mask custom made, which would go over my head and neck and secure me to the radiation unit's bed to keep me very, very still during treatment. Making the mask involved taking a casting of my head and neck (using the same material that is used for casting a broken arm) and then fashioning a clear plastic mask from the mold. This was another tricky time for me as my claustrophobic tendencies made it difficult to have casting material all over my face with only two straws to breathe from until the cast hardened and could be removed. Yikes!

The next part was to mark out the area to be radiated while I was wearing my newly made custom mask and was fastened to the bed of the linear accelerator. (A linear accelerator is a radiation unit that delivers the dose of radiation to the patient.) The radiation oncologist marked out the area to be treated and then he and other members of the radiation therapy team calculated what type, how many doses, and for how long I would have radiation therapy. The consensus was external beam therapy five times per week, in increasing doses over four weeks, making 20 visits in all.

The first two weeks of therapy were fine. I had a very short period of time in the linear accelerator and felt no side effects. By the beginning of the third week, however, the time in the linear accelerator was increasing and I was starting to get more tired, had lost some hair, and was starting to notice a radiation burn in the treated area. I thought to myself, "Cancer patients lose their hair and here I am losing some of mine." Cancer had finally become real in my mind and it was happening to me.

After the fourth week had come and gone, I was having three-hour naps in the afternoon and full ten-hour sleeps at night. My radiation burn was bright red and I was feeling a little nauseated. I was, however, prepared for this as I had been told by the doctors that I would feel the worst effects of the radiation about two weeks after treatment was completed. All was good. I was finished treatment and now it was time to recover.

In time, I slowly returned to work. The way I conduct my appointments with patients now has changed. I spend more time with intraoral and extraoral checks, and I pay close attention to any trigger phrases or answers in peoples' medical histories. In private practice, I now have lesion tracking sheets available to make notes on any lesions seen. I also will take a photo, if possible, to aid myself and the dentist in monitoring lesions. So far, thankfully, I have not seen any oral cancers other than my own. I have, however, pointed out other things to my employer that he confirmed needed attention. One or two of them have saved lives.

It has been 17 years since that fateful change of plans in my life. I learned a lot during that time both about myself as a person and about myself as a dental hygienist. I continue to enjoy being a dental hygienist and spending time with the people and things I love. Life is good and I'm soaking it up.

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Treatment modalities of oral cancer

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ABSTRACT

Almost two-thirds of oral cancer patients are diagnosed at a late stage, leading to extensive treatment and low survival rates. Dental hygienists have frequent contact as oral care providers for oral cancer survivors and should have a basic awareness of the various treatments for oral and oropharyngeal cancer. **Objective:** The aims of this article are twofold: 1) to describe the 3 main treatment modalities for oral squamous cell carcinoma (SCC) and their associated side effects; and 2) to assist the dental hygienist in client education. **Method:** Articles reviewed include those on the treatment modalities of oral cancer published since 1992, retrieved from databases such as Google Scholar, PubMed, and ScienceDirect. **Results and Discussion:** The extent and type of therapy are weighed according to individual patient risk factors, tumour features, and the effects that treatment might have on the patient's quality of life. Single treatment modalities such as surgery and radiation alone are more commonly provided for early-stage cancers, while patients with advanced disease are treated with a combination of 2 or all 3 of the treatment modalities: surgery, radiation, and chemotherapy. **Conclusion:** With improvements in oral cancer treatment, there has been a significant increase in local–regional disease control and overall survival rates. Despite these results, there is still a need to coordinate care between specialists and primary care providers to ensure that both oral and overall health needs are met and to reduce the risk of recurrence and the emergence of second primary tumours.

RÉSUMÉ

Près des deux tiers des patients ayant un cancer buccal sont diagnostiqués tardivement, ce qui mène à un traitement extensif et à de faibles taux de survie. Les hygiénistes dentaires ont souvent des contacts en tant que dispensatrices de soins pour les survivants d'un cancer buccal. Elles devraient alors avoir une sensibilisation de base aux traitements du cancer buccal et oropharyngien. **Objet :** Cet article a un double objet : 1) description des 3 principaux modes de traitement du carcinome des cellules squameuses (CCS) buccales et des effets secondaires associés; 2) assistance aux hygiénistes dentaires pour l'éducation de la clientèle. **Méthode :** Les articles revus comprennent ceux qui traitent des modalités de traitement du cancer buccal, publiés depuis 1992 et puisés dans des bases de données telles que Google Scholar, PubMed et ScienceDirect. **Résultats et Discussion :** L'étendue et le type de thérapie sont pondérés selon les facteurs de risque individuels du patient, les caractéristiques de la tumeur et les effets possibles du traitement sur la qualité de vie du patient. Les modalités de traitement unique, telle une seule chirurgie ou radiation, sont dispensées plus souvent pour les cancers à leur début, alors que les patients dont la maladie est à un stage avancé reçoivent une combinaison de 2 ou 3 modalités de traitement : chirurgie, radiation et chimiothérapie. **Conclusion :** Avec l'amélioration du traitement du cancer buccal, les taux de contrôle local et régional et les taux généraux de survie ont augmenté considérablement. Malgré ces résultats, il est encore nécessaire d'avoir des spécialistes et des fournisseurs de soins afin d'assurer la satisfaction des besoins pour les deux types de soins de santé, buccale et générale, et réduire le risque de récurrence et d'émergence de secondes tumeurs primaires.

Key words: adverse effects, dental care, drug therapy, general surgery, molecular targeted therapy, mouth neoplasms, neck dissection, radiotherapy, squamous cell carcinoma, therapeutics

INTRODUCTION

Oral cancer has a global 5-year survival rate of about 50%, and is diagnosed annually in more than 4000 Canadians and 270,000 people worldwide.^{1,2} Almost two-thirds of oral cancer patients are diagnosed in the late stages of disease when the tumours are large and have spread to the lymph nodes, requiring more extensive treatment and resulting in higher mortality and morbidity rates, and a decreased quality of life.³ Ultimately, the aim of oral cancer treatment is to treat the primary tumour, preserve or restore anatomy and function, and limit recurrence and emergence of a second primary tumour.⁴ While some oral cancer survivors may receive dental hygiene treatment

within a cancer centre, it is likely that many oral cancer survivors will receive their dental hygiene therapy at a private dental office. Dental hygienists must be aware of the types of treatment that oral cancer patients receive and be cognizant of the effects that these treatments may induce. This knowledge would not only assist the dental hygienist in client education and oral self-care, but would also lead to improving overall client care. Since more than 90% of oral cancers are squamous cell carcinoma (SCC), the objective of this article is to review the three main treatment modalities for oral SCC, the factors affecting treatment choice, and the effects of such treatments.

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METHODS

A search of Google Scholar, PubMed, and ScienceDirect for full-text articles published since 1992 was undertaken, using the following key words: oral cancer or head and neck cancer, treatment modalities, surgery or resection, neck dissection, radiotherapy or radiation, chemotherapy, targeted therapy, chemoradiation, and side-effects or toxicities. Articles included peer-reviewed meta-analyses, randomized control trials, cross-sectional and cohort studies that addressed the treatment of oral cancer. Literature reviews and statistical databases were examined mainly for background information. Grey literature was also consulted. Excluded from this review were case studies, statements of expert opinion, and articles not published in English. While over 50 articles fulfilled the inclusion criteria, only 38 articles were included in the literature review.

RESULTS AND DISCUSSION

All 3 main treatment modalities—surgery, radiation (RT), and chemotherapy (CT)—are used to treat oral cancer, either alone or in combination.^{4,5} In general, single modalities are more commonly used in early-stage SCC (Stages I & II) and carcinoma-*in situ* (CIS), while patients with advanced disease (Stages III & IV) are treated with a combination of therapies (Table 1).^{4,6-8} The type and extent of treatment are determined by factors associated with the tumour, the patient, and the medical team.⁷ Tumour characteristics such as site, proximity to bone, the depth of invasion, and stage (tumour size, lymph node involvement, and risk of metastasis) are considered along with the age of the patient, co-morbidities, compliance to treatment, and the desire to make lifestyle changes.⁷ Expertise of the medical team will also influence the treatment decision.⁷ The likelihood of treatment side effects, both short term and long term, and how they may affect the quality of life for the cancer survivor also impact any final treatment decision.^{4,5}

Surgery and neck dissection

Surgery is the most common treatment for oral cancer.⁷ For more advanced tumours surgery is combined with local RT and/or systemic CT.^{4,5,8} The intent of surgery is to completely remove cancerous tissue, leaving histologically normal tumour margins while attempting to preserve normal tissue and function.^{7,9,10} Surgical techniques vary as a result of access and the size of the lesion to be excised. Ideally the surgeon can excise smaller tumours from within the oral cavity. However, larger tumours and those in difficult-to-access sites may require an approach from outside the oral cavity and the removal of both soft tissue and bone. Cheek flaps may be required, either from the floor of the mouth up to access the mandible (lower cheek flap) or from below the eye and down to approach the maxilla (upper cheek flap).⁷ Mandibulectomy or maxillectomy occurs when all or part of the mandible or maxilla is removed. A visor flap is when an incision is made under the chin from side-to-side and the skin is pulled up over the chin and oral cavity.⁷ This technique avoids cutting the lower lip and facial aspect of the chin, while allowing for good access to the anterior aspect of the oral cavity.⁶ More advanced oral cancers may involve the lymph nodes. Positive or suspicious lymph node involvement may require a radical neck dissection, while elective neck dissections are sometimes undertaken even when the lymph nodes are negative to prevent the risk of metastasis.^{4,6,7,9} The level of neck dissection is associated with the number, size, and site (same side, opposite side or both sides) of the lymph nodes.^{4,6,7} In recent years, new technology and techniques have minimized the extent and invasiveness of surgery.^{6,7} These efforts to reduce extensive surgery have resulted in decreased morbidity, increased function, and an overall benefit to the rehabilitation of the patient.^{6,7,10,11}

A new development in surgery is the use of autofluorescence to improve visualization and to delineate the lateral spread of the tumour.¹² Under direct fluorescence visualization (FV), the oral mucosa is exposed to high-

Table 1. General treatment modalities and method of action for different stages of oral cancer

Stages of cancer	Type of treatment	Intent/method of action
Early stage	Surgery and/or neck dissection	Remove cancerous tissue (leaving histologically normal tumour margins) while preserving normal tissue and function.
	OR Radiation	Destroy DNA in dividing cancer cells in a localized region, leaving the target and adjacent tissue intact and preserving a higher degree of function.
Late stage	Surgery and neck dissection and/or radiation	Both remove and destroy cancerous tissue DNA, optimizing the therapeutic effects.
	OR Surgery and neck dissection, radiation and/or chemotherapy	Excise and rapidly inhibit dividing abnormal cancerous cells in order to manage spread and metastasis.
	OR Surgery and neck dissection, radiation and/or targeted therapy	Excise and increase the cytotoxic effect that leads to tumour destruction by blocking EGFR and specific enzymes, altering protein function, increasing apoptosis, and preventing angiogenesis.

energy (blue) light, which excites the normal fluorophores in the cells and tissue, which in turn emit a lower-energy light (green) back out of the tissue.¹² In cancerous tissue, however, the fluorophores are altered and no longer fluoresce, making the cancerous tissue appear much darker than normal tissue under FV.¹²⁻¹⁴ In a pilot study, Poh et al. concluded that FV is able to detect all severe dysplasia and malignancies at the time of surgery, even when the tissue appears clinically normal.¹² Of interest, none of the patients who had FV-guided surgery for SCC, CIS or severe dysplasia suffered a recurrence compared to 25% of the patients who received surgery without the use of FV ($P = 0.002$).¹² In biopsies taken from FV-positive tissue 10 mm or more beyond the clinical border of the tumour, 32 of 36 tissue samples showed some form of histological anomaly: 7 were SCC or CIS; 10 were severe dysplasia; and 15 were low-grade dysplasia.¹³ In comparison, of the 66 biopsies taken from FV-negative areas, only one had mild dysplasia.¹³

Following the excision of the tumour, reconstructive surgery is required to restore any loss of function and/or aesthetics.⁷ Small surgical defects can be covered with split-thickness grafts, while more extensive defects require tissue grafts taken from the forearm.^{7,15} When a segment of the mandible is removed, bone from the fibula is typically the first source for mandibular reconstruction.⁷ The location, size, and extent of reconstruction are the main factors that contribute to the choice of graft, as is the need for soft and hard tissue coverage.⁷ Defects in the oral cavity or dentition may also require prosthetic devices, such as obturators, dentures or implants.⁷

Radiotherapy

There have been significant changes in RT in recent years, from new methods of delivery to variation of delivery schedules. The changes were made to improve treatment outcomes, preserve tissue, and reduce side effects.⁸ In general, the intent of RT is to destroy DNA in dividing cancer cells in a localized region while preserving adjacent tissue and function.^{4,5} RT as a single, primary treatment is not generally used for oral cancer, although it may be used as a sole method of treatment in cases where the location of the tumour makes it difficult to excise, such as the oropharynx, or if the patient refuses surgery.^{4,5,15} RT alone has a similar 5-year survival rate to surgery for early-stage disease, with a 37% local recurrence rate.^{16,17} In comparison to surgery alone, RT produces milder complications and offers better retention of function and aesthetics, and improved quality of life.^{4,5} The use of surgery and postoperative RT is a common combination in oral cancer treatment, used for large tumours and when surgical margins are positive for cancer.^{4,5} RT is usually administered after surgery, as surgery following RT would be hampered by poor healing and an increased risk of infection.⁴ RT combined with CT is the preferred treatment of oropharyngeal cancers.⁷

The two main types of RT are external beam radiation and brachytherapy.⁵ Brachytherapy, a form of internal radiation, involves the precise surgical placement of a radioactive insert into the tumour, directly treating the tumour.⁵ However, it is restricted by the size of the field that it can target effectively.⁵ Brachytherapy can also be used in conjunction with external beam radiation. External beam radiation is provided as a daily outpatient treatment, over the course of about 6 weeks, using a linear accelerator (LINAC) that focuses radiation on the tumour site.⁵ While it is a very effective cancer treatment, it also unfortunately affects the normal surrounding tissue and the normal tissue through which it travels to reach the tumour site.⁵ External beam radiation is the more common form of RT for the treatment of head and neck cancers.⁵

Traditional and current radiotherapy

In traditional external beam radiation, “shrinking fields” are used to deliver different doses to different regions of disease.⁵ “Shrinking fields” refer to a technique in which the most sensitive organs are irradiated first and blocked, treating the overlying low-risk organs next with more superficial radiation.⁵ The high-risk areas surrounding the tumour, grossly involved lymph nodes, and the tumour itself are treated last with the highest dose of tolerable radiation.⁵ It is imperative that areas surrounding the tumours receive a high amount of radiation as they may contain genetic changes that may lead to secondary malignancies.⁵ A full treatment of radiation is divided into smaller amounts known as fractions or doses. Radiation doses vary; generally 1.8 to 2.0 Gray (Gy) are delivered daily, 5 days a week, Monday to Friday.^{4,5} Treatment continues over the course of 6 weeks for a total of 30 fractions, until a maximum of 60 Gy is provided.^{4,5}

Current approaches to RT include 3-dimensional conformal radiation therapy (3D-CRT), intensity modulated radiation therapy (IMRT), and volumetric arc therapy (VMAT).^{4,5,15,18,19} These techniques have been developed both to deliver radiation to the tumour more precisely while protecting normal tissues and to allow for flexibility to alter the dose.^{5,15} 3D-CRT delivers beams from 3 dimensions versus the traditional 2, while IMRT provides even greater control by using beams of different intensities from a variety of dimensions.^{15,18,19} VMAT is a further extension of IMRT, delivering a higher dose faster to the whole tumour volume simultaneously either in a single arc or series of arcs.¹⁸ Su et al. concluded that using IMRT for early-stage nasopharyngeal cancer had 5-year local-regional control rates of about 97%, with similar local recurrence-free and distant metastasis-free survival rates.²⁰ VMAT attained similar results, further reducing treatment time and sparing more normal tissue.^{18,19}

Two more recent advances in RT are altered fractionation and concurrent systemic chemotherapy.^{4,5} Altered fractionation refers to changes in the dose per fraction, the number of fractions delivered per day, and

the overall duration of treatment.²¹ Altered fractionation can further be divided into hyperfractionation and accelerated fractionation.^{5,15} Hyperfractionation provides smaller doses per treatment but delivers 2 fractions per day²¹ for the same or longer time period so that a greater overall dose can be delivered to the tumour. In contrast, accelerated fractionation delivers the total dose over a shorter time period, usually with greater doses per fraction or multiple doses per day.²² By increasing irradiation intensity, accelerated fractionation reduces the risk of repopulation of cancer cells, which may follow delays in treatment.¹⁵ In a meta-analysis comparing the efficacy of hyperfractionation and accelerated fractionation in late-stage disease, the authors found that both significantly improved patient survival rates.²³ Both altered fractionation and hyperfractionation had a slightly higher 5-year survival rate than traditional RT.²³ Lastly, with the purpose of attaining radiosensitization, concurrent chemoradiation (CRT) is the addition of a chemotherapeutic drug to RT.^{4,5,15,24} These drugs make the target tissue more sensitive to RT than the surrounding normal tissue, thereby increasing RT efficacy.²⁵

Chemotherapy and targeted therapies

In the past, CT was primarily a palliative treatment for oral cancer. With the discovery of new drugs, CT has become a significant curative treatment in advanced oral cancer.^{4,5,15} The purpose of CT is to destroy dividing abnormal cancer cells rapidly in order to manage spread and metastasis.^{4,5} CT affects frequently dividing cells, such as those in the oral cavity, skin, bone marrow, alimentary tract, and hair follicles.^{4,5,7,8} Current CT techniques have been shown to reduce toxicities, spare sensitive organs such as the spinal cord, optic nerve, and parotid glands, and decrease treatment time while still maintaining quality and accuracy.^{4,5} Overall, CT offers enhanced local control, improved disease-specific survival rates and can contribute to an enhanced quality of life.^{4,5}

The delivery of CT can be divided into three categories: induction CT (before surgery), concurrent CRT (in conjunction with radiation treatment), and adjuvant CT (after surgery and/or radiation).^{4,5} Induction therapy is used primarily in patients who have advanced stage disease and nodal involvement, and in patients at the greatest risk of recurrence, second primary tumours, and metastases.⁵ As CT is the initial therapy, it can be distributed systemically in blood vessels not yet harmed by radiation, with less concern about toxicities, healing, and immunosuppression.⁴ Advantages include the ability to measure tumour response, inhibit extrascapular spread, and prevent metastasis early on, resulting in a significant improvement of local-regional control and overall survival.^{4,15,26,27}

Concurrent CRT, however, has produced more effective results than induction CT.^{5,27} By combining a chemotherapeutic agent with radiation, the efficacy of RT is

increased and results in better tumour control and survival rates.^{5,24} The combination of induction and concurrent CRT produces even more beneficial effects.^{5,27} Adjuvant CRT is used as a last effort to completely eradicate advanced disease and metastasis.^{4,5}

In general, the common classes of chemotherapeutic agents include platinum compounds (cisplatin and carboplatin); antimetabolites (methotrexate and 5-fluorouracil); taxanes (docetaxel); plant alkaloids; hydroxyurea; anthracyclines; and most recently taxoids.^{15,27} A combination of 5-fluorouracil, docetaxel, and cisplatin has been shown to be efficacious in induction therapy, while more commonly the platinum derivative cisplatin is used for induction therapy alone.^{4,5,15,27}

Other novel treatments still in development include the use of targeted therapies. The main agent is cetuximab, a monoclonal antibody that is intended to target the epidermal growth factor receptor (EGFR).²⁷ The EGFR is overexpressed in epithelial cancers such as oral SCC, and can be enhanced with the addition of RT leading to poor treatment results.²⁷ Cetuximab inhibits EGFR, thereby increasing the efficacy of RT.^{4,5,27}

Patients who receive CRT following surgery have better local-regional control and better overall survival rates than patients who receive only radiation postsurgery.^{15,24} In a recently updated meta-analysis by Pignon et al., both radiation alone and CRT improved local-regional control and reduced mortality.^{28,29} The combination of cetuximab and radiation, however, was significantly more efficient in patients with advanced stage disease.^{30,31}

Side effects

Oral cancer patients undergoing treatment suffer a range of side effects, both physical and psychological. These side effects can have short-term or more long-term complications (Table 2). Cancer survivors of all types may face serious late effects including an increased risk of recurrence and second primary tumours, as well as cardiovascular, renal, and lung complications.³² Oral cancer patients treated with surgery may have difficulties swallowing, eating, and speaking while the tissue damage as a result of their disease and subsequent treatment may also lead to nerve pain, altered sensation or total loss of sensation.^{33,34} Anatomical changes may cause cosmetic disfigurement requiring extensive reconstruction and rehabilitation. Neck dissections to remove positive lymph nodes may result in further pain and nerve damage, limited movement or loss of function of the neck and shoulder area.³⁵ All of these effects can lead to psychological and social problems, reducing the patient's quality of life.^{4,36}

The short-term effects of RT are more well known than the late and long-term effects.²⁵ In the short term, RT can result in mucositis (more than 50% of patients), loss of taste, hoarseness and pain, as well as dermatitis, radiation burn, and an increased susceptibility to infection.^{5,8,37} For more than 60% of patients, xerostomia will be long term,

Table 2. Short- and long-term effects of oral cancer treatment modalities

Treatment modality	Short-term effects	Long-term effects
Surgery	Difficulty swallowing and speaking Anesthesia Paresthesia	Tissue and bone loss Functional problems Cosmetic concerns Difficulty swallowing and speaking
Radiation	Mucositis Altered taste Decreased saliva Increased risk of infections (e.g., <i>Candida albicans</i>) Trismus	Xerostomia Increased risk of periodontal disease and caries Subcutaneous fibrosis Postradiation osteonecrosis Telangiectasia
Chemotherapy and targeted therapy	Nausea and vomiting leading to enamel erosion Mucositis Skin rash Increased bleeding	Bone marrow suppression, increasing the risk of infection Neuropathy Loss of appetite Possible renal, pulmonary, and ototoxicity
Surgery and chemoradiation	Mucositis Stomatitis Xerostomia Altered taste Pain	Tissue and bone loss Increased risk of periodontal disease and caries Bone marrow suppression, increasing the risk of infection

a major concern for dental professionals as it significantly increases a patient's risk of caries and periodontal disease.^{5,8,37} Other long-term effects on both soft and hard tissue include poor wound healing, taste impairment, difficulty swallowing, tissue fibrosis, osteoradionecrosis (ORN), and telangiectasia.³⁸ ORN, chronic ulcers, and telangiectasia may not appear until many years after RT has been completed.³⁸ ORN is non- or slow-healing bone damage as a result of radiation-induced hypovascularity and hypoxia in the bone.³⁹ The mucosa overlying the bone breaks down and the necrotic bone is exposed. The purpose of RT is to destroy cancer cells, but it also destroys normal cells including those involved in the circulation of blood to the bone. The poor blood supply reduces the tissue's ability to heal, and post-RT extractions and surgery increase the risk of ORN. Because of the high risk of ORN, some patients require hyperbaric oxygen therapy prior to dental extractions. Maintaining the health of the teeth and periodontal tissues is vitally important (see Rhodes-Nesset and Laronde⁴⁰ in this issue for details).⁴¹ If the field of RT includes the neck, then damage to the thyroid gland may also occur.¹⁵

Since chemotherapy is delivered systemically, it can have more generalized effects on the body than localized treatment, and has a greater possibility of being more life threatening.⁴ Patients receiving CT for cancers at other sites outside the head and neck will still suffer from the oral side effects of treatment. Cardiovascular, cerebrovascular, and pulmonary complications have been associated with CT.⁴² Many drugs will cause nausea, vomiting and diarrhea, mucositis, and haematologic toxicity.^{5,37} Other drugs, such as cisplatin, can cause

hearing loss, myelosuppression (decreased bone marrow activity), renal dysfunction, and neuropathy.^{5,24} Side effects are dose dependent and are greatly affected by patient age, overall health, and mental deterioration.^{5,15}

Among late-stage cancer patients, CRT increases the adverse effects of both RT and CT, and hence has about twice as many side effects than each therapy alone.⁴³ Approximately 40% of patients who receive CRT suffer from severe late toxicity.⁴³ The severe toxic effects include hypomagnesaemia, myelosuppression, neutropenia, and general haematologic toxicity, as well as more common outcomes such as mucositis, dermatitis, stomatitis, and xerostomia.^{15,24,30} Changing the treatment regime or modifying the dose might be necessary to reduce side effects, yet it should stay within optimal therapeutic range.⁴

Approximately 30% of oral cancer patients will suffer a recurrence or a second primary oral cancer.⁴⁴ While most recurrences will occur within the first few years following treatment, some second primary oral cancers can occur many years after the end of treatment.^{44,45} Due to the high risk of secondary oral cancers, patients with a history of oral cancer should be followed and screened regularly.

CONCLUSION

Advances in the treatment of oral cancer have improved outcomes for those diagnosed with the disease. These improvements have led to a significant increase in local-regional disease control and overall survival rates. This is particularly true for oral cancer diagnosed at an early stage, which is often treated with surgery or radiation alone.^{4,24} For late-stage disease requiring CT or a combination of surgery and CRT, the results remain promising but are

still in need of improvement.⁴ Individual patient factors, tumour features, lymph node involvement, and metastasis have to be taken into account for optimal treatment effectiveness.^{4,5,7} Comorbidities and both short- and long-term treatment side effects must also be examined when creating individual patient therapies.^{4,24,36,37} The purpose of monitoring patients following therapy is to a) provide care for the sequelae of treatment side effects; b) to coordinate care between specialists and primary care providers to ensure that both oral and overall health needs are met; and c) to prevent and identify recurrence or the development of

a second primary tumour.⁴² To provide satisfactory care to this complex group of patients, it is important that dental hygienists understand the various treatment modalities for oral cancer and their possible effects. The patient's hygiene maintenance schedule will result in the dental hygienist's being one of the dental health professionals who is frequently in contact with the patient. Continued surveillance is essential in order to reduce the risk of secondary oral cancers and assist in improving a patient's quality of life and overall survival.⁴

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Dental hygiene care of the head and neck cancer patient and survivor

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ABSTRACT

Dental hygienists, by virtue of their recare schedule, may have the most frequent contact with the cancer survivor. The effects of cancer continue long after the patient completes treatment, and the sequelae of cancer treatment can often be debilitating. The dental hygienist plays a valuable role in the multidisciplinary health care team that follows a head and neck cancer patient. **Objective:** The objective of this article is to provide dental hygienists with a brief overview of the effects of cancer treatment on dental clients and the role of the dental hygienist both prior to and after treatment, with particular focus on head and neck cancers. **Methods:** A review of the oral cancer literature in PubMed and Google Scholar on dental care before and after treatment was conducted and included articles published since 1998. **Results and discussion:** Oral cancer survivors have difficulty eating, speaking, and swallowing as a result of treatment. Radiation therapy presents the most challenges, with patients suffering from hyposalivation, tissue changes, osteoradionecrosis, radiation caries, and an increased risk of clinical attachment loss. Chemotherapy may cause mucositis of the oral cavity and GI tract. Education and treatment prior to cancer therapy can minimize some treatment effects. **Conclusion:** Dental hygienists provide services that can both prevent and aid in the management of the oral complications of cancer treatments. It is important that dental hygienists be aware of and understand the methods for care of these patients.

RÉSUMÉ

Grâce à leur suivi des soins, les hygiénistes dentaires peuvent avoir les contacts les plus fréquents avec les survivants du cancer, dont les effets continuent longtemps après que le patient a terminé son traitement; il peut arriver souvent que les séquelles du cancer soient débilantes. L'hygiéniste dentaire joue un rôle précieux dans l'équipe multidisciplinaire qui suit un patient atteint d'un cancer à la tête ou au cou. **Objectif :** Présentation aux hygiénistes dentaires d'un bref aperçu des effets du traitement du cancer chez les patients dentaires et du rôle de l'hygiéniste dentaire avant et après le traitement, mettant l'accent sur les cancers à la tête et au cou. **Méthodes :** Revue de la documentation de PubMed et Google Scholar sur les soins dentaires avant et après le traitement, incluse dans des articles depuis 1998. **Résultats et Discussion :** Les survivants d'un cancer buccodentaire ont de la difficulté à manger, parler et avaler comme résultat du traitement. La thérapie par radiation est celle qui présente le plus de défis chez des patients qui souffrent d'hypoptyalisme, de changements de tissus, d'ostéoradionécrose, de caries de rayonnement et d'un risque accru de perte d'attache épithéliale. La chimiothérapie peut causer une mucosité de la cavité buccale et d'un vaisseau GI. L'éducation et le traitement avant la thérapie du cancer peuvent minimiser certains effets du traitement. **Conclusion :** Les hygiénistes fournissent des services de prévenance et d'aide ainsi que de gestion des complications buccales des traitements du cancer. Il est donc important que les hygiénistes dentaires connaissent et comprennent les méthodes de soins pour ces patients.

Key words: chemotherapy, clinical compassion, dental hygiene care, hyposalivation, management, osteoradionecrosis, periodontal disease, prevention, radiation, radiation caries, squamous cell carcinoma, surgery

INTRODUCTION

In Canada, the prevalence of people living with a cancer diagnosis is increasing.¹ Early detection, improved access to care, and recent enhancements in treatment protocols are all improving cancer survival rates. Almost 840,000 (1 in 40) Canadians are living with a cancer diagnosis from within the last 10 years.¹ Head and neck cancer is a devastating disease, diagnosed in more than 600,000 people annually worldwide.² While surviving cancer is very good news, it places the onus on the dental hygiene profession to be aware of the long-term and late effects of cancer treatment on the dental client's oral health and what can be done to manage these effects.

METHODS

This review of the literature on head and neck cancer includes randomized control trials (RCT), literature and systematic reviews, and clinical case studies that explore the dental care of patients who have received treatment for head and neck cancer. The search strategy for this review was limited to articles published in English since 1998. Peer-reviewed, full-text articles were searched from PubMed and Google Scholar. The key words used were oral cancer or head and neck cancer; treatment modalities; long-term effects; late effects; oral side effects and toxicities; and dental care. Excluded were acute toxicities or information not applicable to dental hygiene practice.

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RESULTS AND DISCUSSION

The dental hygienist's role in treating head and neck cancer survivors

The dental hygienist's role in supporting the head and neck cancer patient's optimal long-term oral health and overall wellness is comprehensive and can be integral to improving the quality of life of the cancer survivor.³ As in other areas of dental hygiene practice, the emphasis when working with cancer patients is on prevention and management. These areas are important for 3 reasons: 1) to educate and reinforce daily oral health care during active cancer treatment or therapy in order to prevent or decrease oral complications arising from cancer treatment; 2) to manage a patient's existing oral condition, both pre- and post-cancer treatment; and 3) to support a patient's oral function management or rehabilitation following cancer treatment. Indeed, the dental hygienist plays an important role throughout the patient's cancer journey.

Because of the complexity of cancer treatment and the multidisciplinary nature of the health care team, each cancer patient's treatment is individualized.³ Beyond the physical concerns, these patients may face psychosocial and quality of life issues.⁴ A patient-centred focus with active listening and open-ended questions will communicate clinical compassion to the person living with a cancer diagnosis. This attitude of dignity reflects understanding and respect in a non-judgmental way.

Cancer treatment: Curative or palliative?

There are two categories of cancer treatment—curative and palliative—that a patient may receive depending on the location, stage of cancer, and expected outcome. Curative treatment is provided when it is expected that treatment will cure the disease or place the patient in remission. Palliative treatment provides support for the patient, such as pain control, emotional support, and strategies to reduce symptoms and side effects. Patients may receive a single mode of treatment, such as surgery or radiation therapy for early-stage cancers, or a combination of treatments that may include surgery, radiation and/or chemotherapy for more advanced cancers.⁵ In-depth information on the types and delivery of treatment is described by Prelec and Laronde⁶ in this issue.

Some cancer patients may receive a variety of ongoing (palliative) treatment for the relief of symptoms after the primary treatment has been completed.⁷ Given the complexity of their care and easy access to their medical information, some palliative patients may prefer to receive their dental hygiene care within provincial cancer centres or hospitals. However, for supportive or family reasons some patients may choose to remain in their home communities and access oral health care through their community dental or hygiene office. In our experience, patients in remission are quick to request a return to their community clinics, far removed from the institutional

setting of a cancer centre. The dental hygienist's awareness of cancer treatment options for either palliative or curative patients will ensure the development of appropriate hygiene therapy treatment plans.

Information needed prior to dental hygiene therapy

Collaboration and communication with both the patient and the patient's oncologists to determine current blood work and health status prior to dental hygiene treatment are critical. When chemotherapy has been used, the dental hygienist needs to be aware of the patient's immunosuppression levels by reviewing current blood work reports. Collaboration with the patient's oncologist is essential to ensure that it is safe to deliver dental hygiene therapy to this group of patients. Treatment such as scaling and root planing may be contraindicated in clients with neutropenia (low neutrophil count) and thrombocytopenia (low platelet count).⁴

Prior to dental hygiene therapy the clinician should obtain information from the oncologist regarding the type

Table 1. Complications of cancer therapy^{3,9}

Complication	Symptoms
Hyposalivation	Dry mouth, thick ropey saliva
Loss of sensory function	Alteration or loss of taste, bad breath, neuropathy
Limited opening	Pain and/or trismus in muscle, TMJ, neck, shoulder
Infection	Pain, odour, exudate, bleeding
Mucosal changes	Mucositis, halitosis, neuropathy, pain
Caries	Pain, lesions
Periodontal disease progression	Clinical attachment loss, mobility
Risk of mucosal injury	Pain
Osteoradionecrosis	Pain, bad breath, non- or slow healing soft tissue
Poor esthetics	Low quality of life, depression
Trouble speaking	Social withdrawal, depression
Trouble eating and swallowing	Limited energy, discomfort when eating

Adapted from Epstein et al³

and stage of cancer, date of diagnosis, and type of treatment (surgery, radiation and/or chemotherapy) planned. It is important during active cancer treatment to maintain, when possible, a normal self-care oral hygiene routine.⁴ Life-long oral complications from curative or palliative cancer therapy are a difficult reality that cancer patients attempt to accommodate in their daily living. The dental hygienist's role in the management and prevention of these side effects can significantly support the cancer patient prior to, during (if necessary) and after cancer treatment.

Cancer treatment(s) and oral complications

Table 1 summarizes the chronic oral complications that have a significant impact on a cancer patient's health and well-being. The dental hygienist has a professional and ethical responsibility to recognize and respond appropriately to these conditions as they present in the oral cavity.

Surgery

Head and neck cancer patients who undergo surgery may suffer from a limited mouth opening due to scar tissue; neuropathy; loss of sensation; difficulty swallowing and talking; and limited head and neck movement.⁸ Patients who have had a partial glossectomy for the treatment of tongue cancer will have restricted movement of the remaining tongue, resulting in increased biofilm levels due to decreased self-cleansing from tongue movement. A limited opening or tongue movement may also hamper oral hygiene self-care and the ability to deliver dental hygiene therapy.⁹ Patients with a limited mouth opening may also need referral for dietary counselling to prevent malnutrition.¹⁰ Scars and the borders of grafts should be monitored closely for new lesions or recurrences. After surgery the dental hygienist should provide education and support on the care of any prosthetic device, implants used in reconstruction, and tissue graft sites.¹¹

Radiation therapy

Radiation therapy (RT) is very likely to produce significant long-term effects in the oral cavity. One of the most common side effects of RT to the head and neck area is hyposalivation.¹² If the salivary glands are within the field of radiation, they will be damaged and this will affect the amount, consistency, and acidity of saliva.¹² The parotid glands appear to be particularly susceptible to radiation.¹³ Saliva plays a critical role in the oral cavity and is essential for speech, eating, and reducing the risk of infection.³ Hyposalivation (a decrease or lack of saliva) can lead to an increase in the risk of caries and oral infection.¹² While there are a multitude of homeopathic and commercial products available to help soothe the secondary effects of hyposalivation temporarily, these remedies should be considered an adjunct to daily oral care.¹³ It is important that the pH of any of these adjuncts be neutral or alkaline in order to prevent tooth erosion associated with acidic products.³

Hydration of the mucosal membranes may be achieved by frequent intake of water. Small sips of water, held in the oral cavity for a minute prior to swallowing, will assist in hydrating the membranes while milk products may be soothing and lubricating to the tissue.^{3,14} Sugary drinks, candies, and mouth rinses containing alcohol should be avoided; some patients prefer sugarless chewing gum or xylitol mints to stimulate saliva.^{3,12} Caffeine, tobacco, and alcohol should also be avoided as they can cause a further reduction of saliva.^{3,15} The use of nasal strips to open up

the nasal passages and a room humidifier to moisten the air may offer some relief from dry mouth while sleeping.³ Some patients may receive pilocarpine to stimulate the minor salivary glands or the major glands not affected by RT. In some cases, pilocarpine may begin prior to RT as this may result in better patient outcomes insofar as hyposalivation is concerned.^{16,17}

Patients who receive RT are also at risk for radiation caries, a rapid demineralization of the tooth structure that results from RT-induced hyposalivation, a decrease in the pH and remineralizing abilities of the saliva, possible alterations to the tooth enamel, dietary changes, and poor oral hygiene.^{12,16} Since swallowing can be difficult for these patients, they may rely on a softer or pureed diet.¹² Meticulous oral hygiene and a diet low in cariogenic foods are essential to prevent radiation caries.¹⁶ Continued daily application of fluoride is encouraged in the post-treatment phase, with high-risk patients using custom fluoride trays once a day, 5 days a week for 5-minute sessions.³ Calcium and phosphate supplements may also aid in remineralization and can be valuable additions to fluoride.^{3,16}

Osteoradionecrosis (ORN) is an area of exposed bone that fails to heal due to RT, believed to be a result of damage to the bones' blood supply.^{13,15,18} The incidence of ORN is higher in patients who had extractions or periodontal disease after RT, with the greatest occurrence in the posterior mandible.¹⁹ In these cases the oral mucosa is unable to heal or healing is delayed, resulting in bone exposure.¹² If ORN develops, the goal is to remove the necrotic bone and improve the blood flow to the tissue.¹⁶ Most ORN lesions may heal with minimal intervention while others may require more invasive treatment.^{15,19} The prevention of this complication by dental treatment and management prior to RT is critical.¹⁵ Dental extractions from the area that received RT should be avoided. If an extraction is necessary, it should be completed as atraumatically as possible by clinicians with experience in treating post-radiation therapy patients.^{15,19} Dental hygienists can help the patient by encouraging good oral hygiene and removal of debris and impacted food from the ORN areas and recommending the use of chlorhexidine mouthwash.¹⁵ The risk of ORN remains for the life of the patient.²⁰ The best prevention of ORN is a healthy dentition.¹⁹

RT may cause changes to the gingival tissues leading to hypovascularization and hypoxic tissue that affects the healing process. These conditions, coupled with decreased saliva, may lead to loss of clinical attachment.^{3,21-23} A post-RT assessment of periodontal status is recommended to determine the changes in periodontal attachment. Patients who receive RT are at an increased risk of recession and loss of clinical attachment.^{23,24} This change in clinical attachment levels puts the patient at risk for root caries, biofilm retention, and tooth sensitivity. Calculus deposits are often minimal after cancer treatments because of low or a lack of salivary production. Nonetheless, periodontal

therapy is essential to control inflammation, which may be more prominent in the cancer patient as a result of the diminished healing of the irradiated periodontium.¹⁶

Other side effects of RT include candidiasis and changes in the texture of the mucosa.¹³ The oral mucosa may display telangiectasia (small visible blood vessels) and fibrosis as a result of tissue damage from RT, and patients may experience neuropathy.¹² Tissue damage may make the identification of new lesions at the treatment site difficult.

Damage to the muscle may result in trismus, hence limiting the opening of the mouth and causing temporomandibular joint issues.¹² Daily jaw movement exercises, both up and down and side to side, along with warm compress and muscle massage may help prevent trismus. After radiation therapy some patients may undergo physiotherapy in an attempt to maximize the limited oral opening.¹² Limited opening of the oral cavity can lead to compromised oral hygiene, further increasing the risk of caries and infection.¹² Fortunately, recent advances in RT have minimized tissue exposure to radiation, and it is hoped that the effects of RT will be less significant as treatment techniques improve.¹³

Chemotherapy

Given the primarily systemic delivery of chemotherapy (CT), dental hygienists should be aware of its associated late effects even if the CT was not intended for a head and neck cancer. The use of CT for oral cancer has been limited in the past but is becoming more common as an adjunct to RT. Like RT, CT can weaken the immune system by decreasing the number of white blood cells or altering the way they work, thereby increasing the risk of infection and prolonging bleeding time due to decreased platelets.⁸ CT can have an impact on memory and comprehension resulting in a condition known as “chemo brain.”⁸ Mucositis is a side effect of both CT and RT and is difficult to prevent. Oral mucositis is inflammation of the mucosal lining and has various degrees of severity.^{12,25} Mucositis can cause pain and lead to trouble eating, swallowing, and speaking.²⁵ Bland mouth rinses of baking soda and water or topical analgesics can provide patient comfort from the burning sensation of mucositis.¹² Other long-term effects associated with CT include damage to the heart, decreased bone density, and fatigue.⁸ Dental erosion may also occur due to CT-induced vomiting. Dental clients who received CT for childhood cancers have a higher proportion of dental anomalies, such as microdontia and root malformation, and hence have greater dental needs.^{26,27}

Prevention of oral complications

The focus of oral health treatment plans prior to cancer treatment should be on the identification and management of existing dental disease and infection, with the intention of preventing or minimizing oral side effects caused by the cancer treatment.⁴ The pre-cancer treatment dental assessment is critical. If this assessment

is done outside of a cancer centre by a general dental office, consultation and collaboration with the patient’s oncology team is essential.¹⁷

The assessments, conducted by the oral health team and preferably completed 2 to 3 weeks prior to the start of treatment, include a dental exam, periodontal evaluation (which could be completed by the dental hygienist), and any necessary radiographs to assess the presence of active infection.^{12,15} It is imperative that the pre-treatment assessments be completed by clinicians who are experienced in cancer treatment and its potential side effects. Because this may not always be possible due to geographic concerns, all members of the dental team should be aware of the importance of this examination.¹³ The dental hygienist must know what kind of treatment the patient will receive, the dose, and, in the case of radiation, the area or “field” that will be exposed. Patients who will be receiving radiation to the head and neck area may need to have moderate to severe periodontally or endodontically involved teeth within the radiation field extracted by a dentist or oral surgeon prior to cancer treatment.^{15,28} The approach to these teeth is more aggressive than for periodontally involved teeth not undergoing RT because of the risk of ORN.¹⁵ The hygiene treatment plan recommendations must anticipate any changes, often permanent, that the oral cavity will undergo as a result of cancer treatment(s).³ At this time, the dental hygienist can review oral hygiene techniques, stress the importance of regular dental management, provide periodontal debridement, review the side effects of treatment, measure baseline salivary flow and maximum mouth opening, make custom trays for fluoride delivery, and assess the dental compliance of the patient.^{13,15,17} Thorough debridement will contribute to the pre-cancer treatment goal of achieving and maintaining a stable and infection-free oral cavity and reducing the risk of severe infection(s) during cancer treatments.^{4,11,29} Sato et al. found that patients who received periodontal debridement and oral health care instruction prior to surgery were less likely to suffer from an infection of the surgical site than those who did not receive it.²⁹ The completion of all dental work 14 days prior to the start of treatment, particularly RT, allows for adequate healing time.^{12,13} However, this may not be possible if delaying cancer treatment would negatively affect a patient’s prognosis.

The topical application of fluoride is still considered the gold standard in terms of prevention of dental caries for patients receiving radiotherapy.¹⁶ The benefits of fluoride are well documented; it increases the tooth structure’s resistance to acid, inhibits bacteria, and remineralizes incipient caries.¹⁴ The hygienist needs to assess the patient’s caries risk and compliance before recommending either the fabrication of fluoride trays or a brush-on method of fluoride application.¹⁵ Limited mouth opening or trismus may dictate the brush-on method of fluoride application, perhaps with a child-sized toothbrush. To date, there is

no evidence to suggest that one method of fluoride application (brush-on or trays) performs better than others in cancer patients.^{14,16,26} Ideally, the application of topical fluoride continues throughout the RT/CT regimen. We have found neutral 1.1% sodium fluoride gel (NaFl) to be generally better tolerated by the patient during RT as the acidulated fluorides may irritate the tissues and negatively affect compliance.¹⁶ If the cancer patient develops oral mucositis, he or she may need to temporarily stop the topical application of fluoride. This patient requires frequent monitoring to lessen the risk of decay as a result of stopping fluoride application. Patients begin daily fluoride treatments at the start of RT and may continue for years or indefinitely following RT to help reduce the risk of dental caries due to a decrease or lack of salivary production. Daily home care is important and requires the use of daily fluoride to prevent radiation caries.¹⁶

The pre-treatment appointment may also provide an opportunity for the dental hygienist to discuss dietary considerations for the oral cavity. A non-cariogenic diet

is an important aspect in the prevention of dental decay. Nutritional education encouraging the elimination of sugar and acidic beverages and the reduction of simple carbohydrates is ideal, while recommending high calories and a nutrient-dense diet to help maintain weight is also important to overall health. Soft foods or high protein drinks may be required if swallowing abilities become compromised. It is still important, despite dietary changes, for the cancer patient to maintain basic self-care initiatives in order to significantly improve oral health resistance to the complications arising from cancer treatments.

The active phase of curative cancer treatment is not an ideal time for dental or hygiene therapies. Unless a person is experiencing acute pain or infection, elective oral health procedures are not recommended until 3 months after cancer treatment. It is very important that the dental hygienist encourage and support the patient in practising good daily oral hygiene even when that patient may be fatigued by the difficult sequelae of cancer treatment.

Table 2. Management of the head and neck cancer patient before and after treatment

Pre-RT	<ul style="list-style-type: none"> · Educate and stress oral home care · Stress importance of regular follow-up · Discuss the effects of treatment · Complete dental (dentist) and periodontal assessment · Take baseline salivary and mouth opening measurements · Make custom trays for fluoride delivery or teach brush-on fluoride application and educate patient in their use · Arrange for extractions of periodontally involved and nonrestorable teeth by dentist or oral surgeon · Treat restorable teeth (dentist) and other dental problems · Provide thorough periodontal debridement
Post-RT	<ul style="list-style-type: none"> · Check for oral cancer recurrence or second primary tumours/lesions · Monitor for ORN · Manage radiation caries (home fluoride trays, oral hygiene education, diet counselling) · Monitor for and manage mucositis · Encourage frequent periodontal maintenance · Manage hyposalivation (salivary substitutes, recommend sipping on water, sugar-free candy) · Reinforce compliance with oral hygiene · Provide dietary counselling
Post-surgery	<ul style="list-style-type: none"> · Check for oral cancer recurrence or second primary tumours/lesions · Encourage frequent periodontal maintenance · Reinforce compliance with oral hygiene · Adapt oral self-care if limited opening and access
Post CT	<ul style="list-style-type: none"> · Check for oral cancer recurrence or second primary · Monitor platelets and white blood cell levels · Monitor for and manage mucositis · Encourage frequent periodontal maintenance · Reinforce compliance with oral hygiene
Palliative CT	<ul style="list-style-type: none"> · Monitor platelets and white blood cell levels · Reinforce compliance with oral hygiene
All head and neck cancer patients	<ul style="list-style-type: none"> · Make referrals for dietary counselling, psychological counselling, specialists as required · Show compassion · Monitor for quality of life such as signs of depression, family issues · Prevent loss of follow-up (contact patients who miss appointments) · Check for recurrence, second primary tumours/lesions and metastases · Encourage risk habit cessation or moderation (tobacco, alcohol, betel quid)

Management of oral complications

Hygiene therapy after cancer treatments can be very challenging. Cancer survivors risk long-term and late effects as a result of their specific cancer and treatment, and require regular, frequent follow-up once treatment is complete. Often management adaptations, such as shorter appointments, are required due to the person's compromised oral condition, general fatigue, and emotional state.²³ Open communication between the patient, the dental hygienist, and the oncology team will significantly enhance the successful management of oral health complications from cancer treatments.

A clinical evaluation of the oral cavity following cancer treatment should be comprehensive and include a risk assessment for oral complications. Table 2 provides a summary of the management of the patient before and after treatment. The post-cancer treatment clinical evaluation is comprised of a focused medical history including information on the type and stage of cancer, treatment type and dosage, any additional therapy, any treatment difficulties as well as the patient's current health status, including medications.^{4,8} Extraoral and intraoral examinations are a fundamental part of cancer survivors' care in order to assess the existence of lymphadenopathy (swollen lymph nodes), new lesions, recurrences or infection.

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CONCLUSION

Despite advancements in cancer therapy, oral complications from cancer treatments are often unavoidable. Dental hygienists play a valuable role in the periodontal therapy, oral self-care education, and supportive care of the cancer patient. Prevention and management can greatly reduce the risk of secondary oral diseases and minimize any decline in the patient's quality of life. Because patients receiving cancer treatments have a complicated health history, their multidisciplinary medical team must be consulted before providing any hygiene therapy that could potentially compromise the cancer patient's health and well-being. Cancer survivors are increasing in numbers; 63% of Canadians are expected to live 5 years or longer after a cancer diagnosis.¹ Cancer changes people's lives. As oral health professionals we have a responsibility to employ current and evidence-based hygiene practices integrated with an authentic level of clinical compassion for the incredible cancer journey our clients have endured.

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Waterpipe smoking: A "healthy" alternative to cigarettes or a health hazard in disguise?

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ABSTRACT

Objective: To increase awareness among dental hygienists of the use of waterpipes (WPs) and their associated risks. **Methods:** A literature search of studies published between 2000 and 2013 that examined the belief that WPs are "harmless," the risks associated with WP use, and the short-term and long-term health effects of WP smoking was conducted. Historical papers and gray literature were also reviewed to confirm the findings. **Results and Discussion:** The prevalence of WP smoking is on the rise in North America, especially among young adults who may view it as "harmless." WP smokers may be exposed to 3 to 9 times the carbon monoxide and almost 2 times the nicotine of a cigarette after a single 1-hour WP session. Sharing WPs may lead to the transmission of communicable diseases such as herpes, hepatitis, and tuberculosis. WP smoking is also shown to be associated with an increased risk of lung cancer, respiratory illness, and low-birth-weight infants for smokers and may be a gateway to nicotine addiction. The US Food and Drug Administration and the Canadian Food Inspection Agency do not regulate WP packaging, contributing to the lack of standardization of WP contents. **Conclusion:** Dental hygienists need to be aware of the lack of regulations and how this may lead to public misconceptions about WP smoking as a "safe" or "harmless" activity. There is a significant need for in-depth scientific investigation and dissemination of knowledge concerning WP use in order to understand its health effects, to guide cessation efforts, and to shape public policies.

RÉSUMÉ

Objet : Accroître la sensibilisation des hygiénistes dentaires concernant l'utilisation des pipes à eau (PE) pour fumer et les risques associés. **Méthodes:** Recherche documentaire, dans les études publiées entre 2000 et 2013 qui avaient examiné la croyance que les PE étaient « inoffensives », quant aux risques associés à leur usage et leurs effets à court et à long terme. L'on a aussi examiné la documentation et la littérature grise pour confirmer les résultats. **Résultats et Discussion :** La prévalence de la PE pour fumer augmente en Amérique du Nord, surtout chez les jeunes adultes qui la considèrent peut-être « inoffensive ». Les fumeurs par PE peuvent être exposés 3 à 9 fois au monoxyde de carbone et à près de 2 fois la nicotine d'une cigarette après une seule heure d'utilisation de PE. Le partage de PE peut mener à la transmission de maladies contagieuses telles que l'herpès, l'hépatite et la tuberculose. La PE s'avère aussi associée à un plus grand risque de cancer du poumon, de maladie respiratoire et de faible poids des nourrissons à la naissance, et elle peut ouvrir la porte à la dépendance à la nicotine. La US Food and Drug Administration et l'Agence canadienne d'inspection alimentaire ne régissent pas l'emballage des PE, contribuant ainsi au manque de normalisation de fumer avec la PE. **Conclusion :** Les hygiénistes dentaires ont besoin de sensibilisation au manque de réglementation et aux méprises publiques qui prétendent faussement que fumer avec la PE est « sécuritaire » ou « inoffensif ». Il y a un important besoin d'investigations scientifiques approfondies et de diffusion du savoir concernant l'utilisation des PA pour en comprendre les effets concernant la santé, orienter les efforts de cessation et formuler les politiques publiques.

Key words: hookah, oral health, prevention, public health, shisha, tobacco cessation, tobacco smoking, waterpipe

INTRODUCTION

Tobacco products are not just limited to cigarettes and cigars; they also include chewing tobacco, snuff, waterpipes, blunts, bidis, and cloves.^{1,2} Tobacco products may contain up to 4000 chemicals, including nicotine, ammonia, cyanide, and arsenic, all of which are known for their addictive potential, toxicity, and ability to irritate.²⁻⁴ Approximately 200 of these chemicals are deadly, and 60 have been linked to cancer.^{1,3} In spite of the 22 US Surgeon General reports on the adverse health consequences of tobacco dependence and numerous Canadian research studies documenting the risks of cigarettes and other

tobacco products, almost 4.9 million Canadians continue to use tobacco products.^{1,3} Tobacco use is primarily due to the psychopharmacological effects of nicotine, a consistent component of both smoked and smokeless tobacco.^{3,4}

With increasing awareness of the adverse effects of cigarette smoking, alternative sources of tobacco are gaining in popularity but little is known about their negative effects, including their addictive or pathogenic potential, creating a health hazard in disguise. Nicotine makes up 1% to 2% of unburned tobacco, and its levels in cigarette smoke may range from 0.5 mg to 2 mg per cigarette.^{1,4}

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As few as 5 mg of nicotine a day is enough to cause addiction to the drug.^{3,4} For many tobacco users, nicotine exposure may prompt long-term brain changes resulting in the adoption of compulsive drug-seeking behaviour despite the known negative consequences.^{1,5} All tobacco products contain nicotine (Table 1) but the concentration varies across products.^{3,5} Regardless of this variation, many tobacco products are known to contain enough nicotine to induce and sustain tobacco dependence.^{1,4}

This review examines the emerging trend of waterpipe (WP) use in North America, evaluating its possible health consequences and exploring the role of dental hygienists in effective cessation efforts. The review also intends to create awareness among dental hygienists of alternative tobacco use and highlights their potential influence in advocating public policy change.

METHODS

This article offers a comprehensive review of randomized control trials (RCT), literature and systematic reviews, and clinical case studies (in vivo and in vitro) that explore the potential harm of WP use, its addictive properties, and probability of WP use as a public health threat. The literature search was limited to articles published in English, between 2000 and 2013, and relied on a number of electronic databases, including MEDLINE, CINAHL, ScienceDirect, PMC, and Cochrane Library. Search terms, using alternative spellings, included waterpipe, hookah, shisha, narghile, hubble bubble, and goza. In addition, resources compiled by the US Centers for Disease Control (CDC), Health Canada, and the World Health Organization (WHO) were consulted.

Only published trials and review papers were searched, with a focus on articles from geographic areas where WP use is more common, such as the Middle East. Qualitative studies were used to explore attitudes, perspectives, and opinions surrounding WP use. The search also included historical papers, “gray” literature—information not reported in the scientific literature—and websites known to contain publications on this topic.

RESULTS AND DISCUSSION

What is a waterpipe?

The waterpipe, also known as hookah, hubble bubble, and narghile, is a device for tobacco use, growing in popularity in North America due to the common misconception that it is a “safer” alternative to tobacco smoking.^{6,7} A WP has four main components: head, body, water bowl, and hose (Figure 1).^{7,8} On average, 10 g to 20 g of flavoured tobacco (known as shisha) is placed in the head and covered with perforated tinfoil.⁹ A piece of charcoal is then placed on top of the tinfoil to produce smoke, as shisha has a high moisture content and is not able to undergo self-sustained combustion.⁷ Inhaling through the hose creates a vacuum, which pulls the smoke down from the head of the WP to the hollow body where it bubbles up through the water bowl and is cooled before being inhaled.⁷ Hookah filters may be placed in between the body of the WP and the hose in order to reduce nicotine intake, but evidence supporting their efficacy is limited. Because of the size of the WP, deep inhalation is needed to generate smoke and keep it going; the size of a WP puff may be 10 times greater than that required for a cigarette.⁸

Figure 1. Actual waterpipe (right) and schematic (left) showing main parts^{37,38}

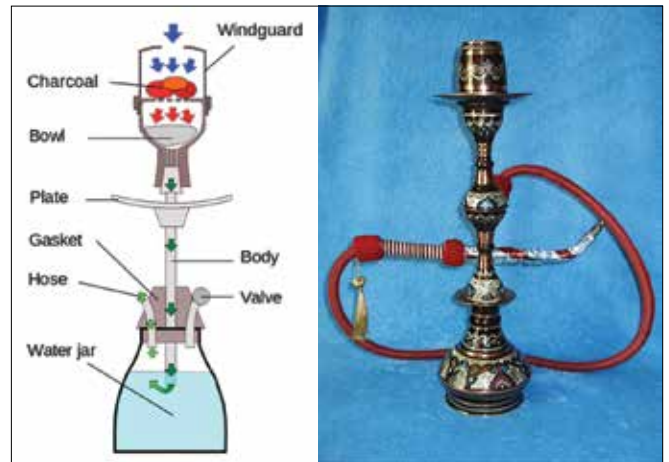


Table 1. Comparison of the different types of tobacco products^{5,7,36}

Tobacco product	Nicotine content (mg)	Consumption time (minutes)	Carcinogenic
Cigarette	1–2	5–10	Yes
Cigars and cigarellas	~100–200	30–60	Yes
Smokeless tobacco (chewing tobacco, dip, snus, snuff)	~100	60–120	Yes
Hookah/waterpipe/shisha	~20	30–60	Yes
Betel quid	1–2	5–10	Yes
Bidis	3–5	5–10	Yes
Electronic cigarette	0–48 (depends on the density)	Variable	No
Pipe	5–8	Variable	Yes

The global spread of WP smoking has been rapid. The origin of WP smoking can be traced to India during the 1500s, when a local physician devised the WP as a “harmless” alternative to cigarette smoking.¹⁰ Unlike other forms of tobacco smoking, the design of the WP allows smoke to pass through a water bowl before entering the smoker’s lungs, which was believed to remove the toxins from the smoke.^{7-9,11,25} Thus, even during its early development, WP was considered a form of “harm reduction” for tobacco users.⁸ With the introduction of conveniently prepackaged and flavoured tobacco (shisha) during the 1990s in the Middle East, WP gained prominence, attracting new users and marking the beginning of a WP epidemic.^{11,12} Since then, it has rapidly increased in popularity, particularly among adolescents in Western countries such as Australia, the United Kingdom, Canada, and the United States.^{12,13} The flavouring, the relative ease of access, the social appeal, and the misconceptions of harm may all be contributing factors to the emerging trend of WP use in North America.¹³

What is used in the waterpipe?

The tobacco used in a WP is known as shisha and is a mixture of tobacco, preservatives, and flavouring, combined with molasses or honey.¹⁴ However, the true nicotine and tobacco content of a package of shisha is unclear. The sale of shisha as a tobacco product is currently unregulated, with manufacturers in North America labelling the packages with statements such as “0.5% nicotine and 0% tar” or “all natural, herbal product.”¹⁴⁻¹⁷ Contrary to the packaging labels, however, the tobacco content in shisha can vary from 5% to 30%.¹⁶

In addition, the number of WP cafes, known as hookah bars or lounges, in North America is increasing. It is common practice for these cafes to prepare non-standardized shisha mixtures on site, combining flavours like chocolate and mint or banana and strawberry.¹⁶ The mixture of different shisha flavours adds to the appeal of WP use but masks the actual nicotine and tobacco content being smoked.^{7,12,16} The flavouring of shisha, mixed with its sugar content, provides a very aromatic smoke, making it pleasant for people who may not otherwise consider smoking.¹¹⁻¹⁷

Shisha is usually sold in 50 g and 250 g amounts, most commonly packaged in a cardboard box with fruit illustrations on the outside (Figure 2a).^{16,18-20} Most shisha is manufactured in Jordan, Egypt, and United Arab Emirates (UAE)¹⁶ and may be purchased online, which makes it more difficult to regulate its sale.¹⁷ While a package of cigarettes is required by law to be 70% covered with warning labels, an average package of shisha may contain no warning labels at all (Figure 2b).¹⁷ Since neither the US Food and Drug Administration nor the Canadian Food Inspection Agency currently regulates WP use, the content and packaging of shisha as well as other accessories such as the charcoal are sold without any standardization in place.^{9,13,17,20}

Figure 2. Flavoured waterpipe tobacco without clear warning labels or health warnings (a). The packaging lists low nicotine and tar content (b)^{39,40}



Table 2. Myths associated with waterpipe (WP) use

Myth	Fact
The WP is a safer alternative to cigarettes due to its lower nicotine content.	WP products and smoking patterns may result in higher nicotine intake. ^{11,14,19,23}
WP smoke is less toxic due to its smoother texture.	The texture may seem less irritating but toxins are present. ^{9,17,19}
The water in the WP filters out the toxins.	The concentrations of the toxins are not adequately reduced to eliminate the adverse health risk associated with tobacco. ^{17,19,33}
Fruits added to flavoured tobacco contribute to making WP smoking a healthy alternative.	The fruit flavours are present to mask the taste of the tobacco and do not add any nutritional value to the tobacco. ^{17,19,20}

Who uses the waterpipe?

Waterpipes appeal primarily to young adults because of their flavour, low cost, and the social aspect of WP smoking. When surveyed in 2006, on average, 23% of Canadians ages 18 to 24 reported smoking a WP in the last year.¹⁵ In addition, 7% of Canadians ages 13 to 18 reported having tried smoking a WP, and 3% of them claimed to have done so in the past 30 days.^{3,6} Of interest, 6% of Canadian medical students reported smoking a WP within the last 30 days, while 40% had smoked a WP at least once before.²¹ In the United States, more than 30% of a large cohort of university students admitted to smoking a WP, with WP use ranking second only to cigarettes in tobacco use in this group.²²

Waterpipe smoking is considered a more pleasant experience than smoking a cigarette. As the smoke passes through the water bowl, it is cooler, smoother, and more moist than cigarette smoke, making it easier to inhale.^{7,12,13,15,16,23} The less irritating WP smoke, combined with the flavour and the perception of reduced harm, is alluring and may lead to nicotine dependence and addiction among younger smokers.^{19,24,25} Since the WP is traditionally smoked in a group, it is an affordable activity for young people, who can share the cost of an average WP smoking session, which ranges between \$12 and \$15 in North America.¹³ During an average session of WP smoking, the hose is passed around the group with everyone using the same mouthpiece, increasing the risk of infectious disease transmission.^{13,16} However, with increasing awareness about infectious diseases, most hookah lounges now offer personal plastic adaptors to minimize the risk of disease transfer.

The hookah bars and lounges provide a setting to socialize for young people, especially for those who may not have access to bars and nightclubs.¹³ In particular, WP use is on the rise among young females who may view WP use as more progressive than cigarette smoking due to its social appeal, flavoured tobacco, and smoother smoke.¹⁶ The lack of regulations surrounding hookah bars and the absence of bylaws and policies governing WP smoking further contribute to this growing trend despite the fact that the WP smoke is not as safe as it was once proclaimed to be.^{12,13,15-18,23}

What are the risks?

Tobacco use, regardless of the form, contributes to morbidity and mortality worldwide.^{2,4,26} The literature on the health effects of WP smoking is limited compared to cigarette smoking or smokeless tobacco use. Although it has commonly been believed that WP smoking is less harmful than cigarette smoking, emerging research shows that the WP has comparable health risks, such as nicotine addiction, tobacco dependence, and decline in overall health (Table 2).⁷ In addition, WP smoking may be the gateway to other forms of tobacco use and, hence, nicotine addiction.^{7,9,11,23,24} A study by Rice et al.²⁷ indicates that Arab American young adults who smoke WPs are 8 times

more likely to experiment with cigarettes, thus increasing their risk of tobacco addiction and dependence at a young age.²⁷ Maziak et al. postulate that, although WP smokers initially are occasional, social users, they may graduate to regular and individual use.²⁸ All of these factors may lead to a public health threat in North America as WP smoking gains in popularity, especially among young adults.⁷

There is some variability in reported chemical exposure levels when smoking with a WP depending on the length and number of daily sessions and the design of the studies themselves. Most WP smoking sessions last from 45 to 60 minutes, exposing the smokers to high levels of nicotine, tar, carbon monoxide^{8,11} and high levels of poisonous metals such as chromium, lead, and arsenic.²⁶ In general, an hour-long WP session is similar to smoking 2 to 10 cigarettes.²⁸ Some sources citing in vitro data, such as the World Health Organization (WHO), suggest that an average WP smoking session may expose the smoker to *more* than the equivalent of 10 cigarettes.¹¹

WP smoking patterns differ from cigarette smoking, with typically only 2 to 3 WP sessions per day.^{14,16,19,29} Nevertheless, these few sessions may still pose a higher risk of exposure to carcinogens, carbon monoxide, tar, and other chemicals.^{14,16,23,29,30} In vitro studies using a smoking machine determined that a single session of WP use may expose smokers to a higher level of nicotine than smoking a single cigarette.^{11,28,30} Indeed, the nicotine content of shisha can be double or more than that found in cigarettes.³¹ Each session may expose the smoker to 3 to 9 times the carbon monoxide of a single cigarette¹¹ and 33.5 mg to 67 mg of nicotine.^{9,12,24,27,32} It should be noted that many studies use in vitro data and may not accurately reflect true WP smoking behaviour. The risk may vary depending on the type of tobacco, burning temperature, duration of smoking, and the WP design such as the addition of hookah filters.³² While the harmful effects of smoking a WP have not been studied as thoroughly as those of other tobacco products, there are still numerous articles discouraging its use and challenging the claims that it is a healthy alternative to smoking.

As mentioned, charcoal is used to heat the tobacco, which increases the amount of carbon monoxide and polycyclic aromatic hydrocarbons (PAHs) being released, two compounds further contributing to adverse health outcomes.^{8,12,16,17,20} PAHs are environmental pollutants generated by smoking and are known to be carcinogenic and mutagenic, and may lead to adverse pregnancy outcomes and developmental delays in children.^{5,20} An average hour-long WP smoking session can lead to inhaling 100 to 200 times the volume of smoke inhaled from a single cigarette, thus exposing one's lungs to excessive tar and carbon monoxide in addition to other carcinogens.^{2,7,8,11-13,15-17} Although the water in the WP may act as a filter for tar, significant risk of exposure to tar remains.³¹

In addition, tobacco-specific nitrosamines have been found in WP smoke. Tobacco-specific nitrosamines such as 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) and N'-nitrosornicotine (NNN) are carcinogens found in all tobacco products, and their formation is attributed to the nicotine in these tobacco products.^{2,30} NNK and NNN form when the nicotine undergoes a metabolic reaction called nitrosation.^{2,30} Radwan et al. compared the tobacco-specific nitrosamines uptake in WP smokers to that of cigarette smokers and confirmed the presence of both NNK and NNN in WP smoke.³⁰

Health concerns

Surprisingly, WP smokers may be aware of the harmful effects of WP but continue to believe that WP smoking is less addictive than cigarette smoking, thus undermining its addictive potential.^{19,28} The irregular pattern of WP use is identified as a barrier to measuring the potential for addiction and nicotine dependence among WP users.²⁸ However, the behavioural and social components associated with nicotine dependence may be reinforced through WP smoking and lead to tobacco addiction in WP users.^{25,28}

Evidence suggests that WP smoking may, like other tobacco products, be a predisposing factor for cancer, abnormal pulmonary functions, low-birth-weight infants, and decreased fertility.^{5,7,14,18,24,29,31} Arab women who smoke WP during pregnancy, particularly in the first trimester, have an increased risk of pregnancy complications such as preterm low birth weight and respiratory distress in the fetus.³⁴ The use of WP also affects the pulmonary function of users although less significantly than cigarette smokers.²⁷ Currently, there is a lack of research relating WP use to cancer, but the presence of carcinogens such as NNN and NNK in WP smoke suggests its potential as a risk factor.

Further research is needed on the long-term effects of WP smoking, particularly within North America. In vivo randomized control trials and case control studies should examine the association between WP smoking and health concerns, morbidity, and mortality, based on both short- and long-term use. In vivo studies, however, are difficult to undertake because of ethical concerns, hindering the development of evidence-based treatment options for WP smokers, despite the emerging health threats posed by WP use.

Health policy

WP use is currently excluded from Canada's tobacco control strategies, such as clean indoor policy, prohibition of sale to minors, taxation, and the regulation of tobacco sales and packaging.¹⁶ The lack of evidence regarding the effects of WP smoking, which may be attributed to ethical concerns regarding in vivo studies, the perceived harmlessness of WP use, and the unfamiliarity with WP in western culture,¹⁷ may explain, in part, the absence of such legislation. Yet, the lack of policies governing WPs

should be a concern for health professionals. Policies on the accurate labelling of shisha and restrictions on its use by minors and in WP cafes should be developed. The increasing use of alternative tobacco products and the public's limited knowledge of their health effects warrant regulatory action and policy change at a federal level, including product health warnings, taxation, and ban on sales to minors.^{7,20,21} Inaccurate labeling is both a public safety issue and a tax evasion problem, creating an urgent need for the standardization of WP tobacco products.

As instructed by the Framework Convention on Tobacco Control (FCTC), federal and provincial governments should implement legislation to mandate appropriate packaging of WP tobacco, its accessories, and sale.^{16,17} Currently the warning labels that may appear on WP tobacco packages are in small type, often written on the sides of the package with no special demarcations or other information.¹⁷ Some packages have questionable ingredient lists, while others offer no information at all.^{8,11-17,23} The *Federal Consumer Packaging and Labeling Act* is responsible for the standardization of the packaging, labeling, importing, and advertising of prepackaged consumer products including shisha.¹⁷ There is an urgent need for the enforcement of this Act to mandate the proper labeling of WP tobacco including the accurate representation of the package contents and prohibition of misleading labels.¹⁷

The venues dedicated to WP smoking, such as hookah lounges, may attract more business as a result of smoking bans in restaurants and bars, as hookah lounges in North America are exempt from the "retail tobacco establishment" classification.^{8,11-13,15-18} Thus, WP smoking venues should be included in the regulations that prohibit the sale of tobacco products in restaurants and bars.^{17,18} Several hookah lounges have evaded the "clean indoor air" laws by setting up WP smoking areas outside, underscoring the need for stricter policies surrounding the operation of WP smoking venues, especially those with easy access to minors.^{18,21} New policies governing WP use and sale should also compel the enforcement of bylaws to control the sale and promotion of WP through the Internet.¹⁶

In Canada, existing legislation, such as the *Federal Tobacco Act* and the *Tobacco Products Information Regulations*, should closely regulate WP tobacco use, sale, labeling, and promotion.¹⁷ Although WP tobacco is part of the broad definition of tobacco in the Act, the vague definition of pipe tobacco creates ambiguity on the inclusion of shisha and its sale to minors.^{17,21} These regulations must recognize WP tobacco/shisha as a form of pipe tobacco and remove any uncertainties regarding WP use.¹⁷ By including WP tobacco smoking in tobacco control efforts, the spread of WP use among young adults, in particular, may decrease.^{16,21,24,25} It is imperative that research be conducted on the mechanism of tobacco and nicotine dependence specifically related to WP use in young people.^{15,21,25}

The role of dental hygienists

Current tobacco cessation efforts rarely target WP smokers, perhaps because of a lack of evidence to support such programs and weak or non-existent policies governing WP use.^{25,35} Nonetheless, health care professionals should begin to address the lack of awareness regarding WP use. Dental hygienists are ideally situated to act as public health advocates, collaborating with policy makers, enforcement officers, and the government to increase awareness of the risks associated with alternate tobacco sources such as the WP.³⁵ The dental hygienist can be an educator, communicator, and advocate, sharing knowledge with clients and the public, and working with their professional associations to encourage policy change. In addition, dental hygienists have a role to play in WP cessation initiatives. Most data to shape such interventions are extrapolated from cigarette smoking cessation efforts.^{25,35} However, it is clear that brief (i.e., 3-minute) advice on quitting tobacco use has been associated with small but significant reductions in tobacco use, compared to no intervention.¹⁹ Dental hygienists are uniquely placed as primary health care providers for client education and tobacco cessation efforts among WP users, many of whom may not be aware of the potential harm or addictive potential of WP smoking.³⁵

Within their clinical practice, dental hygienists can raise awareness of WP in a variety of ways. Many WP users, particularly young adults, view it as a social activity and may not consider its use unsafe or their use of WP to be frequent enough to report in their health history during routine dental visits.¹⁹ A question should be added to the health history questionnaire asking specifically about WP use, as many users may not think of WP smoking as tobacco use. Follow-up questions regarding the frequency of WP smoking are also important and informative for client education to reinforce cessation efforts. Information on WPs can be incorporated into current tobacco cessation efforts by providing education material for an office bulletin or newsletter focused on WP use.

Limited knowledge of WP use and its health effects may contribute to the hesitation on the part of dental hygienists to educate their patients about WP smoking.¹⁹ By increasing their own knowledge and awareness of alternate tobacco sources such as WP, dental hygienists can answer questions about the products and provide useful resources and interventions to clients to help them quit.³⁵ Including WP information in table clinics at health fairs and presentations during National Dental Hygienists Week™ can help to raise public awareness.

Both individual hygienists and the profession as whole can advocate for the health of Canadians by contacting and informing policy makers of the risks of WP use. Dental hygienists can influence policy change by lobbying for the closure of WP lounges, which are currently exempt from the “retail tobacco establishment” classification. Dental

hygiene researchers with an interest in tobacco research can serve as a crucial resource in investigating the health consequences of WP use by obtaining data to conduct retrospective studies to substantiate current evidence. Clinical dental hygienists can use their individual practices as a pool of knowledge to obtain data regarding the public’s attitudes towards and perspectives on WP use. Dental hygiene educators can incorporate WP information in the tobacco cessation curriculum to raise more awareness among future oral health professionals. In addition, all dental hygienists can act as health educators and advocates, promoting tobacco cessation and awareness of various tobacco products to other health care professionals and the public through online blogs and in-service, as well as through presentations in health promotion fairs.

Future needs

There is a dearth of research on WP smoking in North America. Studies are needed on smoking cessation interventions, clinical studies should be undertaken to observe the short-term and long-term effects on both smokers and non-smokers exposed to second-hand smoke, epidemiological studies are required to aid in understanding the current trends in global WP tobacco use and, finally, research on the attitudes and beliefs surrounding WP use are essential to broadening our understanding of this social trend and public health concern. This research will provide evidence to develop policies and bylaws to prevent WP smoking from becoming a public health epidemic not only in North America but globally.

CONCLUSION

The literature suggests that WP use is associated with health risks consistent with other tobacco products such as cigarettes.^{7,8,11–13,15} Future research needs to focus on the role of WP smoking in promoting nicotine addiction and other forms of tobacco use. Global research efforts need to be directed towards increasing awareness of WP use and incorporating WP use into the global tobacco control agenda to cultivate significant and effective tobacco prevention and cessation initiatives. Dental hygienists can play an active role in raising awareness, educating clients, and encouraging them to eliminate tobacco use in all its forms.

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Oral cancer and biopsy protocol: A primer for the dental hygienist

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ABSTRACT

Dental hygiene clients with persisting oral lesions may need to be referred for further follow-up and possible management. These clients may experience anxiety regarding the biopsy procedure and may ask the dental hygienist for additional information. An informed dental hygienist will be able to provide the necessary information to the client to reduce stress and may feel more comfortable referring, thereby decreasing any potential diagnostic delay. The objective of this article is to increase awareness among dental hygienists of how a biopsy is performed, processed, and diagnosed.

RÉSUMÉ

Les clients de l'hygiène dentaire qui ont des lésions buccales persistantes peuvent avoir besoin de références pour d'autres suivis et peut-être des soins. Ces patients peuvent ressentir de l'anxiété face à la biopsie et demander plus d'informations à l'hygiéniste dentaire. Si elle est bien informée, celle-ci pourra transmettre au patient les renseignements nécessaires pour réduire sa tension. Elle se sentira elle-même plus à l'aise d'orienter ainsi le patient, réduisant toute possibilité de délai du diagnostic. Cet article a pour objectif de sensibiliser davantage les hygiénistes dentaires sur l'exécution, la procédure et le diagnostic de la biopsie.

Key words: biopsy, dental hygiene, diagnosis, dysplasia, excisional, incisional, oral cancer, pathologist, pathology report, punch

INTRODUCTION

Oral cancer is a global disease with almost 300,000 people diagnosed annually, more than 4000 of whom are in Canada.^{1,2} About 1 in 10,000 Canadians² is diagnosed with oral cancer while 1 in 800 is diagnosed with dysplasia (oral precancer).³ The stage of oral cancer is directly related to the 5-year survival rate. Oral cancer detected at an early stage, when it is small and localized, has better 5-year survival rates than late-stage cancers.⁴ Not surprisingly, dental professionals using opportunistic screening at dental visits tend to diagnose oral cancers at an earlier stage than other medical professionals.^{5,6}

It is not uncommon for dental hygienists to come across oral lesions in daily practice.³ Yet, even with experience and expertise, they may not be able to differentiate many more common oral lesions from an early oral cancer or precancer. Screening for and referring lesions of concern are an important part of a dental hygienist's scope of practice.⁷ Awareness of the biopsy procedure may not only help dental hygienists to feel more confident in referring a client but will also help them to prepare the client for the procedure. It is imperative that hygienists understand the biopsy procedure and protocols for referral. In a study of Canadian dental hygienists, 69% of respondents reported referring a client for a biopsy (Laronde, unpublished

data). The objective of this article is to increase awareness among dental hygienists of how a biopsy is performed and processed.

METHODS

A search for relevant articles was conducted using the key words oral cancer, dysplasia, biopsy, pathology report, pathologist, diagnosis, oral cancer statistics, and client management. Search databases included PubMed, GoogleScholar, ScienceDirect, and CINAHL. Articles selected consisted of systematic reviews, clinical trials, and expert opinion articles that dated back to 1990. Out of 200 search results, 29 were used for this literature review. Additional information, expert opinion, and images were also gathered from shadowing an oral medicine oral pathologist specialist at practice. Information regarding the preparation of biopsy samples was obtained from observations at a pathology lab.

RESULTS AND DISCUSSION

What is a biopsy?

A biopsy is the removal of a sample of tissue from a living body for histological examination and diagnosis.⁸ A

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Table 1. Comparison of biopsy types^{8,13-16,25-27}

Types of biopsy				
	Punch	Scalpel	Laser	Brush
Advantages	Ideal for labial, buccal mucosa and tongue Simple to use Specimens are smaller, less patient discomfort post-procedure Often requires no sutures (silver nitrate cauterization)	Greater ability to cut sample to the width and depth needed Able to excise entire lesion (excisional biopsy)	Hemostasis –minimal bleeding Minimizes post-operative discomfort No sutures	Non-invasive Does not require local anesthetic Can be used for patients who refuse traditional biopsy
Disadvantages	Limited depth Difficult to access certain anatomical areas (maxillary buccal alveolar ridge and anterior lingual aspect of mandible) Difficult to biopsy freely moving tissues such as the floor of the mouth	More artifacts than in a punch biopsy (crushed, split or fragmented sample) Generally requires more sutures to close wound versus punch biopsy	May produce coagulative artifacts Hampers histological interpretations, especially at the margins Heat generates epithelial and connective tissue damage Thermal damage may simulate mild dysplastic changes	Sensitivity and specificity vary by study Not diagnostic Only determines if lesion is positive, atypical or negative Not to be used for suspected lichen planus, candidiasis, herpetic lesions Inadequate sampling not uncommon
Tissue type	Epithelium	Epithelium	Epithelium	Epithelium
Site used	Limited – need direct access to approach from 90 degrees	Anywhere in the oral cavity	Anywhere in the oral cavity	Anywhere in the oral cavity
Diagnostic	Yes	Yes	Yes	No

histological examination is the current “gold standard” for the definitive diagnosis of a wide spectrum of oral lesions including lichen planus, dysplasia, and squamous cell carcinoma (SCC).⁸ The purpose of a biopsy is two-fold: 1) to confirm the diagnosis of a lesion, such as lichen planus; and 2) to evaluate and rule out precancer or cancer in lesions that have been present for 3 or more weeks after all irritants have been removed, or in red and/or white lesions with no apparent cause.⁹

There are 2 main types of biopsies: excisional and incisional. An excisional biopsy is the complete removal of the lesion and is typically done when a lesion is very small (less than 1 cm) or during surgical treatment.⁹ An excisional biopsy must include a margin of clinically normal tissue, as leaving microscopic remains of a lesion may lead to re-excision.^{9,10} Disadvantages of performing an excisional biopsy on a lesion of unknown histology are the sacrifice of a large amount of tissue for a potentially benign lesion or taking an inadequate margin of a malignant lesion.¹¹

In comparison, an incisional biopsy is the removal of a small piece of the lesion, typically wedge-shaped, for the purpose of diagnosis.¹² Large lesions may vary in disease severity throughout the lesion. Consequently, for large lesions and lesions with variation in clinical appearance, more than one incisional biopsy may be necessary to sample different parts of the lesion to ensure more reliable results.¹³ A typical incisional biopsy is approximately 4

mm to 5 mm in diameter and a minimum of 2 mm in depth,⁸ with a narrow, deep biopsy preferable to a wide and shallow one.⁹ However, it should be noted that the larger the sample, the more accurate the diagnosis.⁸ Tissue location will affect the depth of the sample, as thicker samples are more difficult to acquire from the attached gingiva and hard palate.¹⁴ Generally, an incisional biopsy will include a sample of the lesion and the adjoining normal tissue.⁹

There are 3 types of incisional biopsy: scalpel, punch or laser, with the first 2 being the most common methods. For a scalpel biopsy the clinician uses a scalpel to cut the tissue sample, while a punch biopsy uses a disposable, round cutting device to remove tissue.¹⁴ Punch biopsy tools come in a variety of sizes from 2 mm to 8 mm.⁸ The punch biopsy technique involves placing the punch tool at a right angle over the area to be sampled.¹² The blade is rotated gently to the depth of the bevel.¹² Often a scalpel or tissue scissors are used to cut the deep margin and release the sample.⁹ Nd:Yag and CO₂ lasers can be used to biopsy tissue, particularly in areas where it may be more difficult to perform a scalpel biopsy. The laser also cauterizes the tissue while cutting, minimizing bleeding and eliminating the use of sutures.^{9,15} Excisional biopsies are performed by scalpel or laser. One main disadvantage of the use of the laser for any biopsy is that the pathologist is unable to read the margins of the sample as a result of coagulative effects, and hence, the pathologist is unable to determine

if the lesion margins are free of disease.^{8,13} Using the laser to ablate the tissue without a previous biopsy is also not recommended because ablation leaves no sample to examine to determine a diagnosis.

The brush biopsy is a non-invasive screening tool that collects a sample of cells by brushing the lesion.¹⁶ It is not considered diagnostic and does not meet the current gold standard of a tissue biopsy. The brush biopsy may be used for lesions with a low index of suspicion or if the client refuses an incisional biopsy.¹⁶

How is a biopsy performed?

Oral biopsies are typically performed by specialists or general dental practitioners with expertise and experience. General dental practitioners may not feel confident performing biopsies due to limited practise or training during their education and fear of making a misdiagnosis.^{17,18} Figure 1 illustrates an incisional biopsy performed with a scalpel.

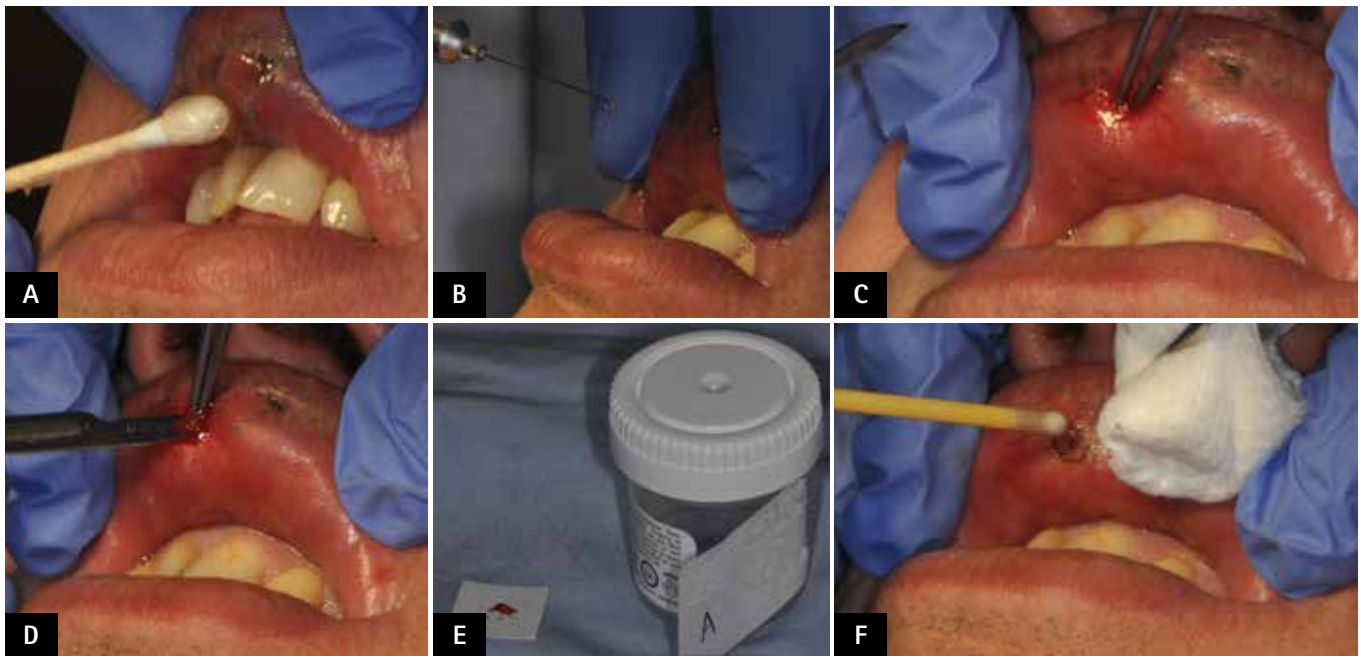
To eliminate errors in tissue processing, the sample bottle must be labelled with client information, including name, date of procedure, date of birth, and site of biopsy.¹² The accompanying pathology requisition form should include pertinent clinical and risk habit information (current and past tobacco and alcohol use); health history including medications; lesion history including when it was first noticed and any changes

in clinical appearance; history of lesion symptoms; location of lesion; appearance, size, and duration; and an image of the original lesion if possible.^{13,19} Any history of previous oral biopsies should be noted as the pathologist may wish to compare tissue samples. The pathology form should also include a diagram of the oral cavity to note the location of the lesion and the area biopsied.⁸ The digital imaging of a lesion is very important both for noting lesion changes and for providing valuable information to the pathologist. The sample should, when possible, be couriered to the pathologist to prevent harm to the sample, such as exposure to extreme temperatures, which may occur if using regular mail service.¹³

How is tissue processed?

Once the biopsy sample has been submitted to the pathology laboratory, the sample tissue must be further prepared and processed before the oral pathologist can reach a diagnosis. Figure 2 provides an overview of sample processing. For lesions presenting with a blistering or bullous appearance, such as lichen planus, pemphigus vulgaris or mucous membrane pemphigoid, the sample may be split in half or 2 samples may be taken and 1 may undergo further immunofluorescence testing.⁹

Figure 1. An incisional scalpel biopsy of the lip



A) Application of topical anesthetic. B) Local anaesthetic is about to be administered deeply and adjacent to the lesion to avoid artifacts caused by the needle and to reduce bleeding. C) Tissue forceps are used to retract the tissue. Avoid forceps with teeth as they will cause artifacts. D) Tissue forceps and scalpel are used to remove the tissue sample. Handle the tissue gently to prevent crushing and tissue distortion. E) The sample is oriented epithelial surface down on a piece of sterile paper (reduces sample curling) and placed in 10% neutral buffered formalin fixative to preserve the tissue. If more than one sample is removed, each sample is placed in a separate formalin container. F) Suture or cauterize the biopsy site if possible to ensure hemostasis (silver nitrate is being used in this image to cauterize the biopsy site).^{8,13,14}

Figure 2. The oral pathology laboratory



A) Orient the tissue sample to identify the connective tissue layer (deep margin) and epithelial tissue layer (outer margin). B) The tissue sample is dehydrated by running it through increasing concentrations of ethanol, thereby preserving the sample and preventing any further degradation of the tissue. C) The dehydrated tissue sample is embedded into a sample block using paraffin wax. D) The sample block is cut into thin slide sections of 5 micrometers thick using a microtome. E) Slides containing the cut tissue are stained with chemicals hematoxylin (stains nuclei blue) and eosin (stains cytoplasm pink). F) Finally, the pathologist uses a microscope to examine the fully prepared slide and make a diagnosis.

Table 2. Description of dysplasia and squamous cell carcinoma diagnoses^{20, 28}

Diagnosis	Description
Mild dysplasia	Minimal dysplastic alterations confined to the lower third of the epithelium
Moderate dysplasia	Dysplastic changes seen in up to two thirds of the thickness of epithelium
Severe dysplasia	Dysplastic cells fill more than two thirds but less than the entire thickness of epithelium
Carcinoma in situ	The entire thickness of the epithelium contains less differentiated cells and dysplastic activity, with no invasion into the basal layer
Squamous cell carcinoma	The entire thickness of the epithelium contains dysplastic cells, with invasion into the basal layer

How does the oral pathologist reach a diagnosis?

When determining a diagnosis, the pathologist will assess the tissue under the microscope for evidence and degree of dysplasia or cancer. Dysplasia is diagnosed as low-grade (mild and moderate) or high-grade (severe and carcinoma in situ [CIS]) (Table 2). Once the dysplastic changes have broken through the basement membrane the tissue is diagnosed as squamous cell carcinoma.²⁰ Criteria for the diagnosis of dysplasia include both cellular and architectural changes established by the World Health Organization (WHO), as described in Table 3.²⁰

How to decipher a pathology report?

After diagnosis, the pathologist will send a pathology report to the clinician who requested the diagnosis. This report can contain a great deal of information and it is

important to read it thoroughly. Pertinent information on a pathology report is generally found under the “final diagnosis” heading. Words such as dysplasia and carcinoma are diagnostic of the tissue sample while other words such as hyperkeratosis (thickening of the keratin layer) and acanthosis (thickening of the intermediate layer) are usually used as more descriptive terms.²¹

Figure 3 is a sample pathology report and identifies the information that would be relayed to the clinician from the pathologist. In addition to the final diagnosis, it also includes the name of the pathologist who performed the tests, his or her contact information, a gross description of the sample, as well as clinical history and information provided by the original clinician. If the patient had had a previous biopsy, the information would typically be included as well.

Table 3. Diagnostic criteria for dysplasia and squamous cell carcinoma^{20,29}

Architectural changes	Cellular changes
Irregular epithelial stratification	Abnormal variation in nuclear size
Loss of polarity of basal cells	Abnormal variation in nuclear shape
Drop-shaped rete ridges	Abnormal variation in cell size
Increased number of mitotic figures	Abnormal variation in cell shape
Abnormal mitoses not limited to basal or parabasal layers	Increased nuclear-cytoplasmic ratio
Premature keratinization in single cells	Increased nuclear size
Keratin pearls within rete ridges	Atypical mitotic figures
	Increased number and size of nucleoli
	Hyperchromasia

Figure 3. Sample oral pathology report

Metropolis General Hospital Department of Pathology 1234 Main St, Metropolis TEL (555) 731-5555 FAX (555) 732-5555 Metropolis Oral Pathology Consultation Report	
Case Number: M – 001 Collect Date: 2013/12/15 Receive Date: 2013/12/16 Date Reported: 2013/12/22	MRN: xxxxxxxxx Patient, Joe DOB/Gender: 1931/07/01 82Y M Ordering Physician: John Smith (DMD)
Final Diagnosis: Incisional biopsy from the left floor of mouth – moderate epithelial dysplasia; the lesion has involved both lateral margins. Electronically signed by: Jane Doe, DDS December 22, 2013 Clinical History as Provided by Submitting Physician: Asymptomatic white lesion on left FOM, present for 3 weeks. Patient is a current smoker (40 pk/yr). Specimen Received: A; Soft tissue floor of mouth Gross Description: The specimen is received in a container labelled with the patient’s name and DOB and consists of a white/tan tissue fragment measuring 0.4 x 0.3 x 0.3 cm and it is submitted in toto as “A1”.	

What are a biopsy's limitations?

Despite being the gold standard, oral biopsy results are subjective and may not accurately represent the severity of dysplasia.^{22,23} Since incisional biopsies only sample a small area of the lesion they may over or underdiagnose the actual lesion.¹¹ Holmstrup et al. found that 35% of lesions examined had a more severe histopathological diagnosis within the whole lesion as compared to the original biopsy site.²⁴ These findings suggest that biopsied sites with persisting or recurring lesions should be followed by continuous observations at close intervals, independent of the presence or absence of epithelial dysplasia diagnosed in the pathology report.²⁴ It is important to note that histological assessment alone cannot predict malignant progression, particularly for low-grade dysplasia.²⁴ Persisting low-grade dysplasias must be monitored and may require further histological testing to detect progression.

CONCLUSION

A biopsy is the simplest method to diagnose a lesion with an unknown cause. It is in the best interest of the client to have a prompt and accurate diagnosis in order to minimize delays should further treatment or management be required. As dental professionals performing intra and extraoral examinations, dental hygienists should be aware of biopsy procedures and have the confidence to make referrals when warranted. Since early detection of oral malignancies can significantly increase the chances of survival for the client, the onus is on dentists and dental hygienists to be knowledgeable and proactive, incorporating intra and extraoral examinations as part of routine dental care.

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Communicating effectively with the dental hygiene client about referral and biopsy

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ABSTRACT

For many people, the word “biopsy” is directly associated with cancer. Yet a biopsy is often the only way to diagnose a variety of conditions and diseases, and the oral cavity is no exception. Discussing the need for a referral or biopsy for a suspicious lesion can be challenging for the clinician. The objective of this article is to provide the dental hygienist with some examples of how to talk with a client about referral and biopsy.

RÉSUMÉ

Pour beaucoup de gens, le mot « biopsie » est associé directement au cancer. Toutefois une biopsie est souvent la seule façon de diagnostiquer une variété d'états et de maladies, et la cavité buccale n'y échappe pas. Discuter du besoin de consultation ou de biopsie pour une lésion suspecte peut poser un défi à la clinicienne. Cet article a pour objet de présenter à l'hygiéniste dentaire quelques exemples d'entretien sur la consultation et la biopsie avec le patient.

Key words: anxiety, biopsy, oral cancer, referral

INTRODUCTION

Finding a suspicious oral lesion in a client can be a harrowing experience. What should the dental hygienist do? How should he or she raise the issue with the client without causing undue anxiety? How can the dental hygienist stress the importance of having the lesion investigated further? One reason that clinicians have given for not providing oral cancer screening to their clients is uncertainty over what to say and where to refer a client with a lesion.¹ Advising the client on the importance of a biopsy and directing this process in a seamless manner is paramount in providing professional services. The objective of this article is to help the dental hygienist prepare a client who requires a referral or biopsy for a suspicious lesion.

RECOMMENDING REFERRAL OR BIOPSY

Many people equate the word “biopsy” with cancer. However, a biopsy is required to provide a definitive diagnosis of a variety of oral tissue conditions and diseases. When a suspicious lesion is found and doesn't resolve after removing any possible irritants, the dental hygienist should refer the client to a specialist for further follow-up and possible biopsy (Table 1). Dental hygienists can also refer to general dentists for biopsies although it is important to ensure that the dentist is comfortable in performing the procedure. The referral can be compared to being referred to a dermatologist for an assessment of skin moles.²

The dental hygienist can further explain that, because many conditions in the mouth look very similar (Table 2), the specialist may want to take a biopsy in order to rule out more serious diseases. The only way to diagnose most oral lesions is to look at a small amount of tissue under the microscope. Clients may have questions about the size of tissue that needs to be removed during a biopsy. Patients usually imagine the worst, but most oral biopsies are small—approximately 4 mm to 6 mm—and in some cases do not require sutures. Let the client know that, regardless of the diagnosis, he or she will not be alone and that the clinician will work with other health care professionals to determine and facilitate the proper management of the client. In some cases, further testing may be required.

Table 1. Possible referral pathways

Options for referral	Area of expertise
Oral medicine specialist	Specializes in diagnosis and management of non-dental oral conditions
Oral and maxillofacial surgeon	Specializes in surgery of the hard and soft tissues of the mouth and jaws
Periodontist	Experience with soft tissue pathology
General dentist	May have experience in performing biopsies (verify prior to referral)
Medical doctor	Can refer to ENT

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Table 2. Examples of what a dental hygienist could say to a client with a lesion

Scenario	Explanation from the dental hygienist
Scheduling a 3-week reassessment appointment	"I (we) are not sure what is causing the white spot on your tongue. I (we) have smoothed down any rough areas that may be causing the white spot. I (we) would like to see you again in 3 weeks to double check it. This will give the site time to heal if it is a result of a bite or rubbing the rough filling we smoothed."
The lesion is still present after 3 weeks	"The white spot on your tongue is still there. Because some lesions that require further treatment look much the same as very common lesions it's a good idea to have it looked into further. I would like to refer you to a specialist who is able to evaluate the tissue and take a biopsy if needed. Viewing tissue under a microscope will give us a true diagnosis of the tissue."
A biopsy is required to assess the lesion	"Sometimes the only way to know the cause of a lesion is to perform a biopsy, which involves taking a very small sample of tissue and looking at it under the microscope. Then we know exactly what the lesion is and how to proceed should any further medication or treatment be needed."

BIOPSY RESULTS

Explaining the results of a biopsy is not typically the role of the dental hygienist but it is important to be aware of the procedure. The dental hygienist may work collaboratively with other health care professionals in explaining the diagnosis, reinforcing the need for follow-up, and providing habit cessation information.² If the biopsy shows that the lesion is benign, a simple phone call informing the client will suffice. If the biopsy result is dysplasia or cancer, however, an appointment with the clinician who performed the biopsy should be scheduled in order to provide the client with a more thorough explanation. The dental hygienist should be available to provide support and to answer any questions that the client may have.² Prior to the follow-up appointment, the dental hygienist should also prepare the proper referral procedure, which may vary by geographic location and access to medical personnel. In British Columbia, a diagnosis of severe dysplasia, carcinoma *in situ*, and squamous cell carcinoma or any other oral cancer is referred to the BC Cancer Agency Oral Oncology Clinic. Low-grade dysplasia may be referred to the oral dysplasia clinic at the Vancouver General Hospital, to a private oral medicine specialist office or to an otolaryngologist (ENT). Minimizing the client's stress at this time is of the utmost importance. Securing an appointment for the client with a cancer centre or a specialist ahead of time to minimize delays is invaluable.

REFUSAL

On rare occasions, a client may refuse a biopsy. Ensure that the client is fully informed of the importance of and need for the test, and document the conversation. To confirm that clients who have been referred to a specialist have complied with the referral, follow-up with the client and document this information as well.² To prevent a delay in diagnosis, the dental hygienist may book the appointment with the specialist for the client prior to the client's leaving the office.

PROTOCOLS

Developing protocols for the management of clients with suspicious lesions is essential. These protocols for reassessment, referral, biopsy, and biopsy follow-up should include what to say and what information is required for documentation and referral. Protocols will not only help the dental hygienist, but will also help to reduce anxiety in the client. Become familiar with specialists or general practitioners in your community who have intraoral lesion expertise and have experience with biopsy.

When a client does not follow-up with a referral due to cost or lives in a community where specialists are not available, the client may contact their medical doctor for a referral to an ENT specialist. It is highly recommended that a referral letter be provided describing the lesion, its history, and the clinician's concerns. Other documentation that will facilitate the referral includes an intraoral image of the lesion or documentation on a mouth map, risk habit history (tobacco, alcohol, betel quid), and medical history. This information is also helpful for an oral pathologist when reading the biopsy results and, when available, should accompany a biopsy sample.

As for all referrals, dental hygienists should take the time to explain and listen to the client's concerns. Written client education information describing the procedure and its importance is essential and should be given to the client. Effective communication can have an impact on the client's anxiety and compliance with referrals and management.²

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Oral cancer screening: Dental hygienists' responsibility, scope of practice, and referral pathway

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ABSTRACT

A comprehensive examination of dental clients by dental professionals, including extraoral and intraoral soft tissue examinations, has the potential to make a difference in the rates of early detection of oral cancer. Dental hygienists have the training to assess oral soft tissues and differentiate between normal, healthy tissues and abnormal or diseased tissues. The dental hygiene appointment is naturally predisposed to opportunistic oral cancer screenings as part of routine dental hygiene care. Practice standards dictate that dental hygienists have a professional responsibility to conduct systematic, comprehensive assessments of the head, neck, and oral cavity and to document changes. When an abnormal lesion persists for more than 3 weeks, the appropriate referral pathway should be initiated. Changes to regulations and increased scope of practice also have the potential to maximize access to oral health care for Canadians. Increasing access points to care and screening outside of a traditional office setting may specifically benefit vulnerable and underserved populations.

RÉSUMÉ

Un examen complet de la clientèle dentaire par les professionnelles dentaires, comprenant les examens extra et intra buccaux, peut permettre de saisir les taux d'écarts de rapidité des détections du cancer buccal. Les hygiénistes dentaires ont la formation requise pour évaluer les tissus mous buccaux et différencier les tissus normaux et la santé des tissus anormaux ou déficients. Le rendez-vous en hygiène dentaire comporte naturellement l'opportunité d'examen d'un cancer buccal dans la routine des soins d'hygiène dentaire. Les normes de pratique décrètent que l'hygiéniste dentaire a la responsabilité professionnelle d'effectuer systématiquement des évaluations entières de la tête, du cou et de la cavité buccale et d'en documenter l'évolution. Lorsqu'une lésion anormale persiste plus de 3 semaines, il conviendrait d'amorcer la procédure de référence. Les modifications des règlements et la croissance d'envergure de la pratique permettent aussi de maximiser les soins buccodentaires des Canadiens et Canadiennes. L'augmentation des points d'accès aux soins et d'examen hors des cabinets traditionnels peuvent bénéficier aux populations vulnérables et mal desservies.

Key words: access to care, cancer early detection, oral cancer, referral, scope of practice, screening

INTRODUCTION

Head and neck squamous cell carcinoma (HNSCC) is the 6th most common cancer in the world,¹ and in Canada, oral cancer is the 13th most common cancer.² This year, more than 4000 Canadians will be diagnosed with oral cancer and approximately 1150 will die as a result.³ Comprehensive extraoral and intraoral examinations and early detection of oral cancer have been shown to significantly reduce both the morbidity and mortality rates of this disease^{4,5} though for decades, the survival rates have remained the same.³ Oral cancer is often identified at a late stage,^{4,6} resulting in more aggressive treatment, increased side effects from treatment, and poorer prognosis.^{4,7} Survival rates and client outcomes are significantly improved when this disease is identified in the early stages.⁸ As with other types of cancer, oral mucosal examination of dental clients has the potential to make a dramatic difference in the rates of early detection of oral cancer. Dental hygienists have the

specific training to assess all oral tissues and differentiate between normal, healthy soft tissue and abnormal or diseased tissues. The dental hygiene appointment is naturally predisposed to oral cancer screenings as a part of routine dental hygiene care.^{9,10} This article will discuss Canadian dental hygienists' scope of practice, its effect on access to oral cancer screenings, and the referral pathways designed for dental hygienists when significant lesions or symptoms are identified.

PRACTICE STANDARDS AND SCOPE OF PRACTICE

Practice standards dictate that dental hygienists have a professional responsibility to conduct systematic, comprehensive hard and soft tissue assessments of the head, neck, and oral cavity.^{9,11-15} These assessments allow for the collection of pertinent information to evaluate a client's oral and general health, and provide the rationale for the planning and implementation phases of care.

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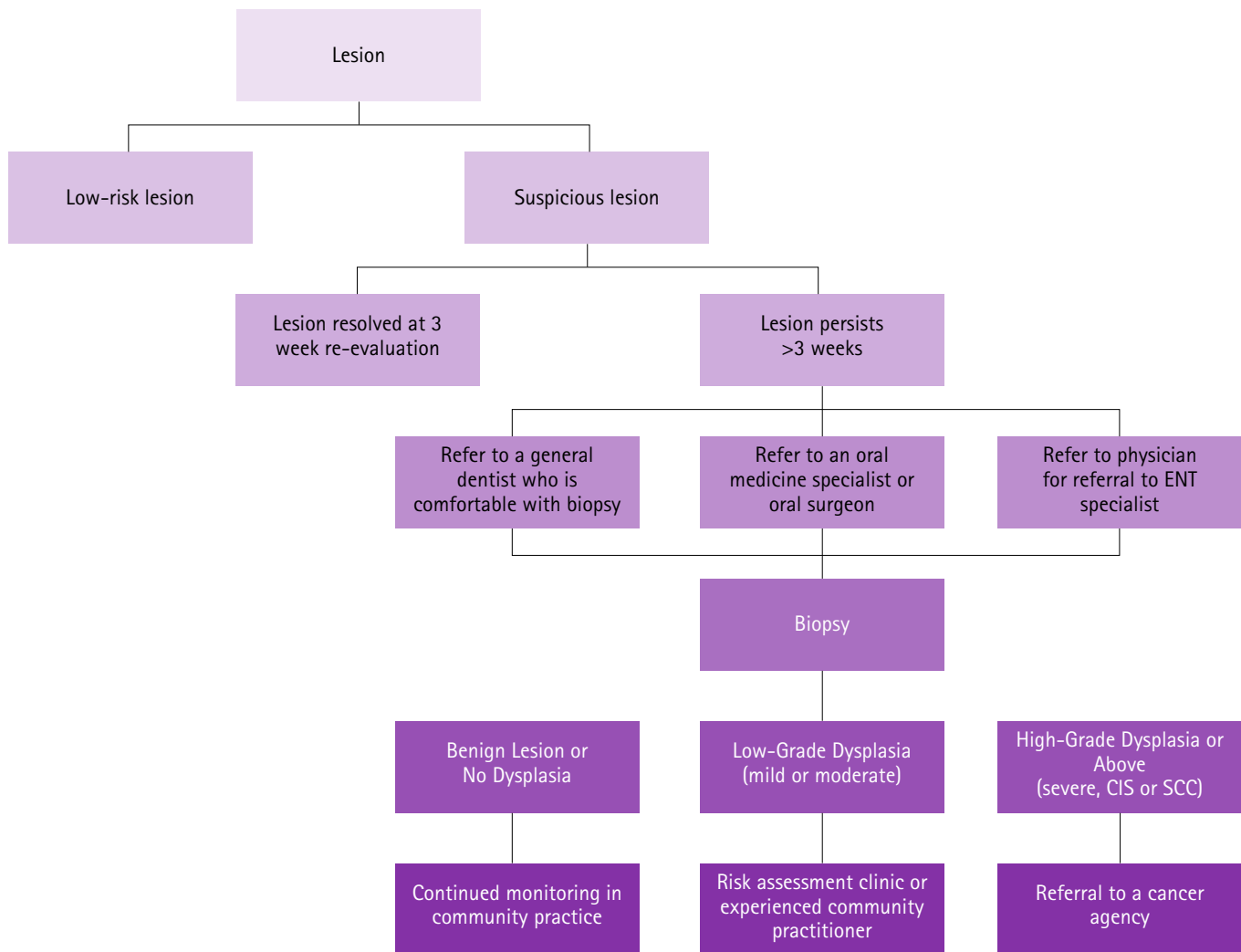
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Figure 1. Suspicious oral lesion referral pathway for dental hygienists



Adapted from British Columbia Oral Cancer Prevention Program, BC Cancer Agency; College of Dental Surgeons of British Columbia. Guideline for the early detection of oral cancer in British Columbia 2008. *J Can Dent Assoc.* 2008 Apr;74(3):245.⁷

Abbreviations: CIS = carcinoma in situ; SCC = squamous cell carcinoma

Oral cancer screenings begin with a thorough review of the client’s medical history, including information regarding previous and current use of alcohol and tobacco and type and amount used. The history of the lesion, including onset, duration, and symptoms should also be recorded. Once this has been completed, a comprehensive clinical examination, including extraoral and intraoral assessments, should be performed. Extraoral examination should include inspection of the head and neck region for asymmetry or swelling. With a bimanual approach, the submental, submandibular, cervical, and supraclavicular regions are palpated for any tender, enlarged, firm or fixed lymph nodes. All oral tissues should be systematically palpated and inspected for irregularities, with particular attention given to high-risk sites including lateral and ventral aspects of the tongue; floor of mouth; soft palate;

and oropharynx.^{7,16} Complete inspection of the lateral aspects of the tongue requires the use of gauze to pull the tongue out, roll it side to side to fully visualize the (bilateral) posterior borders. The base of the tongue may only be visible with the use of a dental mirror when the tongue is fully extended. The dental mirror or tongue depressor should also be used to depress the tongue lightly, while the client says “ahhh,” in order to allow for adequate examination of the tonsils and oropharynx.¹⁷

Dental hygiene standards of care require dental hygienists to perform extra and intraoral examinations for every client at every visit and document changes. Dental hygienists are required to maintain detailed documentation and records consistent with applicable legislation, code of ethics, professional practice standards, guidelines, and policies.^{11–15} Complete documentation of the lesion should

Table 1. Information required for the referral letter

Item	Specific information
Client details	Client name, address, contact information, birthdate
Medical history	Medical history, medications, drug allergies
Social history	Include tobacco and alcohol status
Client chief complaint	Client symptoms <ul style="list-style-type: none"> · asymptomatic · sensitivity, pain · onset and duration of lesion
Detailed description of lesion	Include MCATSS information <ul style="list-style-type: none"> · margins · colour · appearance · texture · size · site
Differential or working diagnosis (optional)	List clinical diagnosis (or diagnoses) to indicate urgency of the referral
Referring clinician details	Name, title, address, and contact information

include a detailed written description of distinguishing characteristics such as margins, colour, appearance, texture, size, and site, which may be charted using the acronym “MCATSS.” Photographs should be taken whenever possible. Visual and tactile examinations are the primary approach to oral cancer screening and lesion assessment. Adjunctive screening tools such as toluidine blue, brush biopsy (OralCDx®) or direct fluorescence visualization (VELScope®) may be considered as complementary to the primary visual and tactile intraoral and extraoral examination.^{7,18} Appropriate knowledge and training in the use of these adjunctive screening tools are required before dental professionals may utilize these techniques in practice.⁷

Interprofessional health care collaboration is a key area of responsibility that dental hygienists must fulfill in the process of client care.^{11,12,14,15} During each phase of dental hygiene care, consideration should be given to findings that require referral to and consultation with other health care professionals. Identification of a suspicious pathology or an abnormal tissue condition that persists for more than 3 weeks is an indication that the dental hygienist must initiate the appropriate referral pathway.^{7,12,19,20}

REFERRAL PATHWAY

Low-risk lesions, such as mucocoeles, amalgam tattoos, and recurrent aphthous ulcers may be documented and monitored for change (Figure 1). Suspicious lesions that have not resolved after a 3-week re-evaluation appointment should be referred to an oral medicine specialist, an oral surgeon or a periodontist.^{7,12,20} Dental hygienists may also collaborate with general dentists who conduct biopsies in their dental offices. Alternatively, clients may be referred

Figure 2. Sample referral letter

DATE

Dental Hygienist’s Name, BDSc, RDH
Practice location
Address

Consulting Health Care Professional Name
Practice location
Address

Re: Client Name, DOB 1960/01/31
Address

Phone: [phone number]

Dear Dr. [Health Care Professional’s Name],

[Client Name] is a 51-year-old female who has been a long-term client in our dental office. She presented to our office 3 weeks ago for her periodontal therapy appointment. At that appointment we discovered an asymptomatic, discrete, homogenous, white, smooth 15 mm x 10 mm lesion on her left lateral tongue. [Client Name] had no memory of biting or traumatizing her tongue. No obvious sources of dental trauma were noted at the time.

Medically [Client Name] has a history of high blood pressure controlled by hydrochlorothiazide. Her blood pressure at her last appointment was 130/82 and is consistent with her previous measurements in our office. She suffers from environmental allergies including dust, broom, and cats. [Client name] is a former smoker, having quit a 20-year, 1 pack/day habit 10 years ago. She is a social drinker, having one glass a wine per day on the weekends.

[Client Name] returned to our office today for a 3-week reassessment appointment. The lesion is still present and remains FV+. As you are aware, a white persisting lesion with no apparent cause is a concern, particularly on a high-risk site such as the lateral border of the tongue. An intraoral image of the lesion was taken at the time of the initial appointment and is included with this letter.

Referral for the assessment, possible biopsy, and management of the lesion were discussed with [Client Name], and she stated that she is interested in determining the cause of the lesion. Please contact us if you require any further information.

Yours sincerely,
[Dental Hygienist Name], BDSc, RDH

to their medical doctor with a request for referral to an ear, nose and throat specialist, a dermatologist or other appropriate specialist.^{12,19,20} Collaboration with dentists, dental specialists or other health care providers will allow for open communication with clients about the risks and benefits of management alternatives, including no treatment or follow-up only.

It is essential that the consultant know certain details about the client and the reason for referral. The referral letter should include the following information: name, title, and address of the person to whom you are referring; client’s name, addresses, contact information, and date of birth; relevant medical/social history; reason for referral; request for advice and/or treatment, as well as any other pertinent information (Table 1). Referral letters can be prepared using pre-printed forms or composed individually, and should be professional, concise, and encompass all case-related information (Figure 2).

ACCESS TO CARE

There is increasing awareness and acknowledgement of the challenges faced by vulnerable and underserved populations in accessing oral health care.^{5,21–27} For many people, access to traditional dental office settings is impeded by systemic barriers that may be persistently complicated by social, cultural, economic, structural or geographic factors.^{22,24,25}

The persons most often impacted by these barriers are the elderly, racial and ethnic minorities, special needs groups, those in rural or geographically isolated areas or with low economic status at any age.^{21,22,24} Outreach programs, mobile clinics, and alternative practice settings owned by independent dental hygiene practitioners, which focus on underserved populations, have the potential to increase the availability of oral cancer comprehensive examinations to vulnerable and at-risk populations.²²

Currently, self-regulation, self-initiation, and supervision requirements vary between provinces.²⁸ Changes in these regulations could lead to increased screening through improved access to care for vulnerable and underserved populations who may not have routine access to traditional dental office settings. In a deliberate attempt to maximize and expand access to oral health care services, Alberta and most recently New Brunswick have given dental hygienists the unrestricted ability to provide full scope of care without limitations.^{15,23,28} Similarly, the American Dental Association

recognized the importance of removing restrictions on dental hygiene practice to create incentives to bring services to underserved areas and in settings where clients' ability to reach dental facilities is limited.²² These measures address the need for more oral cancer screenings by qualified health care professionals and thereby facilitate care by referral to a dentist or appropriate specialist.^{22,24}

CONCLUSION

Population growth and aging are expected to impose a greater demand on our health care system for oral cancer screening, diagnosis, and treatment services.³ Early detection simplifies treatment, increases prognosis, and reduces morbidity and mortality rates of this disease. Dental hygienists are positioned to play a major role in the early detection of oral cancer by serving as front-line examiners. The provision of intraoral and extraoral examinations is within all Canadian dental hygienists' scope of practice²⁸ where, upon identification of a suspicious lesion, the appropriate referral pathway should be initiated. With the goal of increasing access to oral health care and availability of oral cancer screening to underserved and at-risk populations, dental hygienists should continue to seek policy changes in self-regulation, self-initiation, and increased scope of practice.

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