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Functional fitness for dental hygiene students

**Perceived oral health and access to care among men
with a history of incarceration**

An assessment of chlorine stain and collegiate swimmers

Dental care for the client with major depressive disorder

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A new evolution of *Canada's Food Guide*

Salme E Lavigne*, PhD, RDH; Christina Lengyel[§], PhD, RD

As we begin to feel those cooler autumn breezes and marvel at the beautiful display of fall colours that we witness annually as part of the natural beauty of our country, another palette of colours comes to mind: the new *Canada's Food Guide*. For health care professionals, the food guide has always been an integral part of how we practise our profession, particularly within our health promotion efforts. Interestingly, the first-ever *Canada's Food Guide* was published in 1942 as *Canada's Official Food Rules* and, from that early publication, there have been multiple revisions over the years, the last one published in 2007. Thus, the new version released in January 2019 was long overdue!

The new *Canada's Food Guide* is completely revised and has evolved based on an extensive review of scientific evidence and consultation. The new guidelines were developed by scientific nutritional experts who used current evidence from multiple systematic reviews and purposefully excluded any information from industry-commissioned reports that could lead to conflicts of interest. The approach is more holistic as the guide talks about the context of eating, moving beyond just nutrients and food. The objectives of the new guidelines are “to promote healthy eating and overall nutritional well-being, and support improvements to the Canadian food environment.”¹

The guide is meant to assist Canadians in making healthier food choices, with an emphasis on incorporating healthy eating habits based on where, why, when, and how one eats. The approach to healthy eating has been simplified thanks to the use of a plate as a visual representation. Instead of focusing on serving numbers and portion sizes, the guide uses proportions for only 3 food categories: vegetables and fruits (half of the plate);



Salme E Lavigne



Christina Lengyel

protein foods (one-quarter of the plate); and whole-grain foods (one-quarter of the plate). In addition, water is now the recommended beverage of choice. The guide also encourages Canadians to examine how they make food choices by being mindful of their eating habits, planning and cooking meals more often, incorporating cultural traditions, enjoying food, and eating meals with others.

There are 3 specific sections to the guidelines:

1. *Nutritious foods are the foundation for healthy eating.* This guideline emphasizes the regular consumption of vegetables, fruit, whole grains, and protein foods, particularly more plant-based proteins such as legumes, nuts, seeds, tofu, fortified soy beverages, fish, shellfish, eggs, poultry, lean red meat including wild game, lower fat milk, yogourt, and kefir, and cheeses lower in fat and sodium.¹

2. *Processed or prepared foods and beverages that contribute to excess sodium, free sugars, or saturated fat undermine healthy eating and should not be consumed regularly.* Foods that contain mostly unsaturated fat should replace foods that contain mostly saturated fat, water should be the beverage of choice, and alcohol should be consumed with caution.¹

3. *Food skills are needed to navigate the complex food environment and support healthy eating.* This guideline focuses on the importance of skills such as preparing and cooking nutritious foods as a practical way of supporting healthy eating versus eating in restaurants or buying prepared foods. Using food labels is also emphasized to help consumers make more informed food choices.¹

Canada's Food Guide is presented as being better for the environment as it emphasizes consuming proteins from plant-based sources, such as nuts, beans, and lentils, rather than always choosing animal products. This concept also

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aligns with the Planetary Health Diet created by a team of more than 30 world-leading scientists on the EAT–Lancet Commission on Healthy Diets From Sustainable Food Systems.² The Planetary Health Diet focuses not only on what one eats, but also on what foods are nutritious and environmentally sustainable, thus very much focused on plant-based foods.³

Given this divergence from what previous food guides have encompassed, Health Canada has developed a document specifically for health professionals and policy makers to better understand the recommendations.¹ In addition to the new guide, there is a mobile-friendly version that will be continually updated with resources including recipes. There are also numerous resources available from Health Canada for downloading and sharing, such as images, videos, posters, fact sheets, postcards, recipes, and the report itself. All can be found at www.Canada.ca/FoodGuide/

Interestingly, these guidelines correspond well with oral health recommendations as there is an emphasis on sugar reduction in the diet. In fact, the document for health professionals mentions the link between high sugar intake and dental caries, and makes note of the high sugar content of fruit juices. We urge all of you to access *Canada's Dietary Guidelines for Health Professionals and Policy Makers*,¹ connect with a registered dietitian, and take advantage of all of the available resources to create a plan for incorporating these new recommendations into your dental hygiene practices. Happy eating!



A healthy diet is a solution to many of our health care problems. It's the most important solution.
—John Mackey

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ISSUE AT A GLANCE

You will find 3 original research articles in this issue. **Joanne Parsons, Laura MacDonald, Marielle Cayer, and colleagues** assess the effects of a 12-week functional fitness training program on postural awareness, expectations and self-efficacy related to exercise, and core stability of final-year dental hygiene students (pp. 149–56). **Leeann Donnelly, Ruth Elwood Martin, and Mario Brondani** examine the perceptions of oral health and access to care experiences of men with a history of incarceration and identify factors that contribute to oral health inequities within that community (pp. 157–65). **Alexandra Moore, Christina Calleros, Diana Aboytes, and Orrin Myers** study chlorine stain on the dentition of competitive female swimmers and divers and the effects of daily home oral care and professional dental hygiene services on these stains (pp. 166–71).

In addition, we offer a short communication by **Aviv Ouanounou and Kester Ng**, who review the pharmacotherapy of depression and the necessary dental treatment adaptations that are required for clients with major depressive disorder (pp. 172–77). We are also pleased to feature this year's winning entry in the CJDH Student Essay Award competition, written by **Ashley Chicote**, a student at the University of British Columbia (pp. 178–81). Finally, we share the abstracts of the peer-reviewed oral and poster presentations that will be given at the Canadian Dental Hygienists Association's biennial national conference, taking place this month in St. John's, Newfoundland and Labrador (pp. 183–88).

PLAIN LANGUAGE ABSTRACTS

Parsons JL, MacDonald L, Cayer M, Hoepfner M, Titterton A, Willsie J, Webber SC. Functional fitness for dental hygiene students: Does it make them fit to sit? *Can J Dent Hyg.* 2019; 53(3):149–56.

Musculoskeletal disorders (MSDs) pose a significant risk to the well-being and careers of dental hygienists, yet fitness training is rarely included in dental hygiene curricula. This article explores the effects of a 12-week functional fitness training program on the postural awareness, core endurance, and ongoing commitment to exercise of 24 final-year dental hygiene students. The students completed online questionnaires and were tested on their ability to perform a static plank hold, in-line lunges, and trunk stability push-ups one week before the training program started and again one week after the program ended. Ten months after graduation, the students completed a follow-up questionnaire about their experience. Results showed that students improved in some core stability and postural tasks, and continued to recognize the benefits of exercise. Future research should study the effects of such preventive education programs on the incidence of MSDs among dental hygienists.

Donnelly LR, Martin RE, Brondani MA. Perceived oral health and access to care among men with a history of incarceration. *Can J Dent Hyg.* 2019;53(3):157–65.

Researchers invited 18 men with a history of incarceration to discuss their perceptions of oral health and experiences in accessing oral care services, in hopes of identifying factors that contribute to their poorer oral health as well as possible solutions. Ten staff members of a non-profit organization that supports individuals involved in the criminal justice system were also invited to share their thoughts on this topic. The study found that the personal backgrounds, experiences of dental care both before and during prison time, and the stigma of having been incarcerated influenced the men's ability and willingness to seek professional oral care. By creating a safe space for these individuals to receive care comfortably, dental hygienists have the potential to improve access to care for this marginalized group.

Moore AB, Calleros C, Aboytes DB, Myers OB. An assessment of chlorine stain and collegiate swimmers. *Can J Dent Hyg.* 2019;53(3):166–71.

Dental staining is common among competitive swimmers and divers who practise regularly in chlorinated swimming pools. This "swimmer's mouth" phenomenon, which also includes calculus accumulation and dental erosion, may be the result of improper pool chlorination. This study assesses chlorine stain on the dentition of 21 swimmers and divers from the University of New Mexico Swimming and Diving Team and examines the effect of daily home oral care and professional dental hygiene services on these stains. It found that all swimmers and divers had staining, despite maintaining regular home and professional oral care routines. The authors highlight the risks of extended chlorine exposure to the body and recommend careful and regular monitoring of pH levels to protect both oral and overall health. They also encourage further research in this area to establish dental strategies that could shield the teeth from chlorine damage.

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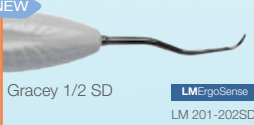


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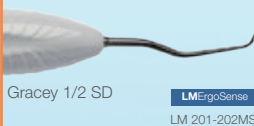


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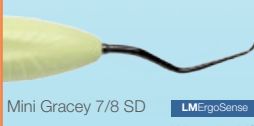
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Functional fitness for dental hygiene students: Does it make them fit to sit?

Joanne L Parsons*, BMR(PT), MSc, PhD; Laura MacDonald[§], MEd, RDH; Marielle Cayer[†], MPT; Mikaela Hoepfner[†], MPT; Ashley Titterton[†], MPT; Justin Willis[†], MPT; Sandra C Webber[‡], BMR(PT), MSc, PhD

ABSTRACT

Background: Static positioning and awkward postures put dental hygienists at risk for work-related musculoskeletal disorders. These disorders often appear during professional training programs. Ergonomics education has been shown to reduce the incidence of injuries, but fitness training to improve postural awareness and endurance is not typically included in dental hygiene curricula. This study assessed the effects of a 12-week functional fitness training program on ergonomic and postural knowledge, outcome expectations and self-efficacy related to exercise, and core stability in final-year dental hygiene students. **Methods:** Participants (n = 24) completed surveys and core stability tests and demonstrated postural movements before and after completing a mandatory weekly training program focusing on dynamic core stabilization, aerobic exercise, and postural awareness. **Results:** Participants improved static plank hold time and left leg forward lunge scores, with no significant changes in right lunge or stability push-up tests. Accuracy in demonstrating postural movements in response to verbal cues improved for 2 of 6 movements. Knowledge about injury risk factors and body mechanics was relatively high at pre-test and did not change post-test. Outcome expectations and self-efficacy were not significantly different from pre- to post-test. **Conclusions:** Functional fitness training resulted in increased core endurance and improved execution of some movement patterns associated with good body mechanics. Our study provides evidence for the inclusion of this type of conditioning program in the dental hygiene curriculum. Further research, including more sensitive tests of physical function as well as the transfer of knowledge and safe postures into clinically relevant situations, is warranted.

RÉSUMÉ

Contexte : Le positionnement statique et les mauvaises postures mettent les hygiénistes dentaires à risque de troubles musculo-squelettiques liés au travail. Ces troubles surviennent souvent au cours des programmes de formation professionnelle. Il a été démontré que la formation en matière d'ergonomie réduit l'incidence des blessures, alors que le conditionnement physique effectué pour améliorer la prise de conscience posturale et l'endurance ne fait généralement pas partie du programme d'étude en hygiène dentaire. La présente recherche a évalué les effets d'un programme de conditionnement physique fonctionnel de 12 semaines sur les connaissances en matière de l'ergonomie et de la posture, des attentes de résultats, de la connaissance de ses propres capacités liées à l'exercice, ainsi que de la stabilité du tronc chez les étudiants de dernière année en hygiène dentaire. **Méthodologie :** Les participants (n = 24) ont rempli des sondages, effectué des tests de stabilité du tronc et démontré des mouvements posturaux avant et après avoir terminé une formation hebdomadaire obligatoire axée sur la stabilisation dynamique du tronc, les exercices aérobiques et la prise de conscience posturale. **Résultats :** Les participants ont amélioré leurs résultats de temps de planche statique et de l'exercice de fente avant de la jambe gauche et n'ont pas montré de changements significatifs dans leurs tests d'exercice de fente avant de la jambe droite ou de répulsions, des exercices de stabilisation du tronc. La précision des mouvements posturaux en réponse aux stimulations verbales s'est améliorée dans 2 des 6 mouvements. Les connaissances sur les facteurs de risque en matière des blessures et sur la mécanique du corps étaient relativement élevées au moment du test préliminaire et n'ont pas changé après le test. Les attentes de résultats et la connaissance de ses propres capacités n'étaient pas significativement différentes entre le test préliminaire et le post-test. **Conclusions :** Le conditionnement physique fonctionnel s'est traduit en une meilleure endurance du tronc et une performance améliorée de certaines séquences de mouvements associés à la bonne fonction mécanique du corps. Notre étude apporte des preuves qui appuient l'ajout de ce type de programme de conditionnement au programme d'hygiène dentaire. Il est justifié de faire des recherches plus poussées, y compris des évaluations plus sensibles de la fonction physique, ainsi que du transfert des connaissances et des postures sécuritaires aux situations cliniques pertinentes.

Keywords: body mechanics, core stabilization, curriculum, dental hygiene, physical activity, physical fitness, posture
CDHA Research Agenda category: capacity building of the profession

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WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Musculoskeletal disorders pose a significant risk to the well-being and career longevity of dental practitioners.
- Because work-related musculoskeletal disorders appear during training programs, functional fitness to improve postural awareness and physical fitness is important to include in dental hygiene curricula.
- After 12 weeks of functional fitness training, students improved in some core stability and postural tasks, and showed high levels of knowledge about and strong belief in the benefits of exercise.

INTRODUCTION

Musculoskeletal disorders (MSDs) are common in the workplace and pose a significant risk to the well-being and career longevity of dental practitioners in particular.^{1,2} Disorders can affect nerve, muscle, tendon or articular tissue, and are often concentrated in the upper extremities. The prevalence of pain associated with MSDs is extensive, ranging from 64% to 93% in a systematic review of dentists, dental students, and dental hygienists.¹ A greater number of dental hygienists than dentists report pain due to work tasks, with the highest disparity seen for hand pain (75% of dental hygienists versus 38% of dentists).³ Elevated rates of neck and shoulder pain have also been reported by dental hygienists compared to dentists.⁴ The impact on the workforce is significant; 18% of dental hygienists who permanently left clinical practice reported MSDs as the primary reason.⁵

Musculoskeletal disorders and pain manifest early, during training programs,⁶⁻⁸ and it has been suggested that dental hygiene students experience MSDs at higher rates than students in other health professions.⁷ A significant proportion (34% to 68%) of dental hygiene (DH) students report symptoms involving the wrist and hand, shoulder, neck, and upper and lower back over the duration of their training program.⁷ Numbness is also found to increase as DH students progress through their studies, in concert with the number of hours they report using vibrating and manual instruments.⁹ Similarly, rates of MSDs appear to rise as more time is accumulated in practice. DH students with no dental-related practice background reported lower rates of neck pain (37%) compared to DH students with prior experience as dental assistants (43%) and dental hygienists with at least 5 years of experience (72%).¹⁰

Risk factors for the development of MSDs in dental hygienists include long periods of static positioning and awkward postures, a confined field of work, forceful and repetitive work, the small size, shape, and vibration tendencies of their instruments,^{2,11} and low levels of exercise.⁶ Much attention is focused on working posture, as dental hygienists spend approximately 50% of their time in 30 degrees or more of trunk flexion, and 86% of their time in 30 degrees or more of neck flexion.¹² These sustained postures can lead to high strain and tissue overload, with increased potential for developing a MSD.¹³ With these risk factors identified, numerous researchers have highlighted the need for early interventions to reduce MSDs in dental practitioners,^{4,6,7,11} including embedding preventive ergonomics education into the curricula of dental programs.⁴

While dental hygiene programs recognize the importance of including ergonomics education in their curricula, data are limited on the extent of its delivery, and there is scant discussion about functional fitness as part of the curricula. A 1998 survey of American DH programs found the vast majority provided more than 10

hours of education on proper client/operator positioning and instrumentation technique.¹⁴ One-third of the programs provided “additional” ergonomics education, most commonly on the topics of preventing MSDs and preventive exercise, but half of those programs devoted less than one hour to these topics.¹⁴

Among practising dental hygienists, those who received ergonomics education, which emphasizes the importance of client and operator positioning,¹⁵ reported lower rates of MSDs.¹⁶ A recent study found that ergonomic self-assessment training improved the posture scores of DH students, and a higher number of training sessions increased their ability to accurately evaluate their working posture.¹⁷ Given that educating practitioners to be more aware of their body posture and function may reduce risk factors for MSDs, there has been increased interest in the role that physical fitness and exercise education can play in addressing these issues.⁸

Several authors have recommended exercise training that includes an abdominal/core stabilization component for practising dental professionals to prevent work-related MSDs.¹⁸⁻²⁰ However, there are few structured intervention studies on the specific effects of exercise training for this population, despite correlations between exercise habits and prevalence of pain,^{3,6} and strong evidence that supervised programs including resistance training can be highly effective for controlling neck pain.²¹ One study in which DH students participated in a yoga intervention twice per week found significantly lower overall and low back pain scores compared to a control group after 13 weeks, but no change in body composition.²² Another study found that dental students who engaged in higher levels of physical activity and participated in a physical fitness course as part of their academic curriculum had lower rates of back pain.⁸ However, this study did not include DH students, and the unsupervised course required only that the students engage in a minimum of 90 minutes per week of any physical activity, with a focus on aerobic sports.⁸ In a survey of practising dental hygienists, those who reported using complementary therapies including yoga had significantly reduced pain levels.²³ However, yoga was the lone exercise-based therapy included in a list of 8 complementary therapies, and its individual effect was not examined. Another study found that a multifaceted program including “regular exercise” reduced rates of MSDs.²⁴ However, the participants in this study were practising dentists, all were male, and the exercise component consisted of only a few stretching exercises and the logging of any sports activities.

Intricately related to introducing and maintaining an exercise program are the notions that an individual’s expectations and confidence to carry out the decisions and tasks needed to engage in the activity (self-efficacy) will ultimately influence whether the exercise behaviour is successful and sustained, or not.²⁵ No mention of these

concepts exists in any literature we are aware of related to the use of exercise training for the prevention of MSDs in dental practitioners.

Given the high prevalence of MSDs among dental hygienists, the early onset of symptoms during training programs, and the lack of information on the effects of embedding physical fitness and exercise education into the DH curriculum, this study aimed to assess knowledge, self-efficacy, outcome expectations, and physical competence regarding core stabilization, safe body mechanics, and exercise in DH students participating in weekly mandatory functional fitness classes over 12 weeks. The primary objectives were to assess changes in their knowledge of body mechanics; outcome expectations related to participating in functional fitness training; performance on physical tests requiring core stabilization; and ability to demonstrate postural movements taught in their functional fitness classes. The secondary objective was to assess the students' self-efficacy regarding participation in functional fitness activities.

METHODS

Research design and participants

The study was a quasi-experimental pre-post design involving a convenience sample of final-year DH students. All students who were capable of participating in the functional fitness classes (a requirement of their university program) were eligible to participate. This study was approved by the University of Manitoba Health Research Ethics Board.

Study protocol

Data collection occurred on 3 occasions: one week prior to beginning fall semester functional fitness classes (pre), within one week of completing fall semester fitness classes (post), and then 10 months later when participants had completed the final semester of their university program (including another 12 weeks of functional fitness classes) and subsequently started working as dental hygienists (follow-up). In the pre- and post-training testing sessions, participants completed online questionnaires and underwent physical testing and an assessment of familiarity with postural cues; for the follow-up assessment, participants completed questionnaires only.

Measures: Physical activity status, knowledge, outcome expectations, and self-efficacy related to engaging in core stabilization/functional fitness exercises

Participants completed online questionnaires at baseline to provide basic demographic information and establish their physical activity status (International Physical Activity Questionnaire [IPAQ] and participation in resistance training and core stabilization exercises),²⁶ and their knowledge of core stabilization and body mechanics principles (14 short-answer questions). Outcome expectations related to engaging in core stabilization/functional fitness exercises

were determined through an analysis of answers to 13 questions. Participants rated their level of agreement with statements such as “Engaging in core stabilization/functional fitness will...1) increase the strength of core muscles, 2) strengthen my bones, 3) aid in weight control,” etc. on a 5-point scale (from strongly disagree = 1 to strongly agree = 5).

The post-training questionnaire included the same knowledge and outcome expectations questions, as well as 5 questions about task self-efficacy related to the functional fitness classes (e.g., “How confident are you that...1) you were able to do the core stabilization/functional fitness exercises the way the instructor wanted them to be done, 2) you were able to see the relevance of doing the exercises as a student in dental hygiene, 3) the physical conditioning gained resulted in an improved ability to maintain good body mechanics in clinical situations,” etc.). For these questions, participants rated their degree of confidence from 0 (not at all confident) to 100 (completely confident). Participants also completed 5 questions regarding their self-regulatory self-efficacy to continue to engage in core stabilization/functional fitness exercises (e.g., “How confident are you that you can...1) continue to engage in these types of exercises at least once per week, 2) do core stabilization/functional fitness exercises with proper technique, 3) set realistic goals for exercise, 4) anticipate problems that might interfere with continued exercise, and 5) develop solutions to problems that might interfere with continued exercise”). The follow-up questionnaire 10 months later included several questions about employment, the IPAQ,²⁶ and repeated the questions regarding outcome expectations and self-efficacy related to core stabilization/functional fitness exercise.

Physical testing

Participants' height and body mass were measured at baseline using a validated protocol.²⁷ Physical testing conducted pre- and post-training included the static plank hold,²⁸ in-line lunge test,²⁹ and trunk stability push-up.³⁰ All physical tests and postural movements were rated by trained physiotherapists and physiotherapy students using standardized rubrics.

A researcher demonstrated the positioning for the static plank hold (forearms and toes touching the ground)²⁸ and participants were given a 5-second practice trial with feedback about proper positioning. The practice trial was followed by a 15-second rest before the actual test repetition. For the test trial, participants were allowed one deviation from correct position, provided they corrected themselves immediately when prompted. The trial stopped when participants reached 2 minutes or when there was a second deviation from the proper position.²⁸

The trunk stability push-up was assessed as outlined by Cook et al.³⁰ following an initial demonstration of the movement by a researcher (push-up from a prone position with feet together and hands placed under the

shoulders with fingers pointing forward). Participants were encouraged to attempt to lift their body as one solid unit, ensuring the chest and stomach came off the floor at the same time, with no adjustment of the initial hand position (for females the thumbs were aligned with the chin; for males the thumbs were aligned with the top of the forehead).³⁰ Participants had 2 practice trials and were given feedback on their form. After a 30-second rest, participants assumed the start position and attempted one push-up. If the attempt was unsuccessful, participants were given another 30-second rest and then attempted another push-up with their hands in an easier position (for females the thumbs were aligned with the clavicle, and for males the thumbs were aligned with the chin).³⁰ Participants were scored (1 to 3) based on the successful completion of the push-up.³⁰

For the in-line lunge test, participants stood with their toes behind a marked starting point with a dowel held behind their back, in contact with their head and buttocks according to the protocol by Cook et al.²⁹ The movement (stepping forward and lowering the back knee to contact the ground before returning to the starting position) was demonstrated before participants attempted it. Participants were allowed 2 practice trials per leg, and up to 3 test trials on each leg. The front leg was scored following Cook et al.²⁹

Postural movement assessment

Participants were asked to demonstrate postural movements in response to verbal cues. The cues were terms used regularly in their functional fitness classes (e.g., “engage your core muscles,” “put your shoulder blades in your back pockets,” “find lumbar neutral”). Postural movements were scored on a scale from 0 to 3, with 3 meaning that all required movement components were demonstrated and no extraneous movements were added; 2 meaning that the majority but not all required movement components were included; 1 meaning that less than 50% of required movement components were demonstrated; and 0 meaning that no attempt of the movement was made.

Functional fitness training program

Participants attended weekly 50-minute functional movement training classes (a mandatory component of a theory/practice course in the DH curriculum) led by a certified fitness instructor. Each class consisted of 5 minutes of warm-up activities (e.g., dance aerobics, step aerobics, marching in place), 40 minutes of dynamic core stabilization and aerobic exercises (in lying, sitting or standing positions using resistance bands, dumbbells, exercise balls, steps, etc.) and 5 minutes of cool-down activities. The core stabilization challenge was increased over the 12 weeks. Physical and verbal cueing for all exercises ensured participants were conscious of lumbar and cervical neutral positions, “soft” joints, and core muscle

engagement. The instructor and an assistant regularly walked among the participants to provide individualized feedback to ensure proper technique was followed.

Data analysis

All statistical analyses were conducted using Microsoft Excel (Microsoft Corporation, Redmond, USA) and SigmaPlot (Systat Software Inc., Chicago, USA). Data were examined for normality using the Shapiro-Wilk test, and mean \pm standard deviation (SD) or median (interquartile range [IQR]) were used to describe data as appropriate. Pre and post differences in knowledge, self-efficacy, physical tests, and postural movement scores were assessed using paired t-tests. Outcome expectations across all 3 time points were analysed using a one-way repeated measures analysis of variance. Relationships between participation in resistance training/core stabilization exercises and IPAQ category and physical performance at baseline were explored using Spearman’s rank correlations. Statistical significance was set at $p \leq 0.05$.

RESULTS

Twenty-four DH students (22 females, 2 males) completed pre- and post-testing. Nineteen students completed the follow-up questionnaire 10 months later. The average attendance at functional fitness classes was 11.8 ± 0.5 sessions over 12 weeks. Pre-training, 6 participants were rated as “high active,” 11 as “minimally active,” and 7 as “inactive” on the IPAQ.²⁶ Metabolic Equivalent (MET) minutes per week, measured with the IPAQ, did not change for the group from baseline to follow-up (1776 ± 1486 min versus 1692 ± 1500 min, $p = 0.87$). There were significant correlations between performance on the static plank hold test and self-reported minutes per week engaged in resistance training ($r_s = 0.78$, $p < 0.001$), minutes per week engaged in core stabilization exercises ($r_s = 0.73$, $p < 0.001$), and IPAQ category ($r_s = 0.48$, $p = 0.02$) at baseline. However, there were no significant relationships between resistance training/core stabilization minutes and the trunk stability push-up and in-line lunge tests. Eighteen of the nineteen participants reported being employed as a dental hygienist on the final follow-up questionnaire. They reported working for 1 to 4 months for 31.1 ± 9.6 hours/week. See Table 1 for a summary of baseline participant characteristics.

Knowledge of core stabilization and body mechanics concepts, outcome expectations of functional fitness participation, and self-efficacy regarding past and future exercise behaviour did not demonstrate significant change over time (Table 2). Participants improved on the static plank and left leg in-line lunge physical tests (Table 3). They significantly improved in accurately demonstrating “put your shoulder blades in your pockets” and “untuck your tail” (Table 4), 2 of the 6 postural movements.

Table 1. Baseline participant demographics

Characteristic	Median (IQR)
Age (years)	23 (5.5)
Mass (kg)	59.2 (14.8)
Height (m)	1.7 (0.1)
BMI (kg/m ²)	21.9 (4.9)
Resistance training participation (min/week)	2.0 (56.3)
Core training participation (min/week)	0.0 (18.8)

DISCUSSION

Since MSDs often appear early in the career of a dental hygienist, embedding structured exercise sessions within dental hygiene curricula may encourage attention to posture and core stabilization during clinical work and everyday life and, therefore, prevent pain and disability. This study found that weekly participation in mandatory functional fitness classes led to some improvements in physical competence, but no changes in knowledge, outcome expectations or self-efficacy to engage in exercise.

Physical activity knowledge and outcome expectations

Baseline scores for knowledge of principles of core stabilization and body mechanics and outcome expectations related to exercise were high, indicating that participants joined the study expecting numerous positive outcomes from exercise and with a good level of knowledge related to these topics. Data on how or where participants acquired their knowledge and expectations were not collected; they may have originated during previous years of education or from extracurricular activities such as other fitness classes or training. Regardless, it is encouraging that DH students are both coming into their final year and entering the workforce with a strong belief in the benefits of exercise, and good knowledge of ergonomic concepts.

Physical testing

The amount of change in physical performance of the 3 core stabilization tests (static plank, in-line lunge and stability push-up) was variable. The static plank hold increased by a significant 23%, which may be partially due to the high degree of similarity between that outcome measure and plank exercises undertaken during the functional fitness classes. Increased muscular endurance, as demonstrated by the static plank hold, may have clinical relevance for dental practitioners, as they are frequently required to function in sustained positions. Further investigation in this area is warranted. Baseline median in-line lunge scores were already high (3/3), perhaps resulting in a ceiling effect. Leg dominance was not recorded, which could be an explanation for the fact that the left leg forward in-line lunge showed a statistically significant improvement, while the right leg forward in-line lunge score improved but did not reach significance. In this relatively small sample, there may have been a dominant stabilization pattern so that participants were more comfortable with their right leg forward. The stability push-up test may also have lacked the sensitivity to detect change. Individuals were scored as either being able to perform the push-up or not. The scoring system did not give credit for partial push-ups or for an increase in the height of the push-up attempt. Therefore, it is possible there were changes in strength that the scoring system was unable to detect.

Similar to normative data,³¹ the scores on the in-line lunge were generally high, with very few participants scoring only 1 out of 3. For the trunk stability push-up, scores were lower than normative values. However, Schneiders et al. noted significant performance differences between males and females on this test, with the majority of males scoring 3, and the majority of females scoring 1.³¹ The present study had only 2 male participants, which may account for the lower overall trunk stability push-up score.

Participants who reported engaging in more minutes per week of resistance training and core stabilization exercises, and/or were categorized as more active on the

Table 2. Questionnaire results^a

	Pre	Post	Follow-up	p value
Knowledge of core stabilization concepts (%)	72.7 ± 14.4	74.3 ± 10.4	N/A ^b	0.58
Outcome expectations of functional fitness classes (out of 65)	57.4 ± 4.8	57.6 ± 4.4	56.3 ± 5.7	0.63
Self-efficacy regarding past exercise behaviour (%)	N/A	74.6 ± 13.7	66.5 ± 12.1	0.08
Self-efficacy regarding future exercise behaviour (%)	N/A	61.6 ± 17.5	66.3 ± 17.3	0.35

^aResults are reported as mean ± standard deviation.

^bN/A: not applicable; outcome not assessed at this time point.

Table 3. Physical test results^a

	Pre	Post	<i>p</i> value
Static plank (sec)	64.3 ± 30.6	79.0 ± 29.4	0.02 ^b
In-line lunge: left leg forward	3 (1)	3 (0)	0.02 ^b
In-line lunge: right leg forward	3 (1)	3 (0)	0.07
Stability push-up	1 (1)	1 (1)	1.00

^aResults are reported as mean ± standard deviation or median (interquartile range), as appropriate.

^bStatistically significant at the $p \leq 0.05$ level.

IPAQ demonstrated better performance on the static plank hold test at baseline. This finding provides support for promoting exercise among dental hygiene professionals, as the improved core endurance may assist in better tolerance for work-related tasks that involve sustained, static positioning.

Postural movement assessment

Scores for functional movements in response to verbal cues at baseline were generally low, which was expected, as the students had not yet been exposed to the functional fitness classes and the associated ergonomics language used. Statistically significant improvements from pre- to post-test were found for “place your shoulder blades in your pockets” and “untuck your tail.” There were no changes for the other 4 movements. There may have been a ceiling effect for “engage your core,” as only 3 of the 25 students scored less than a 3 at baseline. Prior to commencing our study, we confirmed the exact terminology used by the certified fitness instructor when leading the functional fitness classes. However, we did not assess the frequency of usage or whether the instructor was simply stating the terms

rather than explaining them and their importance relative to DH occupational demands. Perhaps students were able to mimic the movements in class, but did not associate the movements with the terminology. Also unknown is the relationship between being able to reproduce the proper movements when cued, and the postures the participants hold in their activities as DH students. The inability to recreate specific movements does not necessarily translate to poor body mechanics.

Self-efficacy related to engaging in core stabilization/functional fitness exercises

Self-efficacy scores regarding future exercise behaviour were relatively low (61% to 66%) and reflect the challenge of maintaining a healthy behaviour given varied and often unfavourable genetic, physical, and social influences.³² Although not significantly different, the scores on the 2 questions regarding clinical situations (“How confident are you that the knowledge gained from taking part in the exercise classes carried over and resulted in greater awareness of body mechanics in clinical situations?” and “How confident are you that the physical conditioning

Table 4. Postural cue results

Postural cue	Pre Median (IQR)	Post Median (IQR)	<i>p</i> value
Hip hinge	1 (1)	1 (0.5)	0.30
Untuck tail	1 (2)	3 (1.5)	0.01 ^a
Find lumbar neutral	1 (0)	1 (0)	1.00
Float ears over shoulders	1 (1)	1 (2)	0.17
Engage core	3 (0)	3 (0)	0.25
Shoulder blades in pockets	1 (1)	2 (1.75)	0.03 ^b

^aStatistically significant at the $p \leq 0.01$ level

^bStatistically significant at the $p \leq 0.05$ level

gained from taking part in the exercise classes resulted in an improved ability to maintain good body mechanics in clinical situations?") were noticeably lower at the 10-month follow-up compared to post-training (64% versus 78%; 57% versus 70%, respectively). These results may reflect the reality of working life as a dental hygienist. Six of the participants at follow-up reported working in more than one clinic; challenging physical environments are just one of the many known factors that influence behaviour change.³³ For example, the mobility of the clinical operator (unit, chair, lighting, etc.) heavily influences body mechanics. In addition, dental hygienists who describe little decision-making involvement more commonly report MSDs.¹⁶ It would be interesting to explore the degree of input that dental hygienists have on the ergonomic design of the operator in their places of employment, as well as the influence that working in 2 or more settings has on the ability, desire, and will to employ good body mechanics.

Strengths and limitations

The small sample size is one limitation of this study. In addition, the study did not control for all factors that may have affected physical performance on testing days, such as the length of time since previous exercise or the amount of sleep prior to testing. However, this study is unique in that it involves a curriculum-mandated, supervised functional fitness intervention developed specifically for the occupational needs of dental hygienists. The only previous study that examined a curriculum-based exercise intervention did not include dental hygienists and did not require the physical activities to have any particular structure or supervision, or to be relevant to the workplace demands of the profession.⁸

CONCLUSION

Following 12 weeks of participation in mandated functional fitness classes, our cohort of DH students showed improvement in the static plank and left in-line lunge tests, and in demonstration of 2 of 6 postural movements. There was no change in their knowledge of principles of core stabilization and body mechanics, their outcome expectations relating to participation in fitness activities or their self-efficacy regarding past and future behaviour. Future studies should assess the extent to which functional fitness or structured exercise programs are incorporated into DH curricula in Canada and continue to examine the effects of these types of interventions on knowledge, physical fitness, and risk factors for MSDs in DH students. By delivering effective preventive education to students in the early stages of their professional programs, educators may improve the likelihood of their graduates enjoying a fulfilling, injury-free dental hygiene career.

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CONFLICTS OF INTEREST

The authors are not aware of any existing or potential conflicts of interest.

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Perceived oral health and access to care among men with a history of incarceration

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ABSTRACT

Objectives: To explore the perceptions of oral health and access to care experiences of men with a history of incarceration and to identify factors contributing to current oral health inequities within their community. **Methods:** A qualitative approach was used via focus group discussions among 18 men with a history of incarceration and 10 staff members of a non-profit organization working with individuals who are involved in or at risk of involvement with the criminal justice system. All discussions were audiorecorded and transcribed verbatim. A thematic analysis was undertaken using *N-Vivo 10[™]*, a qualitative data management program. **Results:** The participants ranged in age from 29 years to 69 years, came from a variety of ethnic backgrounds, and had different prison setting experiences. Five major themes emerged: not on the radar, stigma of incarceration, being shot down, caught in the system, and institutional conditioning. **Conclusions:** The personal backgrounds, experiences with health and dental care during prison time, and the unique challenges faced by men with a history of incarceration influenced their perceptions and their ability to access dental services. Dental professionals can help to change these perceptions and experiences by creating a safe space for these individuals to access and receive care comfortably.

RÉSUMÉ

Objectifs : Explorer la perception sur la santé buccodentaire et l'accès aux soins des hommes ayant des antécédents d'incarcération et cibler les facteurs qui contribuent aux inégalités actuelles en matière de santé buccodentaire au sein de leur communauté. **Méthodologie :** Une approche qualitative a été utilisée au moyen de groupes de discussion comprenant 18 hommes ayant des antécédents d'incarcération et 10 membres du personnel d'un organisme sans but lucratif qui travaillent avec des personnes impliquées ou à risque d'être impliquées dans le système de justice pénale. Toutes les discussions ont fait l'objet d'un enregistrement sonore et ont été transcrites mot pour mot. Une analyse thématique a été effectuée au moyen du programme de données qualitatives *N-Vivo 10^{MD}*. **Résultats :** Les participants étaient âgés de 29 ans à 69 ans, étaient issus d'origines ethniques variées et avaient vécu différentes expériences en milieu carcéral. Cinq thèmes principaux sont ressortis, y compris ce qui ne figure pas sur l'écran radar, les préjugés associés à l'incarcération, être rejetés, être coincés dans le système, et le conditionnement institutionnel. **Conclusions :** Les antécédents personnels, les expériences en matière de santé et de soins buccodentaires au cours de la peine d'emprisonnement, et les enjeux uniques auxquels sont confrontés les hommes ayant des antécédents d'incarcération ont influencé leur perception des services buccodentaires et leur capacité d'y accéder. Les professionnels dentaires peuvent aider à changer la perception et les expériences de ces personnes en créant un endroit sécuritaire pour eux, qui leur permet d'accéder aux services et de les recevoir confortablement.

Keywords: access, incarceration, justice system, oral health, prison system, qualitative research

CDHA Research Agenda category: access to care and unmet needs

INTRODUCTION

In Canada, correctional services are administered either by a provincial or territorial government for sentences of less than 2 years or by the federal government through the Correctional Service of Canada (CSC) for sentences greater than 2 years.¹ In the year 2016–2017, there were on average 117,645 adults under provincial and territorial

supervision; an average of 23,006 adults were under the supervision of CSC.¹ Provincial, territorial or federal supervision can be done in custody (prison or remand) or in a community-based program (probation, parole, statutory release). In 2016–2017, within the overall Canadian correctional system, 39,873 individuals were

WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Men with a history of incarceration tend to have poorer oral health than the general population.
- This study explores perceptions of, barriers to, and facilitators of oral health for this group as a first step in identifying strategies to reduce this disparity.
- Dental hygienists, in collaboration with correctional institutions and community organizations, can improve access to care for men with a history of incarceration by creating a safe space for them to receive professional oral care.

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in custody and the remaining 100,868 were awaiting sentencing or serving their sentence in a community-based program, which translates to roughly 72% living within society.¹ There is an overrepresentation of males within the Canadian correctional system as they up make more than 90% of those under CSC supervision, and there is also an overrepresentation of Indigenous populations as they account for almost one-third of those in the correctional system while making up roughly 4% of the Canadian population.¹

Overall, people in prison are relatively younger, have poorer physical and mental health, and have higher rates of tobacco and alcohol or illicit drug use than the general population.² Other factors such as low socioeconomic status, ethnicity, female gender, intravenous (IV) drug use, and addiction are also known to play a role.³ Furthermore, the poor physical and mental health of incarcerated individuals can be related to inequities in access to health care services.

The health services provided to those in provincial or federal custody differ. Federally, it is the responsibility of CSC to provide essential health care and reasonable access to non-essential mental health services. Provincially, correctional institutions offer a variety of private or government-funded health and educational programs, including mental health services, drug and alcohol counselling, liaison services, Narcotics/Alcoholics Anonymous meetings, and dental care.⁴

Even though the prevalence of chronic medical conditions among the prison population is higher than that of the general population,⁵ incarcerated individuals often report difficult access, or delayed access, to the health services that are available inside correctional institutions. One of the most common complaints made by the prison inmate population in Canada is inequitable access and unavailability of health care, including dental care.⁶ After release from prison, access to medical and dental care seems to worsen despite having similar health insurance status to their peers without an incarceration history.⁷ Furthermore, those who are unemployed, homeless or who have experienced abuse find access to dental care extremely difficult due to past trauma, negative dental experiences, lack of insurance, low oral health care knowledge and awareness, and the perceived stigmatizing attitudes of oral health professionals towards this client group.⁸ Stigma is indeed a major barrier to care experienced by many who are marginalised and vulnerable.

As in other parts of the world,⁹ incarcerated populations in Canada have poorer health and higher mortality rates than the general population.¹⁰ In particular, communicable diseases, sexually transmitted blood-borne infections, mental health disorders, and substance use are highly prevalent among this population.¹¹⁻¹³ Chronic conditions such as cardiovascular disease, diabetes, asthma, and cancer are also prevalent in Canadian prisons and often

attributed to low socioeconomic status and related health behaviours prior to incarceration.^{14,15}

In Canada little is known about the oral health status of those in prison. In the United States nearly half (49%) of the those entering prison report having a dental problem once admitted,¹⁶ yet few report receiving care other than extractions.¹⁷ Oral health conditions left untreated in prison place individuals at a disadvantage when they try to reintegrate into the outside world, especially in Western society where cultural ideals of oral health are focused on a full dentition of straight, white teeth.¹⁸ Limited literature is available to describe the conditions under which oral health is addressed in prison and the impact it has on those incarcerated,^{19,20} and little is known about how those who leave prison view oral health and experience oral health care services, and how access to care is affected by a history of incarceration. In the literature, this population appears to be a forgotten segment of society with regard to their oral health needs and is often not a focus for research and funding.^{3,21}

Although there may be little focus on this population from the research community, organizations that work with these populations appear well aware of the oral health disparities among their clients. The John Howard Society (JHS), a non-profit organization with offices across Canada, has a long history of working with individuals who are involved in or at risk of involvement with the criminal justice system due to poverty, homelessness, substance use, and mental illness. Their goal is to “contribute to public safety by offering services that lead people to be contributing citizens within their communities.”²² Services include assisting individuals with finding housing, obtaining identification, support for mental health and substance use, and developing strategies for reintegration into the community.²² One strategy identified as important for successful reintegration in society is addressing unmet oral health needs.^{23,24} However, a clear understanding of perceptions of, barriers to, and facilitators of oral health is lacking, specifically in the Canadian context.

This study was undertaken in collaboration with the John Howard Society of the Lower Mainland (JHSLM) in Vancouver, British Columbia, Canada. We aimed to explore perceptions of oral health and access to care experiences of men with a history of incarceration and to identify contributing factors for current oral health inequities within their community.

METHODS

A qualitative approach was selected for this study in order to gain a deeper understanding of the issues that affect the perceptions of oral health among this population and how their particular life circumstances influence their ability to obtain oral health care services. Focus group discussions offer the benefit of eliciting norms for groups through interactions between participants whereby they are able to express differing views and consider both individual

and group standpoints on issues.²⁵ Further, in stigmatized and marginalised communities, focus groups can foster socialization and membership, and generate transformative change.²⁵ For this study, a purposefully selected group of 18 men and 10 JHSLM staff members participated in 4 focus group discussions. Approval for this study was obtained from the University of British Columbia, Behavioural Research Ethics Board (BREB # H16-01096).

Focus groups

Three focus groups comprising 18 men were conducted—one at the JHSLM community services office and the other 2 at halfway houses where some of the participants lived. Participants from both provincial and federal institutions, with varying sentence lengths and time since release, were invited to take part. Discussion topics focused on perceptions of oral health, current and past dental experiences, current access to oral health care, oral health priorities, motivations for seeking care, as well as knowledge, attitudes, and beliefs related to oral health.

One focus group comprising 10 purposefully selected staff of the JHSLM was also conducted. Participants were chosen based on their role in the organization and their experience in supporting clients in obtaining oral health services. This focus group was conducted to gain insight into what the organization perceives to be the oral health needs of their clients, how they currently support clients in obtaining oral health services, and what structural barriers or facilitators their clients experience in accessing oral health services.

All focus groups were moderated by one of the authors (LD) with assistance from a graduate student or another member of the research team who documented participant involvement and who took relevant field notes of non-verbal responses and events during the discussion that could add context to the narratives. Each focus group lasted between 35 minutes and 90 minutes and was audiorecorded. A discussion guide was utilized in each focus group with questions that were developed from the literature review and from input from the JHSLM so that overall aims of the study were addressed. Prior to each focus group, a written informed consent was obtained from each participant and a sociodemographic survey was completed by the participants with incarceration history. Each participant received Can\$25 as a token of appreciation for their time.

Data analysis

All audiorecordings were transcribed verbatim. Transcripts were then combined with field notes and inputted into a qualitative data management program (*N-Vivo 10™*) to facilitate coding and thematic analysis. Coding (as a word or words that synthesize a specific excerpt of the transcript or that describe the essence of what was said) of the first 2 focus group transcripts was conducted by 2 members of the research team. The individual coding was compared

and consensus reached on differing interpretations of the narratives. One author (LD) then completed the coding of the remaining 2 focus group transcripts. Coding involved reading the transcripts numerous times to become familiar with the data. Codes were then grouped into categories of similar and differing views on a particular issue that emerged across the transcripts. Similar categories were combined into themes that addressed the aims of this study.

RESULTS

The participants with an incarceration history ranged in age from 29 years to 69 years and came from a variety of ethnic and educational backgrounds. Four participants had spent time in a provincial institution, two in a federal institution, and the remainder had experienced both types of correctional settings (Table 1).

Five major themes emerged: not on the radar, stigma of incarceration, being shot down, caught in the system, and institutional conditioning. They are presented and explained in the paragraphs that follow; quotes from the participant are used to contextualize the theme.

Not on the radar

Perceptions of oral health and the desire to address unmet dental needs among the participants were influenced by multiple factors, including their social situation and how childhood experiences shaped their perceptions of oral health and related care. According to one staff, oral health might not have been a priority in the past and was put aside, remaining off the radar for many of their clients:

For many of us at a young age we would learn that it's just part of your routine to brush your teeth. And for many of them they might have not learned that skill. To them it's not important because it hasn't been taught throughout their life that you gotta brush your teeth. So to them it's a whole new skill they have to learn.

While this quotation offers some insight into how persons with an incarceration history view oral health and how such views might influence dental care utilization, it is not universally applicable. For some participants, such views were influenced by how the institution managed dental care. We were told how incarcerated individuals would do anything to maintain their oral health while they were in prison as it was the only way to keep their teeth:

Two decades in prison and I've been out nine months...For 4 months now, I've had a broken tooth, because I've had cavities and stuff. Everybody tries to take care of their teeth, or at least some people do, because in jail it's the option you have now 'cause still they won't clean them, they won't do any kind of cosmetic stuff. They'll either pull it or the worst case scenario they'll fill it. There's nothing else.

Table 1. Participant characteristics

Participant ID	Age	Self-reported ethnicity	Highest level of education	Time in provincial prison (years)	Time in federal prison (years)	Total years in prison
1	59	White	GED	6	1	>20
2	62	Canadian	High school	10	4	>20
3	69	Indo Canadian	College	1	0	>20
4	56	Caucasian	High school	1	1	3 to 5
5	29	Metis/Canadian	≤Grade 8	1	1	11 to 15
6	59	Canadian	College	2	5	>20
7	35	Metis/French	College	1	0	11 to 15
8	59	East Indian	College	1	1	>20
9	57	Caucasian/Ukrainian	High school	4	4	11 to 15
10	48	White	College	7	0	3 to 5
11	41	Native American	≤Grade 8	4	0	3 to 5
12	64	Indian	High school	0	6	>20
13	56	White	College	1	1	11 to 15
14	58	Chinese	High school	1	1	11 to 15
15	34	Caucasian	High school	3	3	11 to 15
16	49	White	High school	0	2	>20
17	54	First Nation	High school	3	12	>20
18	57	Hungarian	High school	4	4	>20

In exploring why it was worse to have a cavity filled, this participant further described how he thought it would just create more of a problem in the future, believing that the filled tooth would eventually deteriorate and be extracted. We also probed further as to why participants indicated that they had so many cavities and problems when they were released. One participant, who had spent much of his life in prison, told us about the overall lack of dental care available:

I was on the inmate committee for 2 out of the last 4 years. They have stripped away all funding for dental care. You're waiting a minimum of 6 months, a 6-month minimum waiting list, that's for an emergency situation...That's the way it is now.

Beyond emergency care it was apparent that preventive care was perceived as non-existent as one participant told us:

Teeth cleaning is no longer an option for anyone. You can't even go in there and say, 'Hey, I've got my own money. I will pay for this stuff.' 'No, sorry, we don't offer that. You cannot pay.'

While dental care was important for some, not everyone was interested in seeing the dentist. In part this was due to a general fear of dental work, but also of what

might happen based on vicarious experiences. As one participant explained:

I thought about doing the dental thing in there...but I've heard some horror stories that it's half-assed. You're not going to get the professional type of treatment that you would get on the outside. That becomes worrisome for me. I may have an opportunity, a chance, while I'm in this situation, then you are on the outside. More than likely I know that I can get all my teeth yanked out while I'm there, but it's what comes all after that is what terrifies me.

Further discussion revealed that this fear was related to treated cavities returning or not having any teeth due to multiple extractions and the inability to get dentures. The above participant also hinted at the fact that, for reintegrating into society and trying to find housing and a job, having teeth was important.

For those who are released, making a dental appointment might not be a straightforward activity, as they now have to (re)learn how to navigate the health care system. It became clear that for some it would create yet another barrier to accessing dental services:

A lot of us spent our lives in prison, we really don't know the inner workings of how to book appointments, how to deal with this. All of those little details that you guys have grown up and lived your lives doing daily are just another planet to us.

As we heard from the participants and staff, perceptions and behaviours related to oral health develop in childhood and are reinforced through the correctional system when dental concerns are not addressed. Upon release, an unfamiliar dental system may further influence the perceptions of and priority given to oral health where it remains off the radar.

Stigma of incarceration

We found that both experienced stigma and self-stigma of incarceration affected all aspects of the everyday life of the participants, including when seeking dental care. Each participant described how and why they believed that society had a particular view of those who had been in prison, and how that made them self-conscious:

I think we're all pretty used to being looked at like, 'Oh, you're a criminal or you look like one'...I think everybody can tell that I just got out of prison, even if they have no clue. It's just something that you have in the back of your head that you think you stand out.

This self-awareness affected how participants interacted socially, and some avoided social interaction altogether. Because of the perceived stigma of incarceration, many participants tried to hide their past because they believed it led to better experiences at the dental office. As we heard, "they didn't know I was in prison and they treated me like a human being." The ability to hide their current parole or community custody condition was impossible for some because the CSC was their source of health care coverage. As one participant noted, it makes seeking care more difficult especially if one has experienced stigma and discrimination in the past:

It doesn't help that one of your IDs is Corrections Canada that you got to show because 'till you get health coverage, all I had to use was my Corrections Canada because I didn't have a driver licence, I didn't have a health card, or anything...It's like you got to carry this, always. That's the most embarrassing thing that you can make a convict do is carry a CSC ID.

Being shot down

While the stigma of being incarcerated seemed to be a major factor influencing access to care, there were also negative experiences that left some participants with a

feeling of not being cared for or valued. Such experiences drove them further away from seeking dental care:

I think that's the worst problem, is that if you go, you get rejected, and you're just like forget it I'm not going to go anymore...I have had something that needs to be repaired for the last 6 months. I encourage people to go to [the dental clinic] because I'm an activist out there, but for myself I could do without the hassle. It doesn't benefit me.

Even though the participants described various reasons for their difficulties in accessing dental care, all agreed that at some point there was no other option:

My tooth was really hurting. The beer didn't even numb out the pain at the time...and that was when I really, finally made that attempt. I was pretty much shot down. I needed to pay the first \$500 in cash due to my situation. I was so upset that I kicked their front sign. It wasn't like, 'I hate you guys!' It was just the fact that I took it to the point where I really needed to get help, and I finally just made that choice; 'Okay, I got to do it, I'm going to do it,' and then when I really take that first step, I'm shot down.

Much of the reluctance to seek care until it is absolutely necessary seems to be driven or at least influenced by the experience of seeking care within the correctional institution. Access to needed care varies across institutions because of differences in current funding and health care staffing levels. One participant, who was on day parole when he attended our focus group, described his current situation:

For me, because I'm not actually out yet, I'll go to healthcare and they'll be like, 'Oh, you'll get the funding within 3 months,' and I'll say, 'I'm sick, can I get some Tylenol?' They'll say, 'Oh, just wait to see the doctor.' Then that's a 2-month wait. You got to go through the pain. They don't really care.

Staff added that men who had been in prison carried unique experiences with them into the community:

One thing we discovered, once they get out, they're carrying that baggage; dread of dealing with medical and dental inside. They get so frustrated, they basically say, 'To hell with them, I'm not going to bother.' When they get out, nothing is worse for them than facing the same thing in the community.

Even those who have not experienced rejection while seeking care often experience other forms of rejection or discrimination. As one participant said, “I haven’t dealt with it myself personally yet, but most guys get used to being shot down. You get to the point where you stop asking.” For others, there is the perception that they really don’t matter that much in a dental office, as one participant told us: “there’s no one as much as they’ll smile to you and say ‘oh yeah’ and listen to your problem. As soon as they walk out of the office, they close the file and move onto the next one. There’s just no follow through and there’s no care.”

Caught in the system

The majority of the participants in this study were on parole or under community supervision and were living in halfway houses. These individuals confronted an added layer of difficulty when trying to access needed dental care despite being covered through CSC. On multiple occasions we heard that participants “can’t walk into any dentist or doctor. You have to get permission from parole, and tell them where I am going, tell the house where I am going to, what time and what day? We can’t just go walk in and ask.”

Participants also raised the problem of scheduling appointments and having to cancel them at the last minute due to an “unforeseen meeting with a parole officer.” Participants described the strict schedules by which they had to abide as a condition of their custody or release. This restriction makes dental appointments difficult to keep, and potentially erodes their ability to develop a good relationship with a dental office. For others, the CSC coverage was believed to be inadequate:

The thing is CSC does \$500 coverage, but some people could end up in situations where they need more than \$500 coverage and they don’t have it. There’s a lot of people that are living in our situations that are living in halfway houses and stuff and we’re just caught in a system. It’s the never-ending bureaucratic BS that you have to go through, because nothing can happen until it goes through the chain of command. It doesn’t matter what in the meantime happens to you. I brush my teeth obsessively because I don’t have hair and my eyesight’s going from all the drugs I get and the only thing I have is my teeth.

Many participants shared the feeling of being caught in a system and having limited control over much of their lives. This appeared to evoke a sense of frustration and sometimes anger when trying to access needed dental care. As one participant told us:

It’s so frustrating because I said to the lady that runs this house, ‘at least if I was in the

joint I could put up so much problems that they’d have nothing but to deal with me.’ Here I can’t do anything, because if I scream too loud or say anything too much, I risk having them pull my support and I end up back in jail.

This frustration and anger also prompted some participants to fall back on what they know about how to get things that they need:

You’ll find a lot of guys who will just say, ‘Well, the hell with it, I’ll just go and make my own money.’ That’s the problem that you’re finding in this province is that it’s easy to survive out here, but you get a guy frustrated from society and he’s just going to give up and say to hell with it, doesn’t matter to me and they’re going to pay for it one way or another...They don’t have any regret.

Institutional conditioning

One unique perspective to consider when it comes to those with a history of incarceration is the impact of this form of institutionalization on the person. For many participants, re-entering society after being incarcerated for many years is not an easy task. As one participant stated, “all of a sudden, it’s like you’re stuck in society and it’s like in your mind and everything you’re still inside.” Other participants described a sense of support they felt from outside organizations willing to help with their transition back to society. However, many participants spoke about the lack of shared decision making they experienced in prison and how little control they had over their day-to-day lives. Now released and faced with decisions to be made, some find this to be one of their biggest challenges:

Once you do get out in society, the follow up’s done with an organization or whatever that’s actually connected with the inside. You know, you get all the help and support while you’re on the inside. Everything’s there at your disposal, but when you actually get out there, you’re kind of right back into where you first started.

The daily routine many participants experienced over the years while in prison becomes their norm and hard to break, as one participant who had spent 10 years in prison described:

It’s like you look at a closed door and if it’s past 10:30, you don’t even think to open it. You know it’s locked. I’ve been stuck in my bedroom having to go to the bathroom past 10:30 before and got up to go open the door, stopped myself from touching the doorknob. [I

thought] It's way past lockup. Went sat back down on my bed trying to figure out where I'm going to go to the bathroom. It's kind of stupid shit like that that happens to you.

The vast majority of those in the prison system re-enter a society that is very different from the one they left. Much of what they knew prior to their incarceration either doesn't exist, has changed dramatically or is all new. Another participant who had also spent over 10 years in jail found it extremely difficult to adapt to the societal changes around him:

Well, I've done a lot of time and I got out and even a cellphone was crazy for me, but things like looking for a job. 'You've got to go online to do this.' I'm like, 'What do you mean go online?'...Totally ignorant. They don't teach you anything in there about that shit, right...so they keep you totally ignorant to what's going on out here. You do 10 years. You get out. You're lost, totally.

When it comes to oral health and dental care, the transition from prison to free society also has an impact on thoughts and behaviours:

I think a lot of guys have given up on regular checkups. If any guy who's done a long bit, you know regular checkups are not an option. That sort of teeth and maintenance doesn't occur to you as something that you should be doing. You get conditioned to 'no that's not happening, don't ask, because you're not getting it.'

DISCUSSION

The aim of this study was to explore perceptions of oral health and access to dental care experiences among men with a history of incarceration to provide insight into the oral health disparities that this segment of society faces. We found that personal backgrounds, experiences related to health and dental care within prison, and unique challenges faced upon release to the community all influenced these perceptions and the ability and desire to access dental services. Many participants believed that they had unmet dental needs that were affecting their lives and reintegration.

The low value attributed to oral health and access to care appeared to be related to the lack of importance participants placed on it or the perceived inability to have their needs addressed. Such devaluation of oral health seems to be reinforced by the apparent apathy that correctional institutions show towards dental services.

Many individuals who become involved in the criminal justice system have a disadvantaged background that

increases their risk for poor general and oral health.^{2,19} In particular those with adverse childhood experiences, such as poverty, may not receive the education and resources necessary for the adoption of health-promoting behaviours.²⁶ The staff who participated in this study believe that childhood experiences have a large influence on their clients' oral health status even before they become justice involved. Given that overall health and oral health are often found to be poor among those incarcerated^{2,27} and other disadvantaged populations,²⁸ this finding is not surprising. What we did find surprising was that, contrary to reports describing incarceration as a time in which health conditions are addressed and in general overall health improves,²⁹ our participants seemed to experience the opposite, as also found by Douds and colleagues in 2016.³⁰ Marshman and colleagues suggest that dental indifference is commonplace among those who have been incarcerated and tends to decrease their desire to access dental services,³¹ compounded by the perceived fear of substandard or inappropriate care participants may have received while in prison and in the community.

Time spent in prison also appears to have conditioned our participants to focus less on prevention of oral disease, since those services were not available to them. This lack of access to preventive oral care services, especially for those serving longer sentences, seems to exacerbate conditions, creating a need for more extensive services while in prison and upon release. This conditioning tends also to reinforce emergency-seeking behaviour over regular care and, in some cases, substance use as a method of coping with pain.

Participants who did try to access dental care upon release found that the perceived stigma of incarceration was difficult to escape especially when they had to present corrections identification. This, in addition to the poor state of their oral health, the inability to afford needed care or limited control over their daily schedules corroborate previous findings that the walls of incarceration follow individuals into the community.³² In turn, individuals with no other option might fall back on methods of survival that led them to be in conflict with the law originally, increasing the likelihood of recidivism.²⁴

Upon re-entry to the community, if social and financial needs are not addressed and plans for this transition do not include oral health, needs that were not met in prison continue to be a problem.³³ Obtaining housing, employment, and social connections are integral for successful reintegration and each can be affected by poor oral health.^{24,30,32} Dental professionals can aid in lessening this impact by creating a safe space free of discrimination and stigma for these individuals to access and receive care comfortably. In order to do so it is important to appreciate how past negative dental experiences both in and outside of prison may shape behaviour and the ability or desire to navigate a complex system within an unfamiliar society. Collaborations among dental professionals, correctional

institutions, and community organizations such as the John Howard Society are an important step to enable needed oral health care so successful transitions are possible.

Limitations

Limitations of this study include the small sample of participants and the fact that they all came from one organization, which limits any generalization. Although attempts to conduct member checking with the participants were made, none was interested in giving feedback to our thematic analysis. We did not seek information about current dental services within correctional institutions as they vary widely in Canada and can change regularly. The study instead focused only on the perceptions of the men, which may or may not accurately reflect the delivery of oral health care within all correctional settings. The apparent lack of standardization for dental service delivery needs further attention, as do the development and monitoring of policies that support the oral health of those in prison. Future studies should include men with a history of incarceration from other organizations and also include the voice of corrections staff and administration officials.

CONCLUSIONS

Men with a history of incarceration may experience poor oral health. The personal backgrounds, experiences related to health and dental care both before and during prison

time, and the unique challenges faced by these men upon release to the community all influence their perceptions of oral health and their ability to access dental services. Dental professionals can improve the experience of this population by creating a safe space for these individuals to access and receive care comfortably.

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CONFLICTS OF INTEREST

The authors have declared no conflicts of interest.

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An assessment of chlorine stain and collegiate swimmers

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ABSTRACT

Background: Swimming is known worldwide as one of the healthiest, low-impact forms of exercise that promotes a strong body, heart, and mind. However, several studies have suggested that swimming pool chlorination is responsible for dental erosion, calculus formation, and stain in competitive and recreational swimmers, a phenomenon known as swimmer's mouth. The purpose of this observational study was to assess chlorine stain on the dentition of competitive female swimmers and divers from a university team and to determine if dental preventive practices affected chlorine stains. **Methods:** Swimmers were recruited from the University of New Mexico Swimming and Diving Team for this IRB-approved study (#17-481). Participants completed a questionnaire regarding individual oral habits and frequency of preventive visits. Following the questionnaire, an oral screening was completed to evaluate for stain. Fisher exact tests, nonparametric Wilcoxon tests, and descriptive statistics were used to analyse the data. Additionally, a cross-sectional analysis was used to compare the chlorine stain between divers and swimmers. **Results:** Twenty-one females, with a mean age of 20.5 years, participated in the study. One hundred percent of these subjects had staining of the teeth, despite the fact that 85% of them reported brushing their teeth 2 to 3 times per day, and 81% reported receiving regular dental prophylaxis. All participants swam 5 or more times every week, with practice length ranging from 1 to 2 hours. There were no differences in stain between collegiate swimmers and divers. **Conclusion:** Within this study sample, extrinsic staining of the teeth was identified on all swimmers and divers and the presence of stain was not prevented by the frequency of tooth brushing or professional stain removal. Additional oral hygiene regimens should be explored to facilitate the prevention or complete removal of swimmer stain.

RÉSUMÉ

Contexte : La natation est reconnue partout dans le monde comme l'une des formes d'exercice physique les plus saines et ayant le moins d'impact, qui renforce le corps, le coeur et l'esprit. Cependant, plusieurs études ont suggéré que la chloration des piscines cause l'érosion dentaire et la formation de tartre et de taches chez les nageurs compétitifs et récréatifs; un phénomène appelé la bouche de nageur. L'objectif de cette étude d'observation était d'évaluer les taches de chlore sur la dentition de nageuses et de plongeuses de compétition d'une équipe universitaire et de déterminer si les habitudes dentaires en matière de prévention influençaient les taches de chlore. **Méthodologie :** Les nageuses ont été recrutées de l'équipe de natation et de plongeon de l'Université du Nouveau-Mexique pour effectuer cette étude approuvée par le comité d'éthique médicale (#17-481). Les participantes ont répondu à un questionnaire à l'égard des habitudes buccodentaires personnelles et de la fréquence de leurs visites dentaires préventives. À la suite du questionnaire, un dépistage buccal a été effectué pour évaluer les taches. Les tests exacts de probabilité de Fisher, les tests non paramétriques de Wilcoxon et les statistiques descriptives ont été employées pour analyser les données. De plus, une analyse en coupe a servi à comparer les taches de chlore chez les plongeuses et les nageuses. **Résultats :** Vingt-et-une femmes âgées en moyenne de 20,5 ans ont participé à l'étude. La totalité des sujets avait des taches sur les dents, malgré le fait que 85 % d'entre elles ont signalé avoir brossé leurs dents 2 à 3 fois par jour et 81 % d'entre elles ont rapporté recevoir régulièrement des prophylaxies dentaires. Toutes les participantes ont nagé 5 fois ou plus par semaine et la durée de leur entraînement variait d'une à deux heures. Les nageuses et les plongeuses universitaires n'ont démontré aucune différence dans leur taux de taches. **Conclusion :** Parmi cet échantillon de l'étude, des taches extrinsèques ont été décelées sur les dents de toutes les nageuses et plongeuses, et la fréquence du brossage de dents ou l'élimination professionnelle des taches n'a pas empêché la présence de taches. Des mesures supplémentaires d'hygiène buccodentaire devraient être explorées afin de faciliter la prévention ou l'élimination complète des taches chez les nageurs.

Keywords: chlorides, chlorine, colouring agents, mouth, staining and labelling, swimming, tooth discolouration
CDHA Research Agenda category: risk assessment and management

WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Dental staining is common among competitive swimmers and divers who practise regularly in chlorinated pools.
- Daily home oral care and professional dental hygiene services can remove stains but do not prevent them in competitive swimmers.
- Dental hygienists must be aware of swimmer's mouth in order to provide appropriate oral health instructions to their swimmer clients for regular home and professional oral care.

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INTRODUCTION

A phenomenon called swimmer's calculus, or stain, is characterized by hard, brown tartar deposits commonly found on the front teeth. To clarify, staining takes place on the acquired enamel pellicle, the layer of proteins and peptides which have a thickness of 1 μm on the enamel surface.¹ This staining is caused when antimicrobials from pool water, which naturally have a higher pH than saliva, contact salivary proteins and quickly break them down, resulting in organic deposits on the swimmer's teeth.²⁻⁴ Athletic swimmers expose their teeth to chemically treated water when they practise, with these exposures usually lasting over 6 hours per week.²

There is little known about swimmer's mouth although one of the first studies to be released on this topic appeared in the Centers for Disease Control and Prevention's *Morbidity and Mortality Weekly Report* more than 30 years ago.⁵ This study analysed data from 740 swimmers, including 452 frequent swimmers. The report suggested that 15% of frequent, or daily, swimmers had enamel erosion while only 3% of infrequent, or non-swimmers, experienced enamel erosion.⁵ A more recent case report described observations of a competitive swimmer who swam in a gas-chlorinated swimming pool and experienced notable dental erosion within 27 days.⁶ Several other studies have been published evaluating changes in salivary composition, dental erosion, calculus, and stain.^{2,3,5-14} One of these studies more specifically investigated staining of the teeth in competitive swimmers. Escartin et al.⁷ concluded the amount of training time required by competitive swimmers to increase their risk for development of dental stains was more than 6 hours. Furthermore, they reported the prevalence of dental stains to be 60.2%, therefore concluding that competitive swimmers have a higher risk of developing extrinsic dental stains.⁷

Improper pool chlorination has been suggested to contribute to the swimmer's phenomenon.^{4,8,13} If a swimming pool is kept at the optimal pH of 7.4, tooth structure should not be at risk for demineralization. However, if the pH of the swimming pool becomes neglected and is allowed to become more acidic, it is possible this could contribute to the dissolving of tooth structures. This phenomenon has been reported to be more prevalent in gas-chlorinated pool systems.³ When swimming pools are gas-chlorinated, hypochlorous acid is formed. Normally this acid can be balanced with the addition of a strong base, such as ash. However, if there is not enough base to counter the acid from the chlorine, the pool water can become acidic.¹⁵ Several governmental regulations have been developed for swimming pool chlorination with the intent to improve the water quality for swimmers. These include regular pool monitoring and, in particular, the management of pH levels.

Evidence suggests swimmer's mouth, including calculus accumulation, tooth staining, and dental erosion, affects competitive swimmers and divers. The purpose of

this study was to gain insight into and add to the limited body of knowledge on dental staining among collegiate swimmers and divers and the effects of preventive dental strategies on these stains.

METHODS

Study population

Participants were eligible for inclusion in the study if they were members of the female swimming and diving team at the University of New Mexico Johnson Pool Facility. The team consists of 21 females from all around the world, who range from freshmen to seniors. All team members were invited to participate, thus comprising a convenience sample. Participants were recruited through an in-person orientation given during a regularly scheduled swim practice.

Approval to conduct this study was granted by the Human Research Protections Office at the University of New Mexico, #17-481. All study participants provided voluntarily written informed consent prior to participation.

Study design

The study used an analytical cross-sectional design to assess swimmer's stain in a university female swimming and diving team. Personal habits and environmental factors of the participants and the pools they swam in were investigated. Data collected included frequency of dental recall visits, their tendency to plaque and calculus buildup, stain accumulation, and return of dental staining or calculus following dental prophylaxis.

Survey

Participants were administered an 11-item survey that included questions such as how frequently the swimmers attended for professional prophylaxis, when their last prophylaxis took place, and if their dental hygienists had ever mentioned staining to them.

Oral screenings

Screenings were then performed by one examiner, using disposable mouth mirrors and dental loupes with a light, before practice in the natatorium to determine each swimmer's level of stain, based upon the Lobene Stain Index.¹⁶ This index measures the intensity and extent of extrinsic dental stain on the facial surface of the anterior teeth. A chart with pictures indicating the stages of light to heavy stain provided a universal technique for the screening. As per the Lobene Stain Index, stain thickness was measured in 4 categories: 0–none, 1–thin line of stain that can be continuous, 2–moderate to thick band of stain, and 3–stain covering the total area. Presence of stain was measured in 4 categories: 0–no stain present with natural tooth colouration, 1–faint staining, 2–clearly visible stain typically orange to brown in colour, and 3–dark stain usually deep brown to black in colour.¹⁷

Statistical analysis

Quantitative variables were summarized by means and standard deviations, and categorical responses were summarized using frequencies and percentages. Subgroup differences in Lobene Stain Index intensity and thickness categories were assessed using Fisher exact tests. Secondary analysis of ordinal stain intensity and thickness scores were conducted using nonparametric Wilcoxon tests. The p value for this study was set at $p < 0.05$. As this study was conducted with a small planned sample size, a power analysis was not performed.

RESULTS

Twenty-one female subjects enrolled in this study. Sixteen participants were swimmers and five participants were divers, all from the university swimming and diving team (Table 1). All 21 subjects had stain present. Frequency distributions were similar for swimmers and divers for stain intensity and stain thickness (Table 2, $p = 0.32$ and $p = 0.81$, respectively). A comparison of stain intensity and thickness by duration of exposure was also undertaken (Table 3, $p = 0.76$ and $p = 0.19$, respectively). When analysed as ordinal variables, stain intensity was not different for swimmers (1.6 ± 0.5) compared to divers (1.8 ± 0.8 , $p = 0.74$), and stain thickness also was not different for swimmers (1.9 ± 0.8) and divers (1.6 ± 0.9 , $p = 0.41$). Frequency of practice, frequency of experiencing dry skin, and smoking habits were all uniformly reported between the participants.

Sixty-six percent of swimmers reported swimming for 10 or more years, 28.5% reported swimming for 6 to 10 years, and 4.7% 1 to 5 years. All of the swimmers and divers attended practice 5 or more times per week. Practice times varied; 85.7% of swimmers practise for 1 to 2 hours daily and 14.3% practise for 4 or more hours per day. All of the participants reported experiencing dry skin from the chlorine. Thirty-eight percent of the respondents reported getting their teeth cleaned within the last 2 to 3 months, 23.8% reported a cleaning within 6 or more months, 14.3% had their teeth cleaned 4 to 5 months ago or over 1 year ago, and 9.5% of swimmers had their teeth cleaned within the past month. Fifty-two percent of swimmers noticed or have been told that their teeth are stained. Of extrinsic stain retentive factors, 76% reported drinking coloured beverages, 4.8% brush only once a week, and none of the respondents reported any smoking habits. Lastly, 76% of the participants were not aware of the swimmer's mouth phenomenon (Table 1).

DISCUSSION

The purpose of this study was to assess dental stain on collegiate swimmers and divers and the effects of preventive dental strategies on these stains. Results showed that all 16 female swimmers and 5 divers from the University of New Mexico swimming and diving team had staining mirroring what has been reported

as the swimmer's mouth phenomenon.²⁻¹⁴ Interestingly, the presence of stain was not influenced by how often the swimmer received professional prophylaxis; most swimmers answered that they had their teeth cleaned just 2 to 3 months prior to the study. In addition, the majority of the swimmers answered that they brushed their teeth 2 to 3 times a day. Unfortunately, these factors did not help the swimmers remove or prevent the staining completely; therefore, different oral hygiene or other regimens may need to be established to facilitate the complete removal, and preferably, prevention of stain. This finding is similar to those of previous studies done on swimmer's mouth.²⁻¹⁴ In addition to stain, other studies found negative effects such as erosion and calculus formation.^{3,5-7,9-11,13,14} Different colours of stain are indicative of absorption of various chemical structures, making staining an initial indicator of, or precursor to, the possibility of diseases such as this phenomenon.¹⁸

The pool area, in general, is a further determining factor as to what the swimmers' and divers' mouths reveal. Specifically, if any of the railings or lane lines are corroded then tooth structure could be subject to the same outcome. In general, if the chlorine content is too high, then hair will begin to change colour and the skin will burn or itch. When swimmers notice these issues, then overchlorinating the pool could be an obvious factor and teeth may become stained more easily. Pool maintenance is a possible confounding factor to consider when researching this condition.

The pH level of swimming pools is important to monitor for 2 reasons. First, the germ-killing power of chlorine varies with the pH level of the pool. As pH goes up, the ability of chlorine to kill germs goes down. Second, a swimmer's body has a pH between 7.2 and 7.8, so if the pool water is not kept in this range then swimmers will start to feel irritation in their eyes and on their skin. The pH of the saliva can vary over the range of about 5.8 to 7.6, depending on the flow rate. Whole saliva at a very low flow rate may have a pH as low as 5.8, while stimulated saliva may have a pH as high as 7.6 or slightly higher.¹² At this university, pool maintenance employees report keeping the pH of the pool between 7.2 and 7.6, and they report checking these statistics every 4 hours. Maintaining the pH in this range will balance chlorine's germ-killing power while minimizing skin and eye irritation. A pH of below 7.0 and above 8.0 can harm the swimmers and their bodies. Therefore, careful specificity is very important in pool maintenance.¹⁰

Pool maintenance logs were reviewed during this study, and the lifeguards reported that the pH of the Olympic Pool is checked every 4 hours. The staff follows the State Standards of Pool Maintenance, which require that the Olympic Pool temperature be kept between 79 degrees and 81 degrees Fahrenheit, that the pH be maintained between 7.2 and 7.8, that the free available chlorine stay between 1 ppm and 10

Table 1. Summary values for questionnaire by swimmer status, with p value associations

Questionnaire results	All (N = 21)		Diver (n = 5)		Swimmer (n = 16)		Fisher's exact test (p value)
	n	%	n	%	n	%	
1. How long have you been swimming competitively?							
1 to 5 years	1	4.8	1	20.0	0	0.0	
6 to 10 years	6	28.6	3	60.0	3	18.8	0.03
10+ years	14	66.7	1	20.0	13	81.3	
2. How frequently does your swim team practise?							
5 or more times per week	21	100.0	5	100.0	16	100.0	-
3. How long does your typical practice last?							
1 to 2 hours	18	85.7	5	100.0	13	81.3	0.55
4 or more hours	3	14.3	0	0.0	3	18.8	
4. What is the frequency that you have experienced dry skin from the chlorine?							
Frequently (weekly)	21	100.0	5	100.0	16	100.0	-
5. When was the last time you had your teeth cleaned?							
Within 1 month	2	9.5	0	0.0	2	12.5	
2 to 3 months ago	8	38.1	3	60.0	5	31.3	
4 to 5 months ago	3	14.3	1	20.0	2	12.5	0.54
6 months or longer	5	23.8	0	0.0	5	31.3	
Over 1 year ago	3	14.3	1	20.0	2	12.5	
6. How frequently do you get your teeth professionally cleaned by a dental hygienist?							
Every 6 months	12	57.1	4	80.0	8	50.0	
Once a year	5	23.8	1	20.0	4	25.0	0.65
Once every 2 to 3 years	4	19.0	0	0.0	4	25.0	
7. Has your dental hygienist (or you) ever noticed that your teeth are stained?							
Yes	11	52.4	1	20.0	10	62.5	0.15
No	10	47.6	4	80.0	6	37.5	
8. Do you drink coloured beverages (tea, coffee)?							
Yes	16	76.2	5	100.0	11	68.8	0.28
No	5	23.8	0	0.0	5	31.3	
9. Do you smoke daily?							
No	21	100.0	5	100.0	16	100.0	-
10. How often do you brush your teeth?							
2 to 3 times per day	18	85.7	4	80.0	14	87.5	
Once a day	2	9.5	1	20.0	1	6.3	0.58
Once a week	1	4.8	0	0.0	1	6.3	
11. Are you aware of swimmer's mouth?							
Yes	5	23.8	0	0.0	5	31.3	0.28
No	16	76.2	5	100.0	11	68.8	

Table 2. Comparison of stain and thickness of stain among swimmers and divers

	All (N = 21)		Diver (n = 5)		Swimmer (n = 16)		p value
	n	%	n	%	n	%	
Lobene Stain Index intensity							
0 (none)	0	0.0	0	0.0	0	0.0	0.32
1 (faint)	8	38.1	2	40.0	6	37.5	
2 (clearly visible orange to brown colouration)	12	57.1	2	40.0	10	62.5	
3 (dark and usually deep brown to black)	1	4.8	1	20.0	0	0.0	
Lobene Stain Index thickness							
0 (none)	0	0.0	0	0.0	0	0.0	0.81
1 (thin)	8	38.1	3	60.0	5	31.2	
2 (moderate to thick)	8	38.1	1	20.0	7	43.8	
3 (entire area)	5	23.8	1	20.0	4	25.0	

ppm, that the combined chlorine remain <0.4 ppm, and the alkalinity be kept between 60 ppm and 180 ppm.

Despite the strict maintenance of the Olympic Pool, all swimmers reported the repercussions of extended chlorine exposure. While hair and skin are the most noticeably affected, awareness of the harm that chlorine exposure can produce on the oral cavity was the aim of this study. Awareness of swimmer’s mouth will help the local population, and eventually, increase global awareness of the harm chlorine can have not only on the body, but also on the oral cavity.

This study adds to the body of knowledge by bringing awareness to one particular facet of swimmer’s mouth: staining. Staining, in and of itself, is a precursor to the swimmer’s mouth phenomenon. Because minimal research has focused on this phenomenon, there is a need for further studies to facilitate understanding of and possible interventions to alleviate this condition.

The field of dental hygiene is at a pivotal point in history; research drives the profession to new levels. Studies, such as this one, help eliminate avoidable occurrences such as swimmer’s mouth as well as promote oral health. Swimming pools are not only used for competitive swimming, but also for recreation and exercise. All members of society will need to be aware of the harmful effects that chlorine can have upon the oral cavity. Awareness will lead to better treatment options and, hopefully, swimmer’s stain may become a condition of the past.

Limitations

The limitations of this study include extraneous variables associated with individual oral hygiene. Frequency of professional dental cleanings as well as how long each swimmer and diver have been practising over the years were analysed by examining the amount of stain on each swimmer. The extraneous variable was then controlled

Table 3. Comparison of stain and thickness of stain by duration of exposure

	All (N = 21)		<10 years (n = 7)		≥10 years (n = 14)		p value
	n	%	n	%	n	%	
Lobene Stain Index intensity							
0 (none)	0	0.0	0	0.0	0	0.0	0.76
1 (faint)	8	38.1	2	28.6	6	42.9	
2 (clearly visible orange to brown colouration)	12	57.1	5	71.4	7	58.3	
3 (dark and usually deep brown to black)	1	4.8	0	0.0	1	7.1	
Lobene Stain Index thickness							
0 (none)	0	0.0	0	0.0	0	0.0	0.19
1 (thin)	8	38.1	3	42.9	5	35.7	
2 (moderate to thick)	8	38.1	4	57.1	4	28.6	
3 (entire area)	5	23.8	0	0.0	5	35.7	

by simply asking how frequently each swimmer, or diver, receives professional dental cleanings. Ideally, a control group of non-swimmers should have been established to further analyse staining factors. If this route is explored in future studies, then assessors should also be blinded to the swimming status of the subjects. Another confounding factor could be the inclusion of only female participants; future research should include both genders as the male swimmer and diver population could possibly yield different results. The sample size of this population was small, therefore yielding insufficient evidence to determine a statistical correlation to the population as a whole. This study has shown inference rather than significance. Different pools could also yield different results as all pools and jurisdictions follow different standard protocols.

When conducting future studies, it will be important to obtain a larger representative sample of swimmers, both male and female. It would be worthwhile to investigate the potential value of educational seminars for both swimmers and pool maintenance employees. Discussion of the harmful effects of swimmer's mouth at these seminars would raise awareness of this condition and ultimately establish prevention strategies. Studies conducted on a larger scale, taking into account different genders and swimming frequencies could help supply correlational data. Fully understanding the causes of swimmer's mouth and how to prevent it effectively will

only come with more research.

The use of fluoride on teeth before entering the swimming pool environment could prove beneficial in shielding the teeth from damage.¹³ For further research, it is important to note consistent and appropriate recall appointments as well as fluoride treatments at every visit, regardless of age. Analysing whether stain is a function of time or exposure would also be beneficial, as it may allow for the discovery of correlations between how quickly stain develops after regular swimming. If swimmer's mouth is not recognized by dentists and dental hygienists, then it will ultimately result in neglect.¹⁹ Appropriate treatments need to be enforced to ensure that clients are receiving the best care possible.

CONCLUSION

The information gathered from the surveys and screening of the swimmers and divers suggests that dental stain can result from competitive swimming and diving and that traditional preventive dental strategies such as regular dental prophylaxis and recall appointments do not prevent staining in competitive swimmers.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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Medical management, orofacial findings, and dental care for the client with major depressive disorder

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ABSTRACT

Depression is a common mental illness affecting millions worldwide. It is characterised by several symptoms including persistent sadness, constant irritability, and the loss of interest in pleasurable activities. The medical management of depression includes psychotherapy and pharmacotherapy. Depression is associated with numerous oral findings such as diminished salivary flow, rampant dental decay, advanced periodontal disease, and oral dysesthesias.

Many of the oral findings in clients with depression can be due to the disease itself or to the treatment used for the condition; it can be difficult to determine which came first. Dental practitioners need to be aware of these orofacial findings and to treat and manage these clients appropriately. This short communication reviews the pharmacotherapy of depression and the effects of the drugs commonly used. Necessary dental treatment modifications for clients with depression are discussed.

RÉSUMÉ

La dépression est une maladie mentale commune qui touche des millions de personnes dans le monde entier. Elle est caractérisée par plusieurs symptômes, notamment la tristesse persistante, l'irritabilité constante et la perte d'intérêt pour les activités agréables. La gestion médicale de la dépression comprend la psychothérapie et la pharmacothérapie. La dépression est associée à de nombreuses observations buccodentaires, telles que la réduction du flux salivaire, la carie dentaire rampante, la maladie parodontale avancée et les dysesthésies buccales. Plusieurs des observations buccodentaires constatées chez les clients souffrant de dépression peuvent être attribuées à la maladie comme telle ou au traitement utilisé pour traiter la maladie. Il peut être difficile de déterminer ce qui s'est produit en premier. Les praticiens dentaires doivent être conscients de ces constatations buccofaciales et traiter et gérer les clients qui en souffrent de manière appropriée. Le présent court article examine la pharmacothérapie de la dépression et les effets des drogues couramment utilisées et discute des modifications qu'il est nécessaire d'apporter aux traitements dentaires pour les clients souffrant de dépression.

Keywords: antidepressants, depression, oral manifestations, periodontal disease, xerostomia
CDHA Research Agenda category: risk assessment and management

WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Clients presenting for oral care may be taking medication to manage depressive disorders.
- Awareness of these medications and their side effects is essential in order to provide safe and appropriate clinical therapy.
- For clients on tricyclic antidepressants, local anesthesia with epinephrine or levonordefrin must be administered carefully, with regular monitoring of blood pressure and heart rate, to prevent potential complications.

INTRODUCTION AND EPIDEMIOLOGY

Depressive disorders are among the most common neuropsychiatric disorders across all ages. They have been associated with a substantial loss of quality of life and disability, not only for the individuals living with the disorder, but also for their family members who care for them. Moreover, depressive disorders are associated with significant economic and social burdens,^{1,2} and have been associated with significant mortality from suicide.^{3,4} Ranked by the World Health Organization as the first most common cause of disability and premature death in the world, depressive disorders are widespread in the United States.^{5,6} Up to 6.7% of adults in the US suffer

from depression, with 30% having severe depression.⁵ In Canada, a national mental health survey conducted in 2012 found that 5.4% of the population aged 15 years and over reported symptoms of a mood disorder.⁷

Multiple risk factors are associated with the development of depression. These may include positive or negative events in one's life, such as the death of a loved one, diagnosis of a terminal illness or loss of work, as well as other neurological disorders like multiple sclerosis, Parkinson's disease, stroke or head trauma.^{5,8,9} Moreover, certain medications used alone or in combination can cause side effects much like the symptoms of depression.

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The use of alcohol or other drugs can also lead to or worsen depression. Depression can, however, occur for no apparent reason. The symptoms of depression generally include depressed mood, persistent sadness, irritability, feeling of helplessness and guilt, fatigue or decreased energy, sleep difficulties (undersleeping or oversleeping), anxiety, poor concentration, poor memory, weight changes, thoughts of suicide and death or attempt suicide, and the loss of interest in people or activities (Table 1). This short communication reviews the pathophysiology of depression, as well as its medical management, oral manifestations, and the dental care for clients with depression.

PATHOPHYSIOLOGY OF DEPRESSION

While no single physiologic mechanism for mood disorders has been identified, considerable evidence suggests the involvement of several neurotransmitter systems. There are 2 main groups of neurotransmitters that contribute to depression: the monoamines (i.e., serotonin, dopamine, norepinephrine, and epinephrine) and the catecholamines (i.e., dopamine, norepinephrine, and epinephrine). Both monoamines and catecholamines are synthesized from tyrosine and phenylalanine, which are then converted to the aforementioned neurotransmitters. It has been postulated that depression decreases these neurotransmitters at the synaptic cleft between presynaptic neurons and postsynaptic neurons, thus reducing their ability to activate the postsynaptic receptors. This hypothesis, called the Amine Hypothesis, stems from studies in the early 1960s on the antihypertensive drug reserpine.^{10,11} Reserpine induced depression in patients treated for hypertension as well as in normal subjects. Research demonstrated that the mechanism of action of reserpine was to inhibit the storage of serotonin and noradrenaline in the vesicles of presynaptic nerve endings and it was then concluded that depression is associated with decreased amine neurotransmission.^{10,11} In addition to the Amine Hypothesis, depression is thought to be related to neuroendocrine abnormalities. Specifically, abnormalities in the hypothalamic–pituitary–adrenal (HPA) and hypothalamic–pituitary–thyroid (HPT) axes have been identified. It has been suggested that the hyperactivity of the HPA axis alters levels of numerous endocrine gland hormones, leading to an increase in cortisol levels, which in turn produces depression symptoms.⁵

MEDICAL MANAGEMENT OF MAJOR DEPRESSION

The management of major depression in North America usually consists of the pharmacological administration of antidepressants. Antidepressants are the third most commonly prescribed class of medications in the United States for outpatient office visits, following analgesics and lipid lowering agents.¹² However, psychotherapy has also been used extensively and can help many people with depression understand themselves and cope with their problems. For instance, interpersonal therapy works to change relationships that affect depression.¹³ Similarly, cognitive–behavioural therapy helps people change negative thinking and behaviour patterns.^{14,15} With respect to the pharmacotherapy of depression, 5 major categories of drugs have been used for the management of depression: tricyclic antidepressants, selective serotonin reuptake inhibitors, monoamine oxidase inhibitors, serotonin–norepinephrine reuptake inhibitors, and atypical antidepressants (Table 2).

Tricyclic antidepressants

Tricyclic antidepressants (TCAs) include many drugs such as amitriptyline (Elavil), imipramine (Tofranil), trimipramine (Surmontil), nortriptyline (Aventyle), protriptyline (Vivactil), and desipramine (Pertofrane). So named because of their chemical 3-ring structure, these drugs exert their effect by blocking the presynaptic reuptake transporter for norepinephrine (NE) and/or serotonin, thus preventing presynaptic neurons from reabsorbing these neurotransmitters from the synaptic cleft for recycling.^{5,16} Thus, the concentration of these 2 neurotransmitters is increased and neuronal activity is elevated. These drugs are not considered first-line agents and are administered to individuals who are not tolerant of SSRIs and suffer from moderate to severe depression. In addition to their desired effect (the blockade of the presynaptic reuptake transporter for norepinephrine and/or serotonin), these drugs also block the postsynaptic receptors for histamine, acetylcholine, and norepinephrine resulting in adverse effects. For instance, the blockade of postsynaptic receptors for histamine results in sedation. The blockade of acetylcholine may cause side effects such as confusion, memory and cognitive impairments as well as dry mouth. Lastly and most importantly, blocking

Table 1. Symptoms of depression⁵

Persistent sadness, anxious or empty moods	Restlessness, irritability
Loss of pleasure in usual activities	Sleep disturbances
Feelings of helplessness, worthlessness or guilt	Change in appetite or weight
Crying, hopelessness or persistent pessimism	Physical symptoms that defy diagnosis and do not respond to treatment (especially pain or gastrointestinal complaints)
Fatigue or decreased energy	Thoughts of suicide or death, or suicide attempts
Loss of concentration, memory or decision-making capability	Poor self-image or self-esteem

Table 2. Drugs used for the treatment of depression

Classification	Examples	Mechanism of action	Common adverse effects
Tricyclic antidepressants	amitriptyline imipramine nortriptyline protriptyline desipramine	Block the presynaptic reuptake transporter for norepinephrine, serotonin, histamine, and/or acetylcholine	Sedation, confusion, memory and cognitive impairments, dry mouth, orthostatic hypotension, constipation, dizziness, tachycardia, urinary retention, impaired sexual function
Selective serotonin reuptake inhibitors	fluoxetine sertraline paroxetine fluvoxamine citalopram	Selectively inhibit 5-HT uptake	Nausea, vomiting, dry mouth, insomnia & drowsiness, sexual dysfunction, weight loss
Monoamine oxidase (MAO) inhibitors	phenelzine tranylcypromine selegiline	Inhibition of intracellular enzyme MAO in central nervous system neurons	Insomnia, dizziness, blurred vision, sexual dysfunction, hypertensive crisis
Atypical antidepressants	venlafaxine bupropion trazodone	Various, depending on antidepressant	Various, depending on antidepressant

the postsynaptic receptors for norepinephrine may cause a rapid drop in blood pressure and the clinician should be aware of the possibility of orthostatic hypotension, especially when dismissing clients from the dental chair after they have been supine for a period of time. Many geriatric patients with pre-existing medical conditions cannot tolerate the adverse side effects associated with TCAs.^{5,17,18} Furthermore, overdose of these medications may be lethal and, as such, individuals who are considered suicidal should not be prescribed these drugs.

Selective serotonin reuptake inhibitors

Selective serotonin reuptake inhibitors (SSRIs) include fluoxetine (Prozac), sertraline (Zoloft), paroxetine (Paxil), fluvoxamine (Luvox), and citalopram (Celexa). These drugs are considered first-line treatment for individuals with mild to moderate depression.^{15,19–21} These agents exert their antidepressant effect by preventing the reuptake of serotonin by presynaptic neurons in the synaptic cleft, resulting in increased concentration of serotonin and thus enhanced neuronal activity.^{5,21} As opposed to the TCAs, these agents have no effect on NE uptake and have little affinity for muscarinic receptors, as well as many other neuroreceptors.¹⁵ This increased selectivity results in fewer adverse effects compared to TCAs. However, adverse effects remain, including nausea, vomiting, dry mouth, insomnia, drowsiness, sexual dysfunction, and weight loss.^{22,23}

Monoamine oxidase inhibitors

Monoamine oxidase inhibitors (MAOIs) include phenelzine (Nardil), tranylcypromine (Parnate) and selegiline (Eldepryl). Monoamine oxidase is an enzyme that is responsible for the degradation of catecholamines and serotonin; inhibition of this intracellular enzyme in the central nervous system will potentiate monoaminergic

neurotransmission by augmenting NE, serotonin, and dopamine in nerve terminals.²³ These drugs are typically reserved for individuals who are unable to tolerate other antidepressants and are not considered a first-line treatment.²⁴ Adverse effects associated with the use of MAOIs may include dizziness, orthostatic hypotension, insomnia, central nervous system stimulation, weight gain, and edema.⁵

Serotonin–norepinephrine reuptake inhibitors

Serotonin–norepinephrine reuptake inhibitors (SNRIs) include venlafaxine (Effexor), desvenlafaxine (Pristiq), and duloxetine (Cymbalta). Venlafaxine is a drug used to treat depression and depression with anxiety, generalized anxiety disorders, social phobias, and neuropathic pain.^{25,26} Its pharmacodynamics are similar to the TCAs and it has an improved profile of adverse reactions. Adverse effects may include nausea, vertigo (both frequent and may improve), hypertension, and manic reactions.^{23,27} The SNRIs tend to be prescribed for individuals with major depressive disorder, as well as those with combined depression and anxiety disorders, and certain chronic pain conditions.

Atypical antidepressants

The atypical antidepressants are used to treat depression where comorbidity exists. Bupropion (Wellbutrin; Zyban), for example, is a noradrenaline and dopamine reuptake inhibitor (NDRI) commonly used for severe depression but is also used as a smoking cessation treatment.^{28,29} Adverse reactions include insomnia, excitation, restlessness, and seizures. Another example is trazodone, a serotonin antagonist/reuptake inhibitor (SARI) that is used primarily to treat depression with significant anxiety and sleep disturbances. Side effects include severe sedation and moderate sexual dysfunction.

ORAL MANIFESTATIONS AND DENTAL MANAGEMENT

For the dental professional, orofacial manifestations of depression as well as the effects of the pharmacological management of depression warrant consideration. Dentally, clients with depression have higher incidences of tooth loss and non-use of oral health services, and may have poorer oral hygiene resulting in increased incidence of caries and periodontal diseases.^{29,30} The combination of neglect and disinterest, in conjunction with adverse effects from their medications, may result in rampant caries. Those presenting to the practice may also have craniofacial pain conditions including atypical facial pain (“neuralgia”), burning sensation of the oral mucosa (often on the tongue) or some temporomandibular joint disorder. Whether the onset of these conditions resulted in depression or whether clients without depression more readily develop these conditions is unclear. It has been suggested that the pain may arise from stress-induced disruption of the HPA axis, a mechanism previously implicated as the cause of both depression and inflammatory joint disease.^{5,31-34} Other oral findings include dysgeusia, stomatitis, and glossitis.

All the antidepressants discussed above have the potential to cause xerostomia. The majority of SSRIs, TCAs, and some atypical antidepressants have xerostomia listed as a side effect.^{5,35-37} Xerostomia provides a breeding ground for oral biofilm, particularly when oral hygiene is neglected. Furthermore, long-term use of TCAs is associated with an increase in dental decay because these medications induce a craving for carbohydrates.³⁸ In addition, the long-term use of antidepressants has been linked with the development of diabetes mellitus, which has been shown to be a risk factor for periodontal disease.³⁹

The effective management of a client with depression begins with a thorough medical history to ascertain the presence of depression, whether the depression is being treated and managed, and what medications the client may be taking. Due to stigma, some clients may be reluctant to disclose their medical history of depression but may report the medications they are taking; the prudent dental professional should be able to recognize which medications are commonly associated with this condition. In reconciling the medication list, however, it is important to understand where a medication may be used for purposes other than the management of depression. Bupropion, as previously mentioned, may be used for smoking cessation; venlafaxine is often used for the management of post-herpetic neuralgia. An open discussion with the client to understand the indication for the medication is critical. One should not assume that an antidepressant is only being used to treat depression. When there is doubt, contact should be made with the client’s family physician or psychiatrist.

A preventive approach should be taken with these clients, given their propensity for oral diseases. Involving the family whenever possible is advisable as having a

support network may improve oral health outcomes. Salivary substitutes or stimulants (e.g., pilocarpine) should be considered if xerostomia is noted.

Pharmacological agents employed by dentists to control disease, pain or anxiety (e.g., antibiotics, analgesics, and sedatives, respectively) must be carefully selected to avoid potential interactions with the medications being used to manage the depression. For example, SSRIs are known to inhibit cytochrome P450.⁴⁰ Codeine, an analgesic commonly used in dentistry, is a weak opioid that has no analgesic effect on its own but is converted to morphine by the liver enzyme CYP2D6. However, some people lack the ability to make this conversion because of low CYP2D6 enzyme levels. Moreover, the conversion can be inhibited by antidepressant medications such as the SSRIs (e.g., fluoxetine, paroxetine, and sertraline).^{41,42} In addition, MAOIs can increase the potency of other narcotics and TCAs may potentiate other sedatives resulting in respiratory depression.⁵ In many cases, pharmacists can be of assistance in selecting medications that will produce the least interactions and should be consulted.

The administration of local anesthesia with epinephrine or levonordefrin to facilitate treatment must be done following common principles (minimum dosage, aspiration, etc.) to prevent potential complications. TCAs inhibit the reuptake of these vasoconstrictive agents and can result in increases in systolic blood pressure as well as cardiac dysrhythmias.¹² This appears to be more relevant for levonordefrin than epinephrine; thus, the dental practitioner should consider the use of epinephrine with careful aspiration to avoid introducing epinephrine intravascularly. It is therefore our recommendation that, for clients taking TCAs, the dose of epinephrine contained in anesthetics be limited to a maximum of 0.04 mg, which translates into 2 carpules of 1:100,000 epinephrine or 4 carpules of 1:200,000 epinephrine. Moreover, monitoring blood pressure and heart rate is advised when considering multiple administrations of epinephrine-containing local anesthetic. Finally, where possible, epinephrine-containing local anesthetics should be given slowly over time to help limit systemic absorption.¹² The usage of epinephrine- or levonordefrin-containing local anesthetics is of little concern with MAOIs.⁴³ In summary, the prudent clinician should consider monitoring blood pressure and heart rate when multiple administrations of epinephrine-containing local anesthetic are used.

CONCLUSION

Depression is a common medical condition and thus will be seen in many clients presenting for dental care. Since dental disease tends to be more prevalent in this population group compared to the wider client population, it is crucial that these clients be appropriately managed and provided with effective treatment.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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Care aide abilities in oral care delivery and seniors' oral health outcomes

Ashley Chicote*

ABSTRACT

Background: Residents living in long-term care facilities have an increased risk of developing oral diseases and exacerbating existing systemic conditions. Major factors in oral health outcomes include a lack of access to dental care, varying levels of dependency, and comorbidities. While oral health can be maintained through the delivery of daily oral care, it is often insufficient. **Objective:** This literature review examines the effectiveness of theoretical education versus clinical skills training in improving oral care delivery abilities of care aides and seniors' oral health outcomes. **Results:** Adjunctive strategies to include theoretical education and clinical skill refinement have the highest potential to enhance long-term outcomes. **Discussion:** A major factor in the efficacy of oral care delivery are the attitudes of care aides. With the integration of oral health assessment tools into care practices, care staff may learn to recognize oral diseases and determine the oral health needs of residents. Furthermore, oral health professionals should recognize the responsibility they have in supporting care staff throughout geriatric care.

RÉSUMÉ

Contexte : Les résidents qui habitent en établissement de soins de longue durée ont un risque accru de développer des maladies buccodentaires et d'exacerber les états systémiques existants. Des facteurs majeurs en matière des résultats de santé buccodentaire comprennent un manque d'accès aux soins dentaires, divers niveaux de dépendance et des comorbidités. Bien que la santé buccodentaire puisse être maintenue par la prestation de soins buccodentaires quotidiens, ceux-ci sont souvent insuffisants. **Objectif :** La présente analyse documentaire examine l'efficacité de l'éducation théorique par rapport à la formation des compétences cliniques, à augmenter la capacité des aide-soignants à fournir des soins buccodentaires et à améliorer les résultats buccodentaires des aînés. **Résultats :** Les stratégies complémentaires qui visent à ajouter l'enseignement théorique et le raffinement des compétences cliniques ont le plus grand potentiel d'améliorer les résultats à long terme. **Discussion :** L'attitude à l'égard des soins est un facteur majeur dans l'efficacité de la prestation des soins buccodentaires. Grâce à l'intégration des outils d'évaluation de la santé buccodentaire, le personnel de soins peut être en mesure de reconnaître les maladies buccodentaires et de déterminer les besoins en matière de santé buccodentaire des résidents. En outre, les professionnels de la santé buccodentaire se doivent de reconnaître leur responsabilité à soutenir les aide-soignants tout au long des soins gériatriques.

INTRODUCTION

The oral health status of seniors living in long-term care (LTC) facilities has become a growing concern and continues to be a primary focus in public health. Geriatric oral health has become particularly troubling as the aging population has increased in size, with the number of seniors living in LTC facilities also increasing.¹⁻³ In 2016, it was found that 6.8% of Canadians age 65 years and older, and 30% age 85 years and older, were in LTC.⁴ With the prevalence of oral diseases increasing with age and the retention of natural teeth becoming more common, the complexity of seniors' oral health needs has heightened.²

Seniors living in LTC facilities are at a greater risk of oral health complications due to medication-induced xerostomia, lack of access to dental care, inadequate daily oral hygiene, and cariogenic diets.¹ Poor oral hygiene has

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been associated with oral precancer or cancer, aspiration pneumonia, and oral diseases and infections, such as periodontal disease, dental caries, and candidiasis.^{1,2,5,6} In addition, poor oral conditions may result in decreased social interactions, difficulty chewing or swallowing, speaking, nutritional deficiencies, and a lower quality of life.¹ Because many seniors lack dental insurance and visit oral health professionals less frequently, preventive care is imperative to reduce oral diseases and the exacerbation of systemic conditions.

Physical limitations, psychological conditions or other health conditions may result in individuals living in LTC facilities being fully or partially dependent on care aides.² Although care aides receive some training in providing oral care, their delivery methods are often inadequate due

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to a lack of extensive training, insufficient time, lack of oral health knowledge, and lack of resources to perform oral care services.^{2-3,7} With a primary focus on systemic health in LTC facilities, oral health is often overlooked.

Current literature

Various approaches have been undertaken to improve oral care delivery in LTC facilities, including the introduction of guidelines incorporating extensive oral care education, practical training, side-by-side delivery with an oral health professional, provision of resources, and the implementation of oral assessment tools.^{1,3,7,8} Despite identifying inadequate oral care and a higher prevalence of oral diseases in the geriatric population, improvements have been insufficient and unsuccessful. A lack of understanding of the relationship between oral health and systemic health, institutional policy, proper education and skill training, availability of resources, and oral health assessment tools have been identified as barriers to improving the oral health and quality of life of seniors living in LTC facilities, and remain influential factors for oral health outcomes.¹

By focusing on one aspect of the barriers identified, future standardized recommendations for oral care training may be achieved. This literature review aimed to explore the effectiveness of either theoretical education or clinical training of care aides on oral care delivery, and their influences on care aide abilities and oral health outcomes in the geriatric population.

METHODS

The electronic databases of Google Scholar, PubMed, Cochrane Database of Systematic Reviews, and CINAHL were searched to obtain relevant literature. Key terms for the search were geriatric dentistry, senior oral health, nursing aid knowledge, care home, oral hygiene, oral disease, skills, long-term care facility, and residential facility. Inclusion criteria were English full-text, peer-reviewed articles published within the last decade. A total of 8 articles were evaluated, with 4 articles meeting the inclusion criteria. Of these, 1 was a systematic review, and 3 were clinical trials. Additional resources provided supplemental information.

RESULTS

Exploring current strategies to educate nursing aides is necessary to bridge the gap between seniors living in LTC and oral health outcomes. From the assessment of studies, it was observed that neither theoretical education nor clinical skills training exclusively may result in improved delivery of oral care. Rather, adjunctive strategies incorporating both methods are better suited to enhancing care aide abilities and seniors' oral health outcomes. Theoretical education provides the framework for developing oral health knowledge, whereas clinical skills training helps develop the abilities of care aides. Integration of both

approaches should be considered, along with involving dental health professionals in directing oral health education and supporting care staff in LTC facilities.

While there is a need for more research in this area, results from this literature review offer many recommendations to improve care staff education in oral health. Research involving a higher frequency of intervention exposure and a combined longer study period is needed, as well as studies exploring long-term outcomes of interventions conducted by oral health professionals. With the revision of study designs, outcomes may be better accomplished, and standardized oral health education programs may be supported.

DISCUSSION

Care aide attitudes

Modern day nursing care is often complex, given the variety of comorbidities common among seniors. Oftentimes, care aides have high workloads, creating a situation where prioritization of tasks is necessary. This complicates oral care, as oral diseases are prioritized less often when compared to systemic health concerns.⁹ The attitudes of care aides influence oral care delivery and their commitment to long-term implementation. However, a lack of support and educational training often correlates with their attitudes. Care aides often exhibit low confidence in delivering oral care and meeting seniors' oral health needs, and express being unsupported by LTC administrators.⁹⁻¹² Interestingly, care aides generally over-report the ability to perform adequate oral care delivery such as when brushing the teeth and tongue of residents or when cleaning dentures. Observations of oral care delivery revealed that plaque removal from the dentition and/or dentures was often insufficient.¹¹ Additionally, with an increased prevalence of dementia or other cognitive impairments, residents may exhibit combative or resistant behaviours. Care aides are generally less persistent in providing oral care to these individuals, and report having deficient skills to help support oral care delivery.^{9,11,12}

Theoretical education

From the evaluation of peer-reviewed studies, it was observed that routes of intervention most commonly involve theoretical education in the form of presentations. Presentation formats often focus on daily hygiene care such as brushing the dentition, tongue, and dentures. Additionally, presentations are often singular and offered in a short time frame, limiting the amount and depth of information that can be shared and understood by care staff. Several clinical trials that studied this approach report a lack of statistically significant difference in oral health outcomes between the intervention and control groups.¹²⁻¹³ Despite theory-driven approaches being available to many care aides, the assessment of care aide potential and confidence is absent, and long-term success is limited. Moreover, with the lack of behavioural theory

applications, care aides' behaviours and attitudes are minimally changed. It is acknowledged that theoretical education provides the framework for development of oral health knowledge but may be insufficient to support oral care delivery.

Clinical skills training

In several studies evaluated, clinical skills training as an adjunct to theory education had the greatest potential to enhance care aide attitudes and seniors' oral health outcomes. It was found that there was a lack of research exploring the outcomes of clinical skills training exclusively. This may suggest that care staff must be competent in and understand oral health theory to apply concepts in oral care delivery.

Following clinical skills training, care aides expressed feeling more equipped to deliver oral care independently and sufficiently, and this was evident in the measurements across several oral health components such as denture plaque, dental plaque, and gingival bleeding.^{9,13} Through the refinement of skills, care aides expressed being able to provide sufficient care to individuals who displayed resistant or combative behaviours previously, and even saw a reduction in these behaviours.⁹ The application of skills training may be most beneficial in preparing care aides to handle situations more confidently, and may enhance their approach to oral care delivery.

One limitation of this approach is the lack of available dental professionals to educate and support care aides. Both studies that evaluated a hands-on approach involved continuous or intermittent clinical guidance from either a dentist or dental hygienist in oral hygiene tasks.^{9,13}

Interdisciplinary collaboration

By incorporating dental professionals in LTC facilities, care staff and other health professionals may be better supported in enhancing their oral health knowledge and skills. There is limited research on the long-term effects of previous intervention strategies on prevention of oral disease in seniors living in LTC, or on the changing perceptions of the importance of oral health.¹³ However, the inclusion of dental professionals on the interdisciplinary health care team offers an insightful approach to improving the oral health-related quality of life of seniors living in LTC facilities. The involvement of dental professionals in care conferences allows for reciprocal learning among health care providers and helps in the development of personalized care plans encompassing various health concerns.¹³ Despite this, most LTC facilities do not have dental health professionals on their team of care providers. Although future research is needed to explore the impact of interdisciplinary practice in LTC, dental professionals should recognize their role in geriatric dentistry to help reduce oral health disparities.

Oral health assessment tools

Oral health assessment tools are supportive elements

in oral care delivery and have the potential to improve seniors' oral health outcomes. Plaque levels associated with the dentition and/or dentures are often used in measuring the effectiveness of oral health care delivery. However, studies most often fail to report the efficacy on oral health outcomes and improved quality of life.¹³ By recognizing other visual characteristics of oral health and disease, care staff may be better able to determine the health needs of a resident. Furthermore, recognition of oral health and diseases may broaden the dental competency of care staff.

An example of a promising oral health assessment tool is the Revised Oral Assessment Guideline (ROAG), which is a high sensitivity and specificity tool used to assess oral components in the elderly.¹⁴ This tool helps monitor the voice, lips, saliva, swallowing ability, mucous membrane, tongue, gums, and teeth or denture(s) of seniors living in LTC facilities. Similarly, the Oral Health Assessment Tool (OHAT) assesses oral components including lips, tongue, gums and tissues, saliva, natural teeth, dentures, oral cleanliness, and dental pain.¹⁵ Both tools are suitable for use in residential care facilities due to their simple formats and straightforward interpretations of results for non-dental care staff.

Strengths and limitations

Further research is needed to make necessary recommendations to care staff for improving the oral health-related outcomes of LTC residents. Many trials to date have involved short-term or single intervention strategies. Thus, the long-term effects of these strategies remain unknown. Research involving a higher frequency of intervention exposure and a combined longer study period is also needed.

CONCLUSION

This literature review acknowledges the strengths of theoretical education and clinical skills training individually but indicates that adjunctive strategies would be most beneficial for improving care staff abilities and seniors' oral health outcomes. As care aides are often the main providers for seniors living in LTC facilities, it is essential that their perceptions of oral health align with those concerning systemic health. While efforts are being made to improve the oral health outcomes of seniors living in LTC facilities, oral health professionals need to consider their role and responsibility in geriatric dentistry. Although there is inconclusive evidence in supporting care aides through oral health education, current research provides strong recommendations in guiding future practices.

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CDHA 2019 NATIONAL CONFERENCE: PEER-REVIEWED PRESENTATIONS

The scientific program is an integral part of the Canadian Dental Hygienists Association's biennial national conference. The following studies will be presented, either orally or in poster format, between October 3 and 5, 2019, in St. John's, Newfoundland and Labrador.

ORAL PRESENTATION ABSTRACTS

Redesigning a dental hygiene refresher course: A curriculum addition through distance education

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Background: A predominantly clinical dental hygiene refresher course for dental hygienists seeking re-entry into practice was offered in Alberta for over 15 years. Because of the varied educational and practice histories of course participants, however, a newly developed dental hygiene refresher course incorporated a 3-month online component to be completed prior to the clinical practicum. Kern, Thomas, and Hughes' 6-step curriculum development approach (2009) guided the online program design, and Olmstead's framework for preparing professionals (2010) guided the development of learning activities specific to dental hygienists. **Objective:** This project aimed to determine how course participants perceive the interactive online learning activities of the refresher course and to assess their perception of preparedness for the clinical practicum. **Approach:** This 2-part program evaluation included a post-course group session with participants and clinical instructors and the Distance Education Learning Environments Survey (Walker & Fraser, 2005) which measures student perceptions of instructor support, student interaction and collaboration, personal relevance, authentic learning, active learning, and student autonomy. **Results:** Sixteen participants completed the new refresher course from March through June 2019. Three clinical instructors also provided post-course feedback. Participants reported feeling prepared for clinical sessions; valued flexibility and independence of online learning; and appreciated online interactions with fellow course participants prior to meeting face-to-face in clinics but requested more case studies, fewer small assignments, and questioned the relevancy of some assignments. Clinical instructors reported participants came prepared with updated knowledge for the clinic sessions after completing the online activities. **Conclusion:** The 3-month online course with self-paced asynchronous activities improved preparation of participants for the onsite clinical practicum. Participants valued the interactive learning activities and convenience of distance education. However, they

also made recommendations for future changes. Phase 2 of the evaluation provided increased understanding of participants' perceptions of the overall course experience and their resulting performance during the onsite clinical practicum. The combined feedback will allow for further enhancements to the refresher course to ensure appropriate review and preparation by participants for the course and for successful re-entry into dental hygiene practice.

The malignant potential of lichenoid dysplasia

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Objective: Oral epithelial dysplasia (OED) is recognized as potentially malignant. However, when dysplasia coincides with striking lichenoid changes, the cellular atypia is often discounted as reactive. The objective of this literature review was to assess the malignant potential of OED with striking lichenoid features (lichenoid dysplasia, LD), compared to OED without lichenoid features. **Method:** A systematic search of electronic databases was conducted using PubMed and MEDLINE EBSCO. The following key words were used: ["lichenoid dysplasia" OR "lichenoid mucositis"] AND ["progression" OR "cancer"]. The references and bibliographies of included studies and papers were also scrutinized. English-language, full-text, primary, peer-reviewed publications were included in this literature review. Review articles and papers that did not answer the primary research question were excluded. **Results:** The search strategy produced 68 articles, 7 of which met the inclusion and exclusion criteria: 3 molecular studies investigating the expression of biomarkers implicated in cancer progression, 2 case reports of LD that progressed to oral squamous cell carcinoma, and 2 retrospective studies, one of which compared clinical and histological characteristics of LD and OED, while the other investigated the proportion and rate of malignant transformation of both LD and OED. **Conclusion:** Variability in diagnostic criteria and inadequate documentation contribute to the ongoing debate regarding the malignant potential of LD. However, most studies support the finding that OED has malignant risk, regardless of lichenoid changes. Well-designed prospective studies are required to further investigate the malignant potential of LD.

Self-reported oral health status and diabetes outcomes in a cohort of individuals with diabetes in Ontario, Canada

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Objective: To determine the extent of the difference in health complications among a population of individuals with diabetes who report “poor to fair” versus “good to excellent” oral health. **Method:** A prospective cohort study was undertaken of individuals with diabetes from the Canadian Community Health Survey 2003 and 2007–2008 (N = 5,183). Self-reported oral health was linked to electronic health records. Participants under the age of 40, missing self-reported oral health, and those who could not be identified in linked databases were excluded. Diabetes complications were extracted from health records based on ICD codes. A series of Cox Proportional hazards and multinomial logistic regression models were constructed to determine the risk of diabetes complications and the odds of acute or chronic complications, respectively. Participants who did not experience any diabetes complication were censored at time of death or at the study termination date (March 31, 2016). Models were adjusted for age and sex, followed by social characteristics (income, education, ethnicity, and rural vs urban living) and behavioural factors (smoking status, alcohol consumption, physical activity, and dental visits). **Results:** Diabetes complications among participants differed by self-reported oral health. For those reporting “poor to fair” oral health, the hazard of a diabetes complication was approximately 30% greater (HR 1.29 95%CI 1.03, 1.61) than for those reporting “good to excellent” oral health, in a fully adjusted model. For those reporting “poor to fair” oral health, the odds of an acute and chronic complication were approximately 10% (OR 1.10 95%CI 0.81, 1.51) and 34% greater (OR 1.34 95%CI 1.11, 1.61), respectively, in a fully adjusted model. **Conclusion:** Oral health status is associated with diabetes complications and it appears that this link is influenced by the chronic nature of the periodontitis–diabetes link. This study is the first to explore the oral health–diabetes health link among individuals with diabetes in Ontario, Canada.

Caring for clients with head and neck cancer: An interprofessional approach

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Background: Head and neck cancer (HNC) accounts for approximately 4% of all new cancer cases in Canada and 3% of all cancer deaths. While a moderate decrease in HNC has been documented, the incidence of oropharyngeal cancers related to human papillomavirus (HPV) is increasing and is predicted to surpass the prevalence rate of cervical cancer by 2020. Radiation therapy is often used in the treatment of HNC, resulting in acute and chronic side effects. Educating clients to seek pre- and post-radiation treatment dental care is essential to mitigate oral complications. Routine HNC screenings facilitate earlier detection and can improve survival rates. **Objective:** This interprofessional student collaboration session was created for dental hygiene (DH), radiation therapy (RT), and medical laboratory science (MLS) students to better understand the client’s cancer care experience, beyond the DH/RT/MLS points of practice. **Approach:** The first time the session was offered, RT and DH students completed pre-session and post-session surveys. In 4 separate stations, students role-played client education scenarios and identified and described their unique roles and respective responsibilities in a client’s oncological journey, before, during, and after treatment. Following the session, students participated in a question-and-answer discussion. The second year, we offered 2 sessions instead of one, included MLS students as well as client partners who had been diagnosed with HNC, and made use of the university’s Linear Accelerator Training Suite in hopes of accommodating deeper learning about person-centred care. **Evaluation:** All students indicated that they learned a significant amount about the client experience during cancer care and about HNC multidisciplinary care specifically. They articulated feeling more confident in providing clients and their families with mindful, empathetic, high-quality care.

Efficacy of an innovative bio-descaling anticalculus toothpaste: A double-blind randomized controlled clinical trial

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Objectives: Calculus is a calcified mineralized plaque that plays an important etiological role in periodontal diseases. Most anticalculus agents in toothpaste prevent calculus but barely remove existing calculus and may damage tooth structures. The purpose of this randomized controlled clinical study was to test the efficacy of a newly developed anticalculus toothpaste (D-Tart toothpaste) in removing calculus and dental stains compared to Crest antitartar toothpaste. **Method:** The study design was reviewed and approved by the Research Ethics Board at

McGill University (application A08-M35-16B), and all study participants signed informed written consents before their participation. Eighty-three clients who fulfilled the inclusion criteria were blindly and randomly assigned to 2 study groups. Forty-two participants received the intervention (D-Tart toothpaste), and forty-one received the control toothpaste (Crest toothpaste). Calculus, stain, QHI plaque, and gingival indices scores were recorded and compared at baseline, 3, 6, and 9 months, using a generalized linear model analysis with the Wald Chi-Squared Test. Scaling and polishing were offered to all participants at the 3-month visit and the end of the study. **Results:** At 3 months, the intervention group showed 32% less total calculus compared to the baseline mean score ($p = 0.0007$) and 59% less total calculus compared to the control group ($p = 0.0001$). Over the 9 months, the mean calculus score for Crest users was 79% higher than for D-Tart users ($p = 0.0008$). There was a significant improvement in the gingival health of D-Tart users compared to the Crest group at all intervals. However, both toothpastes were comparable in terms of stain removal, which was significantly lower than at baseline ($p < 0.0001$). **Evaluation:** D-Tart toothpaste shows superior efficiency in removing and preventing calculus accumulation than the control toothpaste, and it could be helpful in preventing stain formation after 9 months of use.

POSTER PRESENTATION ABSTRACTS

Admission criteria for Canadian dental hygiene programs as predictors of success on the National Dental Hygiene Certification Examination

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Objective: This project aimed to examine the variation in admission criteria used by Canadian dental hygiene (DH) programs and determine whether these criteria are predictive of student success on the National Dental Hygiene Certification Examination (NDHCE). **Method:** Because this study was deemed outside the mandate of the Research Ethics Board, ethics approval was waived. Admission criteria were compiled from websites of 30 English-language DH programs. Data collected included secondary and post-secondary prerequisite courses, total required post-secondary credits, entrance average/GPA, interview and/or essay, and any other non-cognitive requirements. DH programs were contacted by email or phone to obtain information not available on the websites. The 2015–2017 NDHCE school results were collected from the National Dental Hygiene Certification Board's

website. The association between admission criteria and NDHCE school success rate was determined by calculating Pearson's product-moment correlation coefficient. **Results:** A strong correlation was found between the number of post-secondary prerequisite credits required and NDHCE success rates ($r = 0.674$). There was a weak correlation between program length and NDHCE success rates ($r = 0.177$). Admission criteria included academic performance, non-cognitive requirements, and standardized testing. Academic performance as an admission criterion, which included GPA or high school averages, was the most common criterion used. **Conclusion:** Graduates of programs that required more post-secondary prerequisites may fare better on the NDHCE because the rigour of the prerequisites may have removed lower performing students from the applicant pool. Various interview processes were used by DH programs, with each type capturing different attributes. Standardized testing may equalize the discrepancies in grades from prerequisites obtained from different institutions. Due to variation in selection processes for DH programs, it is difficult to isolate variables that are predictive of success on the NDHCE. However, academic criteria such as the number of prerequisite credits required may predict DH student success.

Committed to yourself or have yourself committed: Balancing family life with student success

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Objective: The purpose of the study was to explore the family-life roles and experiences of mature female dental hygiene students, as well as the different mechanisms used for coping with role conflict in order to better enable and support individual student success. **Methods:** This study employed a mixed-methods explanatory approach whereby quantitative data were obtained from mature female dental hygiene students ($N = 12$) via a 10-item questionnaire comprising both closed and open-ended questions. Closed-ended questions were summarized using descriptive statistics. Open-ended questions were examined for common themes. Additional qualitative data were obtained through personal in-depth interviews examining for supplementary common themes. **Results:** These females identified “mothering” as their primary role prior to entering school and while attending school. All participants indicated the greatest challenge was “time”—time to be a parent, time to complete household responsibilities or time to complete academic work. Yet the prime benefit reported was increased self-confidence. Role conflict was self-imposed. The coping strategy of role redefinition was found to be most beneficial to support change, growth, and development. The educational system offered the least amount of support according to these

respondents. **Conclusion:** The mature female student requires support when returning to higher education. Institutions of higher education need to be cognizant of specific characteristics, barriers, and challenges any student encounters to facilitate their success.

Dental hygiene in-service training in long-term care: Comparing different approaches

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Background & Objectives: Many nursing home residents do not receive adequate oral care from staff. When teeth and dentures are not cleaned regularly, risks increase for caries, gingivitis, oral infections, respiratory pneumonia, diabetes, heart disease, lowered nutrition, and reduced social interactions. The objective of this study was to determine which of 2 methods of in-service training could be effective in motivating staff to carry out oral care with resistant residents. **Methods:** Following ethics approval from the researchers' university and from participating nursing homes, 6 nursing homes in New Brunswick were randomly assigned to 1 of 2 methods of in-service training—a traditional lecture session about the importance of oral health or a new discussion-based session that addressed staff questions, concerns, and past experiences with residents who resisted oral care. In total, 40 staff members received the traditional method of training and 64 participated in the discussion session. Trained dental hygienists measured the oral status of residents at time of training and 4 weeks post-training to index the quality of oral care carried out following training. Three indices were utilized: Gingival Index (GI), Simplified Oral Hygiene Index (OHI-S), and Denture Oral Hygiene Index (OHI-D) [developed by the first author]. Immediately following training, staff filled out a 9-item Likert survey developed for this study that included questions about satisfaction with the training, usefulness of the strategies discussed, and confidence in providing oral care. **Results:** Two 2 (Training method) x 2 (Time of measurement) ANOVAs yielded significant interactions for biofilm and calculus, indicating that the discussion training resulted in superior oral care. Staff members were equally satisfied with both types of training. **Conclusion:** Training focusing on practical techniques for providing care that is safe for both the resident with dementia and the staff member may be more effective than traditional approaches, which often focus on the health consequences of not providing adequate oral care.

Efficacy of student disinfection procedures for dental loupe disinfection

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Objective: Dental magnification loupes may be a source of cross contamination. The primary objective of this pilot project was to evaluate the efficacy of infection control protocol used by third-year dental students. A secondary objective was to determine if a type of procedure could be predictive of contamination. **Methods:** Loupes (N = 25) were swabbed at baseline, wiped with disinfectant, and swabbed again. Students used the loupes for 5 days, after which the loupes were swabbed again. Students followed standard disinfection protocol and were not informed of the purpose of the study. Samples were cultured on blood agar plates and incubated (37°C) for 1 to 2 days in aerobic and anaerobic environments. The numbers of microbes from each sample were enumerated by viable cell count. McNemar's test was used to compare the proportion of contaminated loupes at baseline and day 5. Backward stepwise (Wald) logistic regression was conducted to determine if type of procedure performed was a predictor of contamination at day 5. **Results:** Viable cell counts ranged between 0 and >200. Loupes were classified as not contaminated (0 to 20 colonies), moderately contaminated (20 to 100 colonies) or highly contaminated (>100 colonies). At each time point, 40% of loupes were either moderately or highly contaminated with aerobic and/or anaerobic bacteria. There was no change in the proportion of loupes contaminated between baseline and day 5 ($p = 1.000$) for either bacteria. Overall, 36% (n = 9) of student loupes were uncontaminated at both time points, 16% (n = 4) were contaminated at both times points, and 48% (n = 12) were contaminated either at baseline or day 5. The only procedure that was a significant predictor of contamination was if a restoration was performed on day 5 (immediately before loupe collection) ($p < 0.01$). **Conclusion:** The data suggest that only 36% of students consistently followed disinfection protocols. Future study is needed to determine which types of procedures cause the greatest amount of contamination.

The impact of peer assessment on dental hygiene students' ability to create acceptable Class II composite restorations

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Objective: The objective of this study was to evaluate the impact of preclinical peer assessment on the creation of Class II composite restorations on tooth #15(MO) and #46(MOD), including rubber dam, tofflemire, and matrix band placements. **Methods:** A quasi-experimental design was chosen for this study, which utilized a convenience sample of 20 dental hygiene students enrolled in the winter 2018 Restorative Dentistry course at John Abbott College.

Participants were randomly divided into a control group ($n = 10$; no peer assessment) and an experimental group ($n = 10$; peer assessment). Quantitative and qualitative data were collected from both research groups. Quantitative data analysed the effectiveness of peer assessment on students' performance score in creating acceptable Class II composite restorations on tooth #15(MO) and #46(MOD) and the qualitative data consisted of responses to 8 questions adapted from the Clinical Teaching Preference Questionnaire (Iwasiw & Goldberg, 1993) using a 5-point Likert scale ranging from strongly agree to strongly disagree and 3 open-ended questions using an anonymous online survey to assess students' perception of peer-assessment practice trials. A t-test (Two-Sample Assuming Equal Variances) was performed comparing the control and experimental group performance scores on precognitive, psychomotor, and procedural tests. All responses remained confidential. The study received ethics approval from John Abbott College's ethical committee, certificate number JACREB201711. **Results:** The results showed that peer assessment did not significantly improve students' ability to create acceptable Class II composite restorations. A possible explanation might be the short time (2 weeks) that the experimental group had to gain experience as evaluators. However, students did benefit from the peer-assessment strategy as was supported by their responses to the open-ended questions. With its small sample size, short training time, and low number of peer-assessment encounters, this study's findings cannot be generalized. Although these results were not very encouraging, it was the first peer-assessment implementation in dental hygiene education. **Conclusion:** While this study did not find a positive impact of peer assessment on the achievement of performance scores, it did partially substantiate the benefits of peer-assessment use when creating Class II composite restorations, based on students' perceptions. Further research in the dental hygiene field would be of a great help to investigate the impact of peer assessment in students' active learning.

Musculoskeletal disorders among dental hygienists in Canada

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Objectives: 1) To establish the patterns and frequencies of self-reported occupation-related musculoskeletal disorders (MSD) among dental hygienists in Canada; 2) To identify strengths and weaknesses of MSD prevention training in accredited dental hygiene program curricula. **Methods:** An online survey was distributed via Canadian Dental Hygienists Association social media webpages to registered dental hygienists in Canada. The survey asked questions on demographics, practice history, MSD history, preventive

measures, and injury prevention curriculum. Phone and email interviews were conducted with representatives from 8 accredited, English-speaking dental hygiene schools in Canada. Interviews covered questions on injury prevention curriculum. The study was approved by the university's Research Ethics Board (#DENTUNIT2018-04). **Results:** There were 647 respondents to the survey. Years in practice ranged from less than 1 year to more than 21 years, with 61% having practised for less than 10 years. Most (60%) worked full time. Eighty-three percent of respondents had suffered from an MSD related to their dental hygiene career. The most common region of injury was the neck, followed by the wrist/hand. The most common diagnoses were tendonitis and carpal tunnel syndrome. There was a positive correlation between number of years in practice and the presence of injury ($r = 0.238$, $p < 0.001$). Half of respondents felt that they had been adequately trained on injury prevention. Five of eight dental hygiene schools felt their injury prevention curriculum was sufficient. Identified program strengths include a focus on fitness and self-care, extensive preclinical and clinical training with a focus on positioning and technique, and calibration of instructors to assess ergonomics. Suggestions for improvements were as follows: dedicated ergonomics courses, injury prevention tools, and education on specific MSD and ways to prevent them. **Conclusion:** This survey found an alarmingly high prevalence of MSD among Canadian dental hygienists. This is particularly concerning given the relatively low number of years in practice of the respondents. Despite generally positive views on the current state of injury prevention training, these data suggest that improvements are needed.

Oral health knowledge and challenges in Jordanian individuals with autism: Case-control study

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Objective: This study aimed to identify the barriers to dental care utilization faced by individuals with autism spectrum disorder (ASD) in comparison with individuals without ASD. **Method:** A case-control study of 105 ASD and 100 healthy individuals was conducted to compare their oral health knowledge and dental care challenges. Data collection was made by a self-designed questionnaire. The questionnaire's content validity was established by a panel of experts. The questionnaire was pilot tested using 5 ASD caregivers who were asked to answer the questionnaire and provide feedback. Test-retest reliability was achieved by administering the questionnaire twice to the same individuals ($n = 5$). Lists of special-care centres associated with ASD were obtained from the Ministry of Social Development. Similar questionnaire forms (without a few questions specific to children with ASD) were sent to parents of children without ASD studying at schools in the

same region of the special-care centres. **Results:** Fewer ASD individuals brushed their teeth once or twice daily (31.5%), compared to the control group (41.9 %). Intake of sweets and soda more than once a day was higher among ASD individuals (43.5%, 32.2%) than among the control group (37.2%, 30.9%) respectively. The least common reason for a dental visit among individuals with ASD was for a routine check-up. Barriers such as embarrassment (43.5%), lack of specialist dental staff (28.6%), lack of knowledge of how to treat clients with disabilities (26.6%), and inadequate facilities (34%) are significantly ($p < 0.05$) higher among individuals with ASD than the control group. **Conclusion:** Knowing the factors that are associated with dental care for ASD individuals may assist in reducing barriers to dental care utilization. This study may guide the development of resources to enhance access to dental services and reduce the incidence of oral diseases and increase tooth retention among this population.

The oral health status of recent refugees to Nova Scotia

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Background: In 2017, Canada accepted 320,000 new immigrants. This vulnerable population faces many barriers to receiving oral care. **Objective:** The purpose of this study was to determine the oral health status of recent refugees to Nova Scotia with the intent of providing data to help inform provincial oral health care policy. **Methods:** Approval was granted by the Dalhousie University Research Ethics Board (REB #2018-4444). Participants were recruited from a list of clients who were treated in the Refugee Oral Health Clinic at Dalhousie University from September 2017 to April 2019. Each participant completed a questionnaire that included questions about demographics, oral hygiene habits, and professional oral care. A clinical oral examination that included probing depths, clinical attachment loss (CAL), calculus, debris, gingival status, and decayed, missing and filled teeth (DMFT) was completed by second-year dental hygiene students and verified by a single calibrated professor at the Dalhousie University Dental Clinic. A one-sample Chi-squared test was conducted to compare the clinical data, and one-sample t-tests used to compare DMFT to national data derived from the 2007–2009 Canadian Health Measures Survey. **Results:** 91.9% of new refugees to Nova Scotia are unemployed, and 71.7% visit a dentist for emergency care only. One hundred percent reported not having insurance for oral care. Of the participants, 95.6% have probing depths greater than 4 mm and 89.7% have CAL greater than 4 mm compared to only 20.1% and 15% of the Canadian population. Debris and inflammation

scores for the refugee population were moderate to severe compared to mild for the Canadian population. The refugee population had more decayed and missing teeth than the Canadian population, but fewer filled teeth. **Conclusions:** When compared to the average Canadian population, new refugees to Nova Scotia have poorer oral health as indicated by periodontal and gingival indices. This population also has more decayed and missing teeth, but fewer filled teeth. More research is required to identify barriers to care and strategies to reduce these barriers.

What's the fuss about flossing: An issue of critical thinking

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Introduction: In 2016, a report published by the Associated Press, “Medical Benefits of Dental Floss Unproven,” stated that the US federal government no longer supported flossing due to the lack of longitudinal clinical studies. In response, a pilot study by the Dental Hygiene South Texas Oral Health Network (DH-STOHN) was developed to gather data from practising dental hygienists (DH) and dental hygiene educators (DHE) to assess the effects of the AP report on attitudes towards presenting flossing to their clients. **Methods:** An online survey, formatted with Likert-type dichotomous and open-ended questions, was used to recruit DH and DHE members of DH-STOHN and the Texas Dental Hygiene Association, resulting in a convenience sample of 71 participants. All data were anonymized, aggregated, and analysed for frequency, means, binary outcomes, and thematic narrative. The study was approved as exempt #HSC 20170132E. **Results:** Respondents were primarily female (97%), non-Hispanic white (73%), age 46 years or older (41%), with more than 20 years’ experience (58%), full-time in practice or educators (each 34%), held associate degrees (48%) of which 74% also held bachelor’s or master’s degree, and were aware of the report (77%), 33% of whom had learned of it from “patients, family, and friends.” Most (61%) disagreed that there was “no evidence” to support flossing. Many (49%) felt the report’s references were not reliable. Flossing was by far (62%) the least recommended method for interdental cleaning, with dental hygienists stating, “Clinicians ultimately hold the experience and knowledge to exercise the best judgement in the interests of our patients.” Only 41% felt the report changed their discussion about flossing. “I let them know some type of interdental cleaning is still important.” **Conclusion:** While initial reactions described low levels of confidence in the AP resources, the report enhanced discussions with clients. Dental hygienists are well suited to use their expertise and critical thinking skills to determine individualized oral care techniques for their clients.

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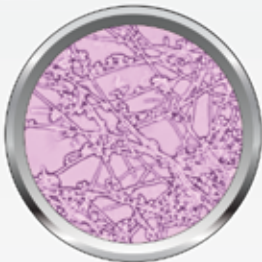
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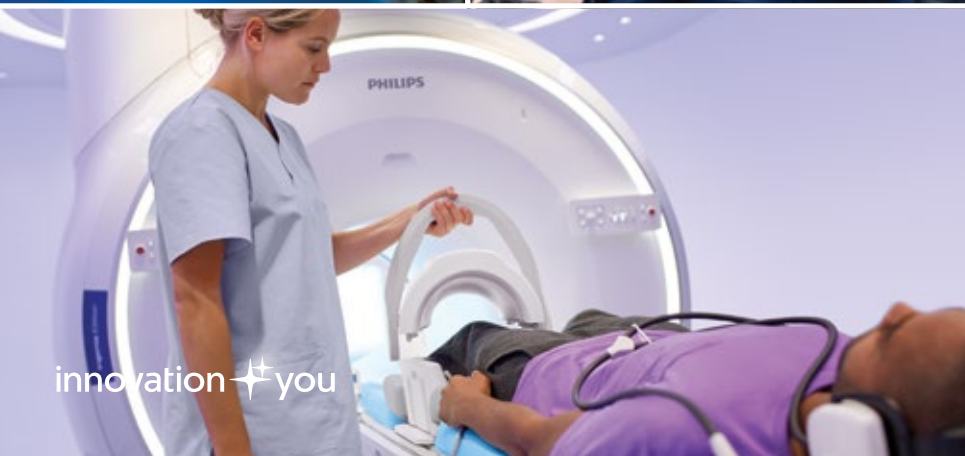
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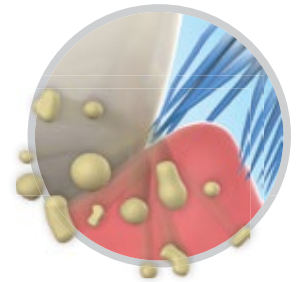
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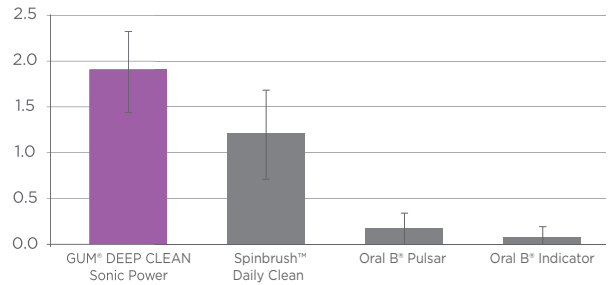
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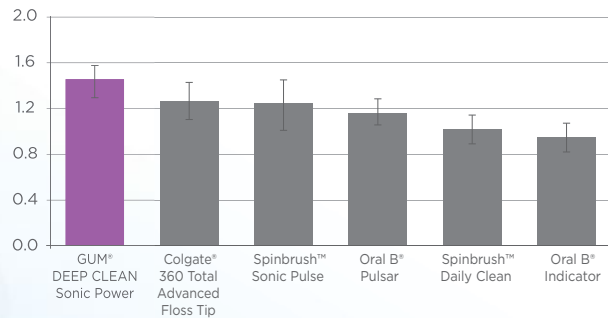
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