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OCTOBER 2018 · VOL. 52, NO. 3

**Language interpreters for immigrant clients
in a dental hygiene clinic**

Critical thinking in dental hygiene education

**Essential elements for the reintroduction of
dental therapy abilities in Canada**

**Silver diamine fluoride and its implications
for dental hygiene practice**

EDITORIAL

A new classification of periodontal diseases



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

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A new classification of periodontal diseases: A paradigm shift for all!

Salme E Lavigne*, PhD, RDH; Jane L Forrest[§], EdD, RDH

We were both privileged to attend the recent EuroPerio conference, the largest periodontal conference in the world, held in Amsterdam in June 2018. With over 10,000 attendees from around the globe, the conference high point was the presentation of the work undertaken by the 110 experts who participated in the World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, resulting in a new classification of these diseases that is important for all dental hygiene professionals. Given that the former classification was almost two decades old (1999), it was truly time for a change and to recognize new knowledge along with its implications.

The modifications to the classification system required an extensive review and interpretation of the scientific literature by experts in 4 separate working groups: periodontal health and gingival diseases and conditions; periodontitis; manifestations of systemic diseases and conditions; and peri-implant diseases and conditions. Once work began, it was recognized that “severity” was not simply the presence of plaque, as every client is not the same. Classifying disease based on plaque microbes was also found not to be viable given the recent Human Microbiome Project that has revealed the presence of over 1,000 oral microbes and has introduced the concept that symbiosis is destroyed when biofilm accumulates, creating a dysbiosis. Secondary descriptors such as extent, rate of progression, diagnostic biomarkers, and patient outcomes were also considered. However, once the working groups looked at the evidence, they agreed that the new system must first be designed to prevent overtreatment and thus they created “case definitions” for each of the periodontal and peri-implant diseases and conditions.



Salme E Lavigne



Jane L Forrest

One notable change to the classification system was prompted by the recognition that there is no evidence to justify the distinction between chronic and aggressive periodontitis as separate diseases. Both are now found under the single category of “periodontitis.” Additionally, the working groups added the category of “periodontal health,” which was not previously included. However, necrotizing diseases and periodontitis as a manifestation of systemic disease remain the same. Overall, the new classification is very different from the previous version as the periodontitis category is based on the oncology system of “staging” and “grading” of disease. Staging classifies both severity and extent of current tissue loss, including tooth loss due to periodontitis, while also incorporating the level of complexity in the long-term management of both function and esthetics. In contrast, grading incorporates 4 other biological dimensions: history-based periodontitis progression; risk for further periodontitis progression; anticipated inferior treatment outcomes; and risk that the disease or its treatment may have a negative impact on the general health of the client. This system is aligned with the principles of “personalized medicine” based on the multifactorial etiology, and is believed to optimize care and improve prognosis while being adaptable over time.

The presentation concluded with a 4-step practical approach to implementing the new classification for periodontitis¹:

Step 1: Prepare an initial overview of the case—based on full mouth radiographs, full mouth probing depths, and missing teeth to first categorize either mild to moderate periodontitis or severe/very severe periodontitis.

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Step 2: Determine Stage I, II, III, IV to establish case complexity—based on a consideration of maximum clinical attachment loss (CAL) or bone loss; confirmation of bone loss patterns (horizontal or vertical); and tooth loss due to periodontitis.

Step 3: Determine and refine the Grade (A, B or C)—based on history/risk of progression/age; risk factors; medical status and systemic inflammatory considerations; response to scaling and root planing and plaque control; and detailed assessments.

Step 4: Establish treatment plan—based on stage and grade, to fall under either standard treatment (mild to moderate periodontitis, stages I & II; grade A or B) or complex and/or multidisciplinary treatment (severe/very severe periodontitis, stages III & IV; grade B or C).

This editorial has hopefully provided some background on this new classification system. However, coverage of all the specific details is beyond the scope of this piece. We urge all of you to read the recently published article by Caton et al.² in its entirety as it offers a more detailed introduction to this new system. The updated classification incorporates 2 decades of contemporary research findings and will guide how inclusion criteria are defined for future periodontal and peri-implant research. As professionals in a dynamic and evidence-based discipline, dental hygienists should start using this new classification system as it will allow them to remain current in clinical practice and in how future practitioners are prepared in our education programs.

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CLARIFICATION

In my June 2018 editorial, “Quality assurance: A professional responsibility” (*Can J Dent Hyg*. 2018;52[2]:95–96), my opening paragraph suggested that dental hygienists in all Canadian provinces and territories are self regulated. This is, in fact, not the case. Dental hygienists in Prince Edward Island and the territories are still working towards professional self-regulation. I apologize for the lack of clarity in my wording, and I thank the attentive reader who brought this ambiguity to my attention. SL

ISSUE AT A GLANCE

We are pleased to feature 3 original research articles in this issue. **Heather Doucette and colleagues** explore the use of language interpreters in an immigrant dental hygiene clinic (pp. 167–73). **Helen Symons** examines student perceptions of their acquisition of critical thinking skills during their dental hygiene education (pp. 174–81). **Susanne Sunell and colleagues** identify and review the essential elements for the reintroduction of dental therapy abilities in Canada's health care system (pp. 182–91).

In addition, this issue includes a position paper and statement from the Canadian Dental Hygienists Association on the use of silver diamine fluoride in dental hygiene practice (**Julie Farmer et al.**, pp. 192–207) and the winning entry from our second annual CJDH Student Essay Award competition, written by **Alison Ashworth** (pp. 208–212). Finally, **Chandra Madsen** shares her review of *Community Oral Health Practice for the Dental Hygienist*, 4th edition (pp. 215–16).

PLAIN LANGUAGE ABSTRACTS

Doucette HJ, Haslam KS, Zelmer KC, Brillant MS. The use of language interpreters for immigrant clients in a dental hygiene clinic. *Can J Dent Hyg.* 2018;52(3):167–73.

This study explores the perceived benefits of using volunteer and professional language interpreters when working with clients with limited knowledge of English. Twenty-six dental hygiene students, 9 faculty, and 35 interpreters at a dental hygiene clinic in Nova Scotia, Canada, responded to a survey about their experiences. Most students and faculty preferred to use volunteer language interpreters with dental training rather than professional interpreters without dental knowledge, because the volunteer interpreters were more helpful with the medical history and in explaining treatment options to the clients. A majority of students and faculty also said that they would not feel comfortable treating a client with limited knowledge of English without a language interpreter. Students, faculty, and interpreters alike agreed that the presence of an interpreter facilitated culturally competent care.

Symons HM. Critical thinking in dental hygiene education: Examining student perception. *Can J Dent Hyg.* 2018;52(3):174–81.

This study offers insight into how students develop critical thinking skills as adult learners in higher education and, more specifically, in a dental hygiene program. Data were gathered through a focus group session and individual interviews with 7 recent graduates of a community college-based program in Ontario, Canada. Participants noted that their critical thinking began after acquiring a base knowledge in dental hygiene theory. Small group work, discussion, and case-based learning in a clinical setting were all identified as valuable and effective in nurturing critical thinking among students.

Sunell S, Wright AE, Udahl BK, Benbow P. Essential elements for the reintroduction of dental therapy abilities in Canada. *Can J Dent Hyg.* 2018;52(3):182–91.

Since the closure of Canada's dental therapy diploma program in 2011, there have been discussions at the national and provincial levels about reintroducing dental therapy abilities into postsecondary oral health education. The authors of this study interviewed 53 key informants from Canadian underserved populations, governments, educational institutions, and regulatory bodies, and found unanimous support for the re-establishment of dental therapy abilities in Canada. The interviews also revealed essential elements for the viability and sustainability of any educational model. These elements include workforce delivery and remuneration models, supportive regulatory parameters, employment opportunities for graduates, sustainable oral health programs for underserved groups, and the collaborative resolution of policy contradictions and professional conflicts.

The keyword and author index to volume 52 (2018) begins on page 220.

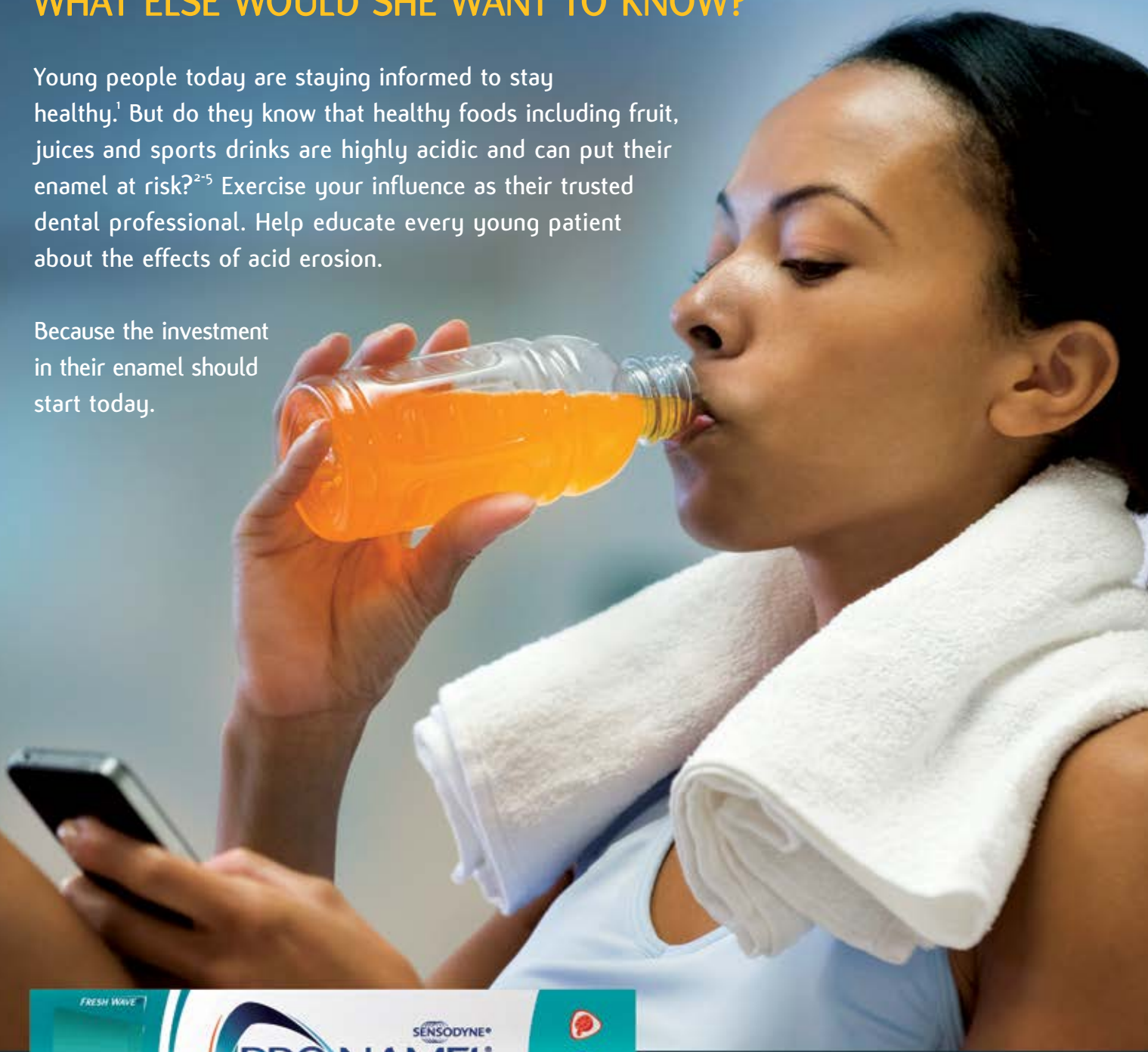


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1. GSK data on file, 2013. 2. Lussi A. Erosive tooth wear – a multifactorial condition. In: Lussi A, editor. Dental Erosion – from Diagnosis to Therapy. Karger, Basel, 2006. 3. Lussi A. *Eur J Oral Sci*. 1996;104:191–198. 4. Hara AT, et al. *Caries Research*. 2009;43:57–63. 5. Lussi A, et al. *Caries Research*. 2004;38(suppl 1):34–44.

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The use of language interpreters for immigrant clients in a dental hygiene clinic

Heather J Doucette*, DipDH, BSc, MEd; Kim S Haslam*, DipDH, BA, MEd; Kellie C Zelmer[§], BSc, MSc; Martha Smith Brillant[†], PhD

ABSTRACT

Background: This study evaluated the perceived benefits of using professional and volunteer language interpreters with diverse health care backgrounds in an immigrant dental hygiene clinic where the majority of clients have limited English proficiency.

Methods: An original survey was distributed to dental hygiene students (N = 26), faculty (N = 9), and interpreters (N = 35) involved in the immigrant clinic between September 2016 and April 2017. Closed-ended questions were summarized using descriptive statistics. Open-ended questions were examined for common themes.

This project was approved by the Research Ethics Board (REB # 2016-4076). **Results:** Response rates were as follows: dental hygiene students (84.6%), faculty supervisors (77.8%), professional interpreters (100%), and volunteer interpreters (24.2%). All faculty (100%) and 95% of students reported working with interpreters, all of whom had backgrounds in health care; 84.6% of faculty and 71.4% of students preferred to collaborate with untrained volunteer interpreters, specifically, those who were dental students. Both untrained volunteer and professional interpreters felt they aided in the treatment of clients in a culturally competent manner and their assistance was an overall benefit to both the student and client. Faculty (85.7%) and students (66.7%) reported they would not feel comfortable treating an immigrant client with limited English proficiency without an interpreter. **Conclusions:** This study revealed that interpreters with various health care backgrounds are useful in an immigrant dental hygiene clinic. The untrained volunteer interpreters with dental backgrounds were preferred over professionally trained interpreters.

RÉSUMÉ

Contexte : La présente étude examine les avantages perçus de l'utilisation d'interprètes professionnels et bénévoles, dotés de formations variées en soins de santé, dans un cabinet d'hygiène dentaire destiné aux immigrants où la majorité des clients ont une maîtrise limitée de l'anglais.

Méthodologie : Un sondage original a été distribué aux étudiants en hygiène dentaire (N = 26), au corps professoral (N = 9) et aux interprètes (N = 35) qui étaient des participants dans le cabinet pour les immigrants entre septembre 2016 et avril 2017. Des questions fermées ont été résumées au moyen de statistiques descriptives. Des questions ouvertes ont été examinées pour trouver des thèmes communs. Ce projet avait été approuvé par le Comité d'éthique de la recherche (CER # 2016-4076). **Résultats :** Les taux de réponse étaient comme suit : étudiants en hygiène dentaire (84,6 %), superviseurs du corps professoral (77,8 %), interprètes professionnels (100 %) et interprètes bénévoles (24,2 %). L'ensemble du corps professoral et 95 % des étudiants ont collaboré avec des interprètes ayant une formation en soins de la santé; 84,6 % et 71,4 %, respectivement, préféraient collaborer avec l'interprète bénévole non formé, en particulier ceux qui étaient des étudiants en dentisterie. Les bénévoles non formés et les interprètes professionnels ont tous deux pensé qu'ils ont aidé au traitement des clients de façon culturellement compétente et que leur aide était, dans l'ensemble, un avantage tant pour l'étudiant que pour le client. Le corps professoral (85,7 %) et les étudiants (66,7 %) ont signalé qu'ils ne se sentiraient pas à l'aise de traiter un client immigrant ayant une connaissance limitée de l'anglais, sans un interprète. **Conclusions :** Cette étude a révélé que les interprètes dotés d'antécédents variés en soins de santé étaient utiles dans un cabinet d'hygiène dentaire destiné aux immigrants. Les interprètes bénévoles non formés ayant de l'expérience en dentisterie étaient privilégiés par rapport aux interprètes dotés d'une formation professionnelle.

Key words: access to care, at risk population, barriers to care, culturally competent, dental hygiene, immigrant, oral health, refugees

CDHA Research Agenda category: access to care and unmet needs

WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Newcomers to Canada face many barriers to oral health care, including language.
- Dental hygiene students who have an opportunity to work with language interpreters in a clinic setting may develop a better appreciation of such barriers to care.
- This experiential learning may also increase cultural competence and instill a sense of professional responsibility to help underserved populations.

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INTRODUCTION

The population of Canada is increasingly multicultural.¹ Canada accepted 271,845 new immigrants in 2016, with plans to increase this number to 320,000 in 2017.² Recently, the Syrian crisis and Canada's commitment to resettlement resulted in 33,723 Syrian refugees arriving in Canada between November 2015 and November 2016.³ Refugees to Nova Scotia have access to dental care coverage under the Interim Federal Health Program. However, the dental services covered under this program are limited to the emergency relief of pain and infection. Routine dental care and preventive services are not covered.⁴ There is very limited literature on the oral health status of new immigrants to Canada. A 2014 study found rates of oral disease of both recent immigrants and refugees to Nova Scotia to be higher than the Canadian average.⁵

There are many barriers to receiving health care, including oral health care, for immigrants to Canada. Among them are accessibility, socioeconomic factors, and cultural differences, including language.^{6,7} Language, in particular, is one of the most frequently reported barriers by both recent immigrants and health care providers.^{7,8} In 2016, 13.3% of Canadians reported primarily speaking a language other than English or French.⁸ In a scoping review of immigrant barriers to accessing health care in Canada, Kalich et al. recommended that further study of the recognized barriers to care be conducted with a focus on expanding the knowledge base of health care providers and proposing possible solutions.⁷

Enhancing the cultural competence of health care providers is a step towards addressing many of the barriers to care faced by recent immigrants to Canada. Cultural competence, as it relates to health care, is the acquisition of skills and knowledge that promote effective and appropriate communication with clients from diverse cultures. It also includes an understanding of the barriers to care that exist and why those barriers are present. This understanding should then lead to a belief system based on the equitable delivery of care to underserved populations.⁹

It is widely accepted that health outcomes are more favourable when clients with limited English proficiency (LEP) receive care in their own language.¹⁰⁻¹⁴ However, the challenge of locating a health care professional who speaks the same language as an LEP client is often insurmountable. Although health care professionals are encouraged to enlist the assistance of interpreters when communicating with an LEP client, professional interpreters are underutilized.¹⁵ This may be partially attributed to the lack of experience many health professionals have in working with an interpreter.¹² To overcome this barrier, it has been suggested that health profession programs should include the use of interpreters as an experiential component of their curricula.^{11-13,16} The experience of working with an interpreter during their education may prompt more health professionals to enlist the assistance of an interpreter when treating LEP clients in the future.¹²

While there are many studies on the use of interpreters in primary health care settings, there is very little literature on the use of interpreters in the dental care setting. Despite the inclusion of cultural competency as a component of the Canadian national competencies for both dentistry and dental hygiene, the authors could not find any studies on the use of interpreters in dental or dental hygiene schools in Canada. In the United States, only 61.9% of dental schools indicated that their graduates were prepared to treat LEP clients upon graduation.¹¹

While there is a body of research that supports the use of professionally trained interpreters over ad hoc or untrained volunteer interpreters,^{10-14,16-18} these terms are not clearly defined. Ad hoc or untrained interpreters could be family members, friends, office staff in the health care setting or the health professional providing treatment.^{15,19} Although professional interpreters in the health care setting have medical interpretation training they may not be familiar enough with dental-related terminology to effectively communicate the information required for a client to make a fully informed decision regarding dental treatment.²⁰

The Dalhousie University Faculty of Dentistry in Nova Scotia, Canada, began an initiative in 2012 to provide dental hygiene care to recent immigrants who were clients of the Immigrant Services Association of Nova Scotia (ISANS). Most ISANS clients have limited English proficiency. As part of the initiative, ISANS provided professionally trained interpreters to facilitate communication between the clients and the students performing oral hygiene treatment. While the professional interpreters provided by ISANS had a health care background obtained in their country of origin, they no longer practised in their respective fields in Canada and had not received interpretation training specific to medical terminology.

The number of professional interpreters provided by ISANS was limited, and concerns were expressed by students and supervising faculty that the ISANS-provided interpreters may not have enough knowledge of health and dental terminology to accurately obtain a medical history and explain treatment.

The population at Dalhousie University is diverse and includes many students and faculty who speak languages in addition to English. For these reasons, it was decided to enlist the assistance of dental and other health profession students and faculty who spoke the same languages as the clients to help with interpretation.

The purpose of this study was to explore the perceived benefits of volunteer and professional language interpreters in a dental hygiene clinic for immigrant clients.

METHODS

The study received approval from the Health Sciences Research Ethics Board (REB # 2016-4076) at Dalhousie University.

The study involved a cross-sectional branching survey developed specifically for this study using Opinio survey software. The survey consisted of questions specific

to each subgroup of participants (students, faculty, interpreters). The questions were primarily closed-ended with the exception of 2 open-ended questions (Tables 1 and 2). Participants were recruited via email invitation, which included a link to the online survey. The invitation was distributed to all dental hygiene students (N = 26), faculty (N = 9), professionally trained interpreters (N = 2) and volunteer interpreters (N = 33) who participated in the Dalhousie immigrant dental hygiene clinic between September 2016 and April 2017.

Data were exported from Opinio to Statistical Package for the Social Sciences (SPSS) software to generate descriptive statistics. Open-ended questions were examined by an experienced research assistant for common themes to gain more insight into the quantitative analyses.

RESULTS

The response rates for each invited group of participants were 84.6% (n = 22) of dental hygiene students, 77.8% (n = 7) of faculty supervisors, 100% (n = 2) of professional interpreters, and 24.2% (n = 8) of volunteer interpreters.

Students and faculty

All faculty respondents reported having supervised students using both professional interpreters and volunteer interpreters throughout their time in the immigrant dental hygiene clinic. Almost all (95.5%) of the dental hygiene student respondents had used an interpreter. Most of these (61.9%) had worked with both professional and volunteer interpreters; 38.1% had only worked with volunteer interpreters. Most of the faculty (71.4%) and student (84.6%) respondents reported that they preferred

Table 1. Percent frequencies of the responses obtained from the dental hygiene students and faculty

Question	Response	Frequency (%)	
		Students (n = 22)	Faculty (n = 7)
Did an interpreter assist in communicating with the ISANS client?	Yes	95.5	-
	No	4.5	-
Did you supervise a student who had an interpreter assist in communicating with an ISANS client?	Yes	-	100
	No	-	-
Was the interpretation provided by:	A professional interpreter		
	Volunteer interpreter	38.1	
	Both	61.9	100
	Unsure		
If both, which interpreter did you feel was more helpful?	A professional interpreter		
	Volunteer interpreter	84.6	71.4
	No difference	15.4	28.6
Would it be helpful for the interpreter to have health care knowledge?	Yes	100	66.7
	No		33.3
With what aspects of the appointment was the interpreter helpful?	Reviewing medical history	23.8	28.6
	Explaining treatment options	23.8	
	Client education		
	Local anesthetic	38.1	28.6
	Post-treatment instruction		
	Arranging subsequent appointments		
	Not helpful		
Were there any obstacles to having an interpreter during the appointment?	Other	14.3	42.9
	Yes	28.6	14.3
	No	71.4	85.7
	Yes	90.5	100
Do you feel that the interpreters helped in ensuring that the ISANS clients were treated in a culturally respectful manner?	No	4.8	
	Unsure	4.8	
	Yes		
Would you be comfortable treating an ISANS client without an interpreter?	Yes	33.3	14.3
	No	66.7	85.7

Table 2. Percent frequencies of the responses obtained from the volunteer and professional interpreters

Question	Response	Frequency (%)	
		Volunteer (n = 8)	Professional (n = 2)
Are you employed as an interpreter?	Yes		100
	No	100	
If yes, for how long?	Less than 5 years		50
	5 to 10 years		50
Are you professionally educated as an interpreter?	Yes		100
	No	100	
Do you have any formal health care education?	Yes	87.5	100
	No	12.5	
If yes, was your health care education helpful in your role as an interpreter in the ISANS clinic?	Yes	85.7	100
	No	14.3	
	Unsure		
If no, would it have been helpful?	Yes		
	No	100	
Have you ever interpreted for medical/dental procedures prior to this experience?	Yes	25	100
	No	75	
What aspects of care do you feel you were most helpful with?	Reviewing medical history	25	50
	Explaining treatment options	12.5	
	Client education	25	
	Local anesthetic	12.5	
	Post-treatment instruction	12.5	
	Arranging subsequent appointments		
	Answering client's general comments		
	Not helpful		
	Other	12.5	50
Do you feel that the dental hygiene students treated the clients in a culturally competent manner?	Yes	100	100
	No		
	Unsure		
Do you feel that your assistance was an overall benefit to the dental hygiene student?	Yes	100	100
	No		
	Unsure		
Do you feel that your assistance was an overall benefit to the client?	Yes	100	100
	No		
	Unsure		

to collaborate with the volunteer interpreters. The explanations provided for this choice were as follows: volunteer interpreters were more readily available, as they outnumbered the professional interpreters; some volunteer interpreters spoke languages common to the clients that the professional interpreters did not speak; and many of the volunteer interpreters were dentistry students. The remaining respondents (28.6% faculty and 15.4% of the students) did not have a preference for one type of interpreter over the other.

All students (100%) and 66.7% of faculty felt that it would have been useful to have an interpreter with a health care background, particularly a dental background. Reasons given for this were facilitating communication to allow for informed consent and to reduce client anxiety. The 33.3% of faculty who felt that having a health care background would not be useful explained that the interpreter should only translate what is being said between the care provider and client, and that “The student or faculty can always try re-phrasing” if the interpreter did not understand.

Students and faculty reported that interpreters were most useful for reviewing medical history, explaining treatment options, and explaining procedures involving local anesthetic. Some respondents (14.3% of dental hygiene students and 42.9% of faculty) felt that the interpreters were helpful with all aspects of the appointment.

A minority of respondents reported obstacles to having interpreters present at the appointment. Dental hygiene students identified a lack of interpreters and small variety of languages spoken by professional interpreters as obstacles that increased the length of appointments. The obstacles identified by faculty were the space constraints within a cubicle and interpreters who took up time speaking to the client about unrelated topics.

All faculty (100%) and 90.5% of dental hygiene students responded that having either type of interpreter helped to ensure that the clients were treated in a culturally respectful manner.

When asked if they would feel comfortable treating or supervising a student who was treating an LEP client without an interpreter, 66.7% of dental hygiene students and 85.7% of faculty responded no. The dental hygiene students explained that they would not have confidence in their ability to obtain informed consent or the correct medical history from an LEP client, would have difficulties communicating treatment options and the steps of procedures, and would have difficulties reducing the anxiety that many clients experience during their first dental visit. Of the 33.3% of students who responded that they would feel comfortable treating an LEP client without an interpreter, 50% qualified their response by stating that this depended on the English proficiency of the client and whether the student was confident the medical history and informed consent were already accurate and complete.

Interpreters

Both professional interpreters and most (87.5%) of the volunteer interpreters reported having formal health care education in areas such as nursing, optometry, pharmacy, pediatrics, and dentistry. All of them felt that this background was helpful in their role as an interpreter in the immigrant dental hygiene clinic, particularly in regard to health terminology when completing the client's medical history.

Both professional interpreters and 25% of the volunteer interpreters had previous experience interpreting medical or dental procedures. Volunteer interpreters felt they were most helpful in reviewing medical histories, explaining treatment options, providing client education, explaining local anesthetic, and reviewing post-treatment management. The professional interpreters felt most helpful in reviewing the medical history and educating the client on the use of dental supplies provided during the clinic.

Both professional and volunteer interpreters felt that the dental hygiene students treated the clients in a culturally competent manner.

All the interpreters felt that their assistance was an overall benefit to both the dental hygiene student and the client. Specifically, they felt their assistance helped to ease communication to obtain informed consent, provide a comfortable and culturally conscious environment, answer client questions, and deliver clear instructions.

Suggestions to improve the immigrant dental hygiene clinic

Respondents were asked for suggestions on how to improve the immigrant dental hygiene clinics. Faculty and student suggestions included adding more interpreters (particularly those with a dental background), increasing the number of faculty supervisors, emphasizing the importance to clients of arriving to their appointments on time, and providing an orientation session on the clinic and what to expect to all the individuals involved.

The volunteer interpreters suggested having an information session on how to properly interpret in the clinical setting and having more interpreters who could speak Swahili in particular, as the number of interpreters for that language was very limited.

The professional interpreters suggested that students be advised on how to properly communicate through an interpreter; that is, to speak directly to the client rather than to the interpreter. They also suggested that the students try to complete the treatment in as few appointments as possible as it was difficult to arrange to have the clients return multiple times.

DISCUSSION

While there is a significant amount of literature on the use of language interpreters in primary health care settings, there has been little research on the use of language interpreters in a dental or dental hygiene setting, and even less on the use of language interpreters in the educational context for these professions. The purpose of this study was to examine the perceived benefits of having volunteer untrained language interpreters and professionally trained language interpreters in a dental hygiene clinic where dental hygiene students treat immigrants with limited English proficiency.

The use, and lack of use, of language interpreters for LEP clients in primary health care and dental settings is a complex issue. There are a multitude of studies that support the use of trained professional interpreters over ad hoc or voluntary interpreters.^{8,14,19,21,22} However, the terms "professional," "ad hoc," and "voluntary" are not clearly defined. Ad hoc or voluntary language interpreters could be defined as family, friends or people unacquainted with the client but who speak a language in common with the client.^{15,17,23} The professional interpreters in this study were not trained specifically in medical interpretation. The volunteer language interpreters in this study were students who self-identified as having a primary language in common with the client. These students did not have any interpretation training but were fully fluent in the

language for which they interpreted. Arabic, Swahili, and Nepalese were the 3 primary languages of the clients who required the use of a language interpreter. The interpreters were required at various times during the appointment but were most commonly required at the beginning of the appointment to review the medical history, prior to the commencement of treatment to explain treatment and receive consent, and post-treatment when instruction for home care was provided.

The researchers could not find any studies that examined the use of dental students and health profession students as volunteer language interpreters in a dental hygiene clinic in an educational setting.

The results of this study indicate that the majority of students treating LEP clients, and the faculty supervising the students, preferred to have volunteer language interpreters with dental training but without professional interpreter training over those with professional interpretation training but no dental knowledge. The reasons given were that the dental students who volunteered as interpreters were helpful with the medical history, the explanation of treatment options, and the explanation of the use of local anesthetic. For many of the clients, this was the first time they had received dental care, thus being able to properly communicate allowed clients to express their concerns and allowed dental hygiene students to inform them of what to expect during procedures, specifically in regard to normal sensations when receiving local anesthetic. The ability of the volunteer interpreters to convey detailed clinical information contrasted with the professionally trained language interpreters provided by ISANS who did not have a dental background and therefore lacked dental terminology.

With the increase in immigrants to Canada, many of whom are of LEP, there is an increased need for health professionals to provide care in the language of the client, which may be different from their own. However, there is evidence that health professionals do not consistently utilize language interpreters when treating an LEP client.¹⁴ To address this situation, it has been suggested that health profession programs include more experiential learning for students in the treatment of clients from different cultures^{11,24-27} and, more specifically, the use of interpreters when treating LEP clients.^{12,13,16,23,28} After having the opportunity to treat LEP clients with the assistance of a language interpreter, the majority of the students in the study indicated that they would not feel comfortable treating an LEP client without a language interpreter; the

majority of faculty supervising the students would not feel comfortable supervising the treatment of an LEP client without an interpreter.

Cultural competence of health care professionals is central to removing barriers to care for underserved populations. The majority of the students and faculty surveyed felt that the presence of an interpreter, volunteer untrained or professionally trained, was helpful in ensuring the clients were treated in a culturally competent manner. This perception was confirmed by the interpreters who reported that the students demonstrated culturally competent care.

The low response rate of the volunteer interpreters (24.2%) is a limitation of the study. This low response rate may be due in part to the fact that many of the volunteer interpreters graduated and may not have had access to the university email account used for the survey invitation. The small population of professional interpreters (N = 2) eligible for the study is also a limitation. It is important to note that the professionally trained language interpreters in this study did not have medically specific interpretation training. Therefore, the findings of this study cannot be applied to other health care settings where the language interpreters are trained in medical interpretation.

CONCLUSION

This study helps to provide insight into students' experience of working with language interpreters in a dental hygiene clinic. Eliminating barriers to oral care for underserved populations is multifaceted and requires an exploration of possibilities. Introducing students to experiential learning and involvement with these populations may provide the students with a better appreciation of the barriers and the need to address them.

For future research, the authors would like to examine if there is a perceived increase in cultural competence of students after being involved in these clinics. Gaining insight into the experience of the LEP clients at the dental hygiene clinics may also help to identify barriers to care that still exist and ways to minimize these.

CONFLICTS OF INTEREST

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

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Critical thinking in dental hygiene education: Examining student perception

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ABSTRACT

Background: Critical thinking is a high-level cognitive function desired in graduates of higher education, including professional education programs such as dental hygiene. Research has examined best practices in nurturing critical thinking in adult education and professional education. Yet research specific to critical thinking in dental hygiene education is limited, let alone research that aligns dental hygiene educational strategies with the development of critical thinking. **Methods:** This exploratory qualitative study is designed to deepen understanding of dental hygiene students' perceptions and experiences of acquiring critical thinking skills during their professional education. Data were gathered during a focus group session followed by individual interviews of 7 recent graduates of a community college-based dental hygiene program in Ontario, Canada. Inductive data analysis was performed using an interpretive perspective. **Results:** Participants indicated their critical thinking began with acquiring base knowledge of theory related to the field of dental hygiene followed by the development of a thought process using case scenarios with small group work and discussion. The clinical setting was noted as a real and challenging environment in which to apply critical thinking. Participants valued being offered a variety of activities aimed at developing their critical thinking. **Conclusion:** Many of the findings of this exploratory study align with research on developing critical thinking in adult education and professional education. This qualitative study provides beneficial preliminary information about how dental hygiene students develop critical thinking.

RÉSUMÉ

Contexte : La pensée critique est une fonction cognitive de haut niveau recherchée par les diplômés d'études supérieures comprenant les programmes de formation professionnelle tels que l'hygiène dentaire. Plusieurs études ont porté sur les pratiques exemplaires pour soutenir la pensée critique dans les programmes de formation adulte et professionnelle. Cependant, la recherche orientée vers la pensée critique dans la formation en hygiène dentaire est limitée et il y a encore moins de recherches qui alignent les stratégies de formation en hygiène dentaire avec le développement de la pensée critique. **Méthodologie :** Cette étude qualitative est conçue pour approfondir la compréhension des perceptions et des expériences d'acquisition de compétences en pensée critique des étudiants en hygiène dentaire pendant leur formation professionnelle. Les données ont été recueillies lors d'une séance en groupe de discussion suivie par des entrevues individuelles de 7 diplômés d'un programme d'hygiène dentaire d'un collège communautaire en Ontario, Canada. L'analyse inductive des données a été effectuée sous l'angle de l'interprétation. **Résultats :** Les participants ont signalé que leur pensée critique a commencé en acquérant des connaissances de base sur la théorie liée au domaine de l'hygiène dentaire, suivie par le développement d'un processus de pensée au moyen de scénarios de cas jumelés à du travail en petit groupe et des discussions. Le milieu clinique était noté comme étant un environnement réel et difficile, dans lequel il faut appliquer la pensée critique. Les participants ont apprécié l'offre d'une variété d'activités visant à développer leur pensée critique. **Conclusion :** Plusieurs conclusions tirées de cette étude exploratoire s'alignent avec la recherche sur le développement de la pensée critique en éducation des adultes et des professionnels. Cette étude qualitative fournit de précieux renseignements préliminaires sur la façon dont les étudiants en hygiène dentaire peuvent développer la pensée critique.

Key words: critical thinking, dental hygiene, professional education

CDHA Research Agenda category: capacity building of the profession

INTRODUCTION

The literature on dental hygiene and critical thinking (CT) demonstrates that critical thinking is a desired outcome in the professional education of dental hygienists.^{1,2} In Canada, this fact is supported by the documentation and regulations in the field of dental hygiene education with respect to CT, specifically from the Commission on Dental Accreditation of Canada³ and the National Dental Hygiene Certification Board.⁴ In addition, the *Entry-to-practice competencies and standards for Canadian dental hygienists* includes “critical thinker” as a core ability, along

with others such as “advocate,” “communicator,” and “collaborator.”⁵ These standards combined with research on the topic^{1,6} suggest that entry-level CT is being developed to some degree in dental hygiene students through their formal professional education.

The complex nature of CT makes researching and reaching a consensus on most aspects of it difficult.^{7,8} This challenge includes arriving at a definition of CT. Bassham et al. define CT from a philosophical perspective:

WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Critical thinking is one of the core competencies of dental hygienists.
- This article focuses on one model for developing critical thinking in a dental hygiene education program.
- The findings of this study could help dental hygiene educators enhance the critical thinking components of their curricula.

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[C]ritical thinking is the general term given to a wide range of cognitive skills and intellectual dispositions needed to effectively identify, analyze, and evaluate arguments and truth claims; to discover and overcome personal prejudice and biases; to formulate and present convincing reason in support of conclusions; and to make reasonable, intelligent decisions about what to believe and what to do.^{9,p1}

From an adult education perspective, Brookfield's¹⁰ thoughts on critical thinking fit with this definition, although he refers to the term "assumptions" that require introspective appreciation and consideration to ultimately take "informed action."

Facione, using a Delphi committee approach, arrived at a lengthy, discipline-neutral consensus statement about CT that identified 6 cognitive skills of critical thinking: interpretation, analysis, evaluation, inference, explanation, and self-regulation.¹¹ One novel aspect of this consensus statement is the suggestion that the ideal critical thinker possesses 19 affective dispositions, some of which include routinely inquisitive, unbiased, confident, and systematic in complex deliberations.¹¹ This comprehensive definition of CT is long-standing and well accepted in the literature.^{5,12,13}

Research on the general topic of dental hygiene education is emerging; research specific to CT in dental hygiene education is limited, let alone research that aligns dental hygiene educational strategies with the development of CT. Therefore, the purpose of this preliminary study is to add to the information in this area by asking a core research question: According to dental hygiene graduates, which specific activities nurture the development of critical thinking in the professional education of dental hygiene students?

The literature shows numerous methods of instructional design for enhancing CT.^{7,10,14,15} Each method has its own advantages and disadvantages, and no one method is deemed to be the best by researchers.^{10,15} This information supports secondary research questions including: Which teaching and learning methods were effective for the individual learner? Do the learning activities currently being offered align with those discussed in the literature as educational strategies for nurturing CT?

Study in this area is intended to enhance the dental hygiene program being investigated, and to stimulate discussion and research on CT in dental hygiene education more generally.

METHODOLOGY AND METHODS

This basic qualitative inquiry used an interpretive theoretical framework in order to construct meaning from the participants' experiences of developing CT during their dental hygiene education.¹⁶ To capture each participant's perceptions, a focus group was conducted followed by individual interviews, using a semistructured format for both.^{17,18} The focus group was intended to stimulate thought on this challenging topic, and subsequent individual interviews allowed for exploring certain subjects in greater depth as well as pursuing areas that were not originally anticipated in the focus group. This approach was chosen to encourage the flow of discussion

to a variety of experiences and to capture these experiences with sufficient depth. In the interviews, the term "paint a picture with your words" was used in order to encourage sufficient detail. The focus group and individual interview guides are found in Appendix 1.

Ethics approval was obtained from the research ethics boards (REB) at both St. Francis Xavier University, Antigonish, Nova Scotia, Canada, and Fanshawe College, London, Ontario, Canada. These REB approvals were adhered to with respect to all aspects of this research, including participant contact and consent as well as data collection and retention.

This study focuses on the strategies for nurturing CT in the dental hygiene program at Fanshawe College (London, Ontario) as perceived by students. Participants (N = 7) were from a recent graduating class (N = 31) of the dental hygiene program at the college where the principal researcher teaches. This methodology was chosen as it was deemed to best fit the type of data and rich detail desired to answer the questions posed, or to paint a picture of these participants' experiences. Purposeful sampling of recent graduates was used to form the focus group.¹⁹ They all had the shared experience of being a dental hygiene student in this program. All participants were employed as dental hygienists at the time of the interviews, either on a part-time or full-time basis. Table 1 outlines the participant demographics: they ranged in age from 23 to 31 years and all had completed at least 1 year of postsecondary education prior to completing their dental hygiene education. All participants were Caucasian and female. These characteristics reflect the general demographics of their dental hygiene class, which was young and female. Pseudonyms were used for these participants once data analysis began.

Thematic data analysis was conducted to identify categories, patterns, and themes with the intention of uncovering meaning to address the research questions.^{16,19} Data analysis was initiated immediately following the focus group but prior to the individual interviews to identify aspects that needed clarification and follow-up. An interpretive perspective was used to discover meaning from these graduates' experiences of developing CT during their education or to paint a picture of the process through their eyes, in order to ultimately compare this picture to the literature on CT in adult education. To further dissect the data, the more complex definition of critical thinking by Facione¹¹ was considered in reference to the research questions.

RESULTS

The focus groups and follow-up interviews began with a review of the definition of CT by Bassham et al.⁹ Participants were then asked: Do you think you learned CT while you were a dental hygiene student? Participants agreed that they had in fact learned CT while they were students. The remainder of the focus group session and interviews involved identifying examples of CT during their dental hygiene education followed by recognizing and analyzing the activities or exercises that led to this demonstration of CT.

Table 1. Demographics of research participants

Age	Marital status	Employment status (as a dental hygienist)	Postsecondary education (in addition to dental hygiene education)
28	single	part-time	Pre-health science certificate (1-year program)
23	single	part-time	Pre-health science certificate (1-year program)
31	married	full-time	Pre-health science certificate (1-year program)
23	single	part-time	Pre-health science certificate (1-year program)
23	single	part-time	Pre-health science certificate (1-year program)
23	single	part-time	Level I & II dental assisting certificate (1-year program)
23	single	part-time	Level I & II dental assisting certificate (1-year program) Completed 2 years of general arts and science program

Many specific topics and courses, such as client assessment and clinical practice, were identified by participants as playing a role in their journey to develop CT. When participants were asked how these courses or activities helped them to think critically, themes began to emerge. Three themes were identified: 1) strategies to nurture CT; 2) facilitators; and 3) barriers to CT. These themes are outlined in Table 2 along with subcategories for each theme. In keeping with qualitative research, the data were rich with the participants' own explanations and words. The participants were enthusiastic in their discussion and shared their thoughtful perceptions of this demanding topic. On many occasions, participants were challenged to articulate their thoughts on the topic, to isolate it from thinking and learning, and to delve more deeply into the question at hand.

Theme 1: Strategies to nurture critical thinking

The importance of base knowledge and developing a thought process for critical thinking

Participants indicated their CT began with acquiring base knowledge of dental hygiene theory, which was followed by developing a thought process. During both the focus group discussion and follow-up interviews, participants noted that they were exposed to different thought processes relating to CT during their dental hygiene education. The thought process entailed a logical sequence that was dependent on the situation. The thought process began simply, with easy or simplistic examples, and gradually became more complex. Through discussion in the focus group, participants concentrated on a process for reaching sound conclusions that was needed to think critically and was indeed developed during their education. In one exchange during the focus group, participants Jill and Sue described a CT thought process that involves the weighing of options as the definition by Bassham et al.¹¹ suggests but acknowledged that they needed to be open to considering options not initially obvious to them.

Critical thinking activities

The role of discussion and group work. Participants indicated that the emerging thought process for CT was

nurtured by using case scenarios with small group work and discussion. Beginning in the focus group, some participants stated that discussion was beneficial, almost necessary, in order to compare their own opinions to others. Dialogue could take place in a variety of ways, such as involving the entire class with facilitation by faculty or students, or it could be small group discussions involving students only.

Sue outlined one instance in the “process of care” course aimed at developing treatment planning skills; treatment plans had previously been mentioned by several participants as requiring CT. Sue explained that this course used scenarios that were initially discussed in small groups followed by a large group discussion facilitated by faculty. She observed that this approach

“really did [help] because everyone had different opinions on different topics and subjects. You were thinking one way, when someone else mentions something else that makes us change our thought pattern.”

Case scenarios. The discussions and small group work described by the participants often focused on case studies or case scenarios. Case scenarios could entail a description or assessment data of a client, including medical and dental information, as well as personal information, such as gender, age, occupation, and cultural background. In linking this to the thought process for CT, participants found their thought process in case scenarios was enhanced by using hands-on activities or approaches where students could gauge their path or choices in comparison to others.

Ethical dilemmas were discussed in the focus group by several participants including Sue, who summarized them as follows:

“[T]hey [ethical dilemmas] usually required a lot of CT I think, because people had so many different opinions about ethical dilemmas that it brought out a lot of information that I personally wouldn't have thought about.”

This statement suggests that Sue recognized her own opinion or assumption on the ethical dilemma and was receptive to changing it, which is an element of CT.

The clinical environment. The clinical setting was noted as a real and challenging environment in which to

Table 2. Emergent themes from student perceptions of developing critical thinking

Emergent theme	Subcategory
Nurturing critical thinking	The importance of base knowledge Developing a thought process for critical thinking Critical thinking activities: <ul style="list-style-type: none"> • the role of discussion and group work • case studies and case scenarios • critiquing studies • the clinical environment Awareness of the process
Facilitators of critical thinking	The role of confidence, emotions, time constraints, and being put on the spot Thinking outside the box Reflection
What didn't work? (barriers to critical thinking)	Value noted in all activities Activities that did not require the thought process for critical thinking

apply CT. According to participants, the nurturing of CT in the clinical environment involved many of the topics already outlined. In a sense, participants perceived clinic to be the ultimate and real case study that required CT to provide care. The process of gathering and interpreting data, identifying significant information and patterns, and ultimately reaching a sound clinical decision was reflected in many comments, such as Meg's from her follow-up interview:

"Some examples were definitely in class when we were doing different examples of the periodontal assessment or using the instruments. It gave us like a base knowledge and then using that we could bring it into clinic and really uses our CT skills to analyze and interpret different data for different specific clients."

In her description, Meg was referring to the comprehensive data collection in clinic that required CT to decipher for the next steps in the process of care, such as diagnosis and treatment planning. Participants commented specifically that their experiences in the clinical environment increased confidence in their ability to think critically.

Participants acknowledged the role of clinical teachers in guiding and modeling CT. Teachers were a source of options in their decision making, and of feedback and guidance in the students' CT process as captured by the following collection of comments:

"helps you to think of other options"
"to have a different opinion"
"[the clinical teacher] gives you constructive criticism. Not just always spoon feeding you or telling you what you should do, but challenging you to think."

Participants valued being guided through problem solving and CT in the clinical environment by these teachers, and not being fed the answers. The focus group chuckled at this realization, as the graduates acknowledged that they typically did not feel that way at the time.

Theme 2: Facilitators of critical thinking

Several additional aspects were threaded through the participants' discussions about how CT was developed during their dental hygiene education.

The role of confidence, emotions, and time constraints

This unexpected group of influences was somewhat intertwined and proved challenging for participants to explain in terms of the specific impact on CT.

The role of confidence was a theme in developing CT from the focus group. Participants identified a need for confidence in their base knowledge as well as in their ability to critically think in order to actually think critically. A lack of confidence would affect their thought process. During her individual interview, Meg provided her interpretation:

"I think if you're not confident, you're not going to be able to think of all the different options you have. So if you're not confident, you're probably a little bit nervous and shy and you're not really thinking outside the box. If you're only thinking one specific solution and I think, if you're confident, then you can be a little more like, okay what about this? And it just opens your senses a little bit more to different options."

Emotional state or current state of mind could be a barrier to CT for some participants. Some examples of these emotions were frustration, anxiety, and the need to keep calm. Kim first alluded to this in the focus group when she commented:

"I found in clinic when you were working on a patient, and you're doing something where you're getting frustrated and you're getting yourself worked up and therefore you're not really thinking the way you should be."

During the focus group, participants mentioned CT with a time constraint, such as with a time-limited in-

class activity, or during a clinical session when tasks needed to be done in reasonable time frames. Upon further examination, participants commented that they needed to review the situation afterwards to self-assess their use of CT skills because of the time constraint and their thinking in action. This process had similarities to the term “evaluation” in the definitions of CT. Opal thought it helped her to reflect:

“You always reflect back. After the situation, you reflect back and see; you assess what your behaviour [was] or whatever you did, you try to think about it again and self-reflect, self-assess to make sure that what you did, [or] a decision you made, was the best decision or not. Or could you improve on it next time if you were put in that situation or [a] position like that again?”

Thinking outside the box

Thinking outside the box was mentioned during the focus group in reference to CT. When asked to explain what this meant, participants commented:

“It’s not just one answer, so you assess more possibilities”
“it gives you more avenues to solve a problem or deal with a different situation.”

In linking their comments to the definition of CT these graduates found thinking outside the box ensured that all possibilities were considered when thinking critically, which requires an expansion of thought that could include base knowledge and perspective. Another interpretation referred to being open to options or different opinions during the CT process. As well, Meg provided a hint that she was using her CT beyond the walls of her formal education when she commented about “thinking outside of school,” which is desired in adult education. Although their wording differs from the formal definition of CT, these graduates seem to have captured much of its essence.

Reflection

“Thinking back” was a term commonly used in the focus group when discussing the previous topics related to CT. For example, one participant commented:

“[M]aybe if you think back to what you did, you think, oh, maybe I should change how I do something or maybe you realize . . .”

Opal previously mentioned the use of reflection when determining whether her decisions were good ones. During the focus group, Lynn also referred to reflection:

“[W]e learn from mistakes as long as you’re open minded . . . you can learn from your mistakes if you’re able to self-reflect on them and realize you made a mistake or could have done something different.”

Theme 3: Barriers to critical thinking, or what didn't work?

Participants were asked which of the activities were the least helpful in nurturing their CT. The focus group felt the least useful approaches were working in large groups and being fed the answers to questions, as they did not result in active participation in the thought process needed for CT. Jill explained:

“[S]omething that didn’t work was when someone just told you the answer because it never pushed you to think for yourself or to look for the information to have the knowledge to critically think.”

DISCUSSION

Many of the findings of this exploratory study align with research on developing CT in adult education and professional education. Participants identified acquiring baseline knowledge in order to think critically in dental hygiene as their first step, which is supported by Brookfield, who acknowledges that discipline-specific knowledge is required in order to think critically within different fields.¹⁰ Graduates then described the need to develop a thought process for CT that included being exposed to diverse ways of thinking and to options that they might not have considered originally. This description aligns with research on CT^{7,10,20} and specifically with the definition of CT provided by Bassham et al. who describe a process designed “to effectively identify, analyze, and evaluate arguments and truth claims . . . to formulate and present convincing reason in support of conclusions; and to make reasonable, intelligent decisions about what to believe and what to do.”^{9, p1} Furthermore, these participants felt dialogue in small groups enabled them to develop the skills and thought process needed to accomplish elements of Bassham’s definition, including the necessity to have a wide range of cognitive and intellectual dispositions.⁹

Participants readily acknowledged the use of case scenarios or real-world situations to develop CT, which is supported in the literature.^{10,21} Case scenarios are useful for weighing opinions and recognizing the process of reasonable and intelligent student decision making.⁹ In order to fully realize the process, students should be coached through CT by the instructor.²⁰

Aspects of the thought process described by these participants resemble a number of strategies mentioned in the literature on developing CT. These strategies include concept mapping^{22,23}, problem-based learning²⁴, active learning and the flipped classroom²⁵, cooperative learning¹⁴, case based learning¹⁵, and cognitive apprenticeship which parallels modeling CT²⁰. The literature can be confusing and contradictory on the value and use of these elements as overt steps in developing CT.^{9,15,26}

Further parallels with adult education and how critical thinking is learned, as outlined by Brookfield,¹⁰ are evident. The findings of these participants echo Brookfield’s 5 themes regarding how students learn CT and, more particularly, the first of the 5 themes involving a social process that includes small group work.¹⁰ Brookfield identifies critical thinking as a social learning process, with specific mention

of students working in small groups to encourage self-awareness of their own assumptions and to discover new assumptions and perspectives.¹⁰ This theme mirrors the perceptions of the study participants regarding the value of discussion and their preference for small group work. Additionally, their identification of the use of case studies, critical incidents, simulation, and scenarios are congruent with Brookfield's third theme.¹⁰ These specific themes are also captured in other literature on this topic.²⁰ Without exception, all of these themes mirror the perceptions that participants in this study arrived at regarding their path to acquiring CT skills.

Participants valued being exposed to diverse thought processes in nurturing their CT, yet there was limited discussion of or linkage to discovering and overcoming personal prejudice and bias, an element in the definition of CT provided by Bassham et al.⁹ Being exposed to diverse thought processes requires an openness or acceptance which may mean overcoming personal prejudice or bias. Participants frequently acknowledged the need to be open to considering different opinions when thinking critically, but failed to recognize looking internally to identify a personal prejudice, bias or assumption. Perhaps participants did not fully understand this concept; it can only be speculated that the lack of attention to this aspect of the definition is due to the challenging nature of the topic and time limitations to pursue all aspects to a similar depth.

The participants were not shown the more complex definition of critical thinking by Facione and the Delphi committee,¹¹ which mentions breaking down a larger problem. However, participants alluded to this approach throughout their discussions. The Delphi committee highlighted 6 cognitive skills of critical thinking in its definition: interpretation, analysis, evaluation, inference, explanation, and self-regulation.¹¹ Although participants did not view this list, they referred to certain elements in their discussion. For example, they used the term "thinking outside the box" to illustrate their appreciation for expanding their thought process to consider using cognitive skills, such as analysis, when thinking critically. This comprehensive and long-standing definition of CT by Facione¹¹ clearly suggests that affective dispositions and mood, feelings or attitudes play a role in addition to cognitive function,¹¹ which were mentioned by the recent graduates in this study. The comments and examples provided by the participants can be linked to the affective dispositions of CT written by the Delphi committee.¹¹

When comparing the perception of participants to information in the literature regarding nurturing CT in adult learners, consideration was also given to what was lacking in the participants' assessment of their experience. Many researchers agree that a reflective process is required for CT development.²⁷⁻³⁰ However, these graduates could not specifically identify that this was what they were doing on the numerous occasions they mentioned self-assessment or the term "thinking back." With prompting during the follow-up interviews most participants did mention a form of reflection as an informal process. This suggests the need for expansion of this component to enable students

to appreciate all aspects of reflection in order to fully challenge themselves and their understanding of the world.

Effectiveness of activities

A secondary question in this research was: Which teaching and learning methods were effective for the individual learner? As outlined in the preceding discussions, there was agreement among the participants or similarities in their responses to this question. The results suggest that a variety of strategies throughout their dental hygiene education were perceived as beneficial by these dental hygiene graduates, such as the use of small group work, discussion, and case scenarios. In essence, the activities noted by participants are not mutually exclusive as they interweave and inform each other. It can ultimately be concluded that there is no recipe or set of instructions for teaching CT: the literature also suggests this^{7,15}, and the perceptions of these participants do not suggest a standardized approach.

CONCLUSION

This qualitative investigation contributes to both adult education and dental hygiene education with respect to best practices in nurturing CT. This exploratory study provides insight into how students develop CT as adult learners in higher education and, more specifically, in a dental hygiene program. There is significant alignment between these students' perceptions of their journey to CT and the literature, even though these elements and an in-depth analysis of CT definitions were not shared with the participants during this study. Participants' descriptions of group activities suggest those from the literature on nurturing CT, such as problem-based and case-based learning, were most important. As well, participants alluded to other influences, such as emotions and confidence, which are also discussed in the literature on CT skills.

This study has revealed the challenges of exploring this topic and isolating its features. The findings suggest that research in adult education and CT must continue in order to extend the literature. Areas for future study should include determining whether activities noted by the participants actually developed their critical thinking skills and what other factors may influence critical thinking.

Future research could also investigate if the ability of female dental hygiene students to think critically would increase their likelihood of having an awareness of the influence of power, gender, class, and social factors as young adult learners, females, and professionals. Since CT is a desired outcome in adult education, which includes dental hygiene education, this discourse on CT must continue to ensure all adult learners are empowered with the ability to think critically.

CONFLICT OF INTEREST

The author declares no conflicts of interest relating to this research.

APPENDIX 1. Focus Group and Individual Interview Guides

Focus Group Guide

To begin the focus group, a definition of critical thinking will be provided with a follow-up question or activity to ensure participants understand and to also serve as an ice-breaker. Bassham, Irwin, Nardone, and Wallace define critical thinking as:

the general term given to a wide range of cognitive skills and intellectual dispositions needed to effectively identify, analyze, and evaluate arguments and truth claims; to discover and overcome personal prejudice and biases; to formulate and present convincing reason in support of conclusions; and to make reasonable, intelligent decisions about what to believe and what to do.^{9 p1}

1. Please provide examples from when you were a dental hygiene student of your thinking critically.
2. a) Looking back on the situations or examples you just provided, which learning experiences or activities would you say led to this critical thinking?
b) Can you provide additional exercises or activities from your dental hygiene education that contributed to the development of your critical thinking skills?
3. In your opinion, how did these experiences contribute to your critical thinking skills?
4. Of all the experiences mentioned, which were particularly helpful or not-so-helpful in nurturing your critical thinking? Why?
5. Can you provide additional experiences that nurtured critical thinking in your dental hygiene practice after you graduated?

Individual Interview Guide

1. Do you wish to offer any follow-up comments from the focus group discussion?
2. Review of the definition of critical thinking from the focus group. Provide examples of you thinking critically as a dental hygiene student.
3. Do you think you learned critical thinking while you were a dental hygiene student?
If yes, do you think this learning was a result of your dental hygiene education or from some other influences? Can you explain this?
If your dental hygiene education played a role in your development of critical thinking, which courses assisted you in accomplishing any element of this definition?
How did these courses help you to think critically? (i.e., Assignments, activities, homework, methods of evaluation)
If no, where or how do you think you learned to think critically?
4. Do you have any additional learning experiences that triggered the development of critical thinking in your dental hygiene education that weren't mentioned here or during the focus group? Please explain.
5. Of the experiences you or the focus group mentioned, can you describe the influence this experience or activity had on your critical thinking development? Which were the most useful? Which were the least useful? Why?
6. How do you think these experiences or activities could have been improved to assist you in nurturing your critical thinking?
7. If you could design the ideal educational program for critical thinking for you as a dental hygiene student, what would it include?
8. Do you have any other observations or comments to share on this topic?

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Essential elements for the reintroduction of dental therapy abilities in Canada

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ABSTRACT

Background: Oral health inequalities persist in Canada; those with the greatest oral health needs have the greatest difficulty accessing care. With the closure of the only dental therapy program in 2011, access to restorative and surgical oral health services has decreased. **Objective:** To explore how dental therapy abilities might best be integrated into Canadian postsecondary oral health education. **Methods:** Purposeful sampling was used to invite key informants from Canadian underserved populations, government, educational administrators, and educators as well as international educators and administrators for a semi-structured interview. The overall response rate was 74% (n = 53). Thematic analysis was used to code the data, identify similarities and discrepancies, and generate themes. **Results:** Respondents provided input on educational models and emphasized the following essential elements that need to be in place for any educational model to be viable and sustainable: innovative workforce delivery models, remuneration models for cost-effectiveness, supportive regulatory parameters, sustainable oral health programs and initiatives for underserved groups, employment opportunities for graduates, and increased management of policy interferences and professional tensions. **Conclusion:** There was unanimous support for the re-establishment of educational models incorporating dental therapy competencies. While an educational model was considered necessary, it was not viewed as sufficient for the re-establishment of dental therapy abilities within Canadian postsecondary education. The above essential elements were described as critical for any educational model to be viable and sustainable. Bringing these essential elements together requires the support of health professionals, educators, regulators, and governments.

RÉSUMÉ

Contexte : Les inégalités en santé buccodentaire persistent au Canada; les personnes qui ont les plus grands besoins en santé buccodentaire ont la plus grande difficulté à accéder aux soins. Avec la fermeture du seul programme de thérapie dentaire en 2011, l'accès aux services de restauration et de chirurgie en santé buccodentaire a diminué. **Objectif :** Explorer comment les compétences en thérapie dentaire peuvent mieux être intégrées à l'éducation postsecondaire canadienne sur la santé buccodentaire. **Méthodologie :** L'échantillonnage choisi à dessein a été utilisé pour inviter des intervenants clés provenant de populations canadiennes mal desservies, du gouvernement, d'administrateurs de l'éducation et des enseignants ainsi que des enseignants et administrateurs internationaux à une entrevue semi-structurée. Le taux de réponse global était de 74 % (n = 53). L'analyse thématique a été utilisée pour le chiffrage des données, le repérage de similarités et de divergences et la production de thèmes. **Résultats :** Les répondants ont fourni des commentaires sur les modèles éducationnels et ont fait ressortir les éléments essentiels suivants, qui doivent être en place pour que tout modèle éducationnel soit viable et durable : modèles de prestation de services novateurs en matière de main d'œuvre, modèles de rémunération permettant la rentabilité, paramètres réglementaires favorables, programmes ou initiatives de santé buccodentaire durables pour des groupes mal desservis, occasions d'emplois pour les diplômés et gestion accrue des interférences de politiques et des tensions professionnelles. **Conclusion :** Il y avait un soutien unanime pour le rétablissement de modèles éducationnels qui incorporent les compétences de thérapie dentaire. Bien qu'un modèle éducationnel ait été jugé nécessaire, il n'a pas été perçu comme suffisant pour le rétablissement des compétences de thérapie dentaire au sein de l'éducation postsecondaire canadienne. Des éléments essentiels ont été notés comme étant critiques à la viabilité et à la durabilité de tout modèle éducationnel. Rassembler les éléments essentiels demande le soutien de professionnels de la santé, d'enseignants, de responsables de la réglementation et de gouvernements.

Key words: access to care, dental therapy, mid-level provider, multiskilled provider, underserved communities

CDHA Research Agenda category: access to care and unmet needs

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WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Canadians living in rural, remote, and Indigenous communities experience higher rates of oral disease than the general population.
- The re-establishment of dental therapy abilities within Canadian postsecondary education is an opportunity to increase the capacity and flexibility of the oral health workforce.
- Collaboration among all stakeholders is key to the success of any new educational model integrating dental hygiene and dental therapy abilities to improve access to care for underserved populations.

INTRODUCTION

The oral health of Canadians has been improving, but oral health inequalities and inequities remain. In 2000 the American Surgeon General's report¹ drew attention to what he called the "silent epidemic" of oral disease; the situation in Canada is similar.² Oral disease remains an epidemic despite a variety of efforts to manage it.

The limited inclusion of oral health care in health care systems has profound implications for vulnerable and unserved population groups.³⁻¹² The global economic impact of oral disease in 2010 was estimated to be US \$442 billion, which translated to 4.6% of global health expenditure with 83% of these costs attributable to high-income countries such as Canada.⁴ Additional productivity losses in terms of days missed from work as a result of oral infections were found to be US \$144 billion. Canadians alone spend \$14 billion every year on dental care; less than 6% of these costs are covered by the health care system.¹³

Those who can pay for services are generally well served by the current private practice, fee-for-service oral health care model.^{14,15} However, disparities have been increasing particularly for underserved groups of Canadians.^{2,13,14,16} There is a need to fill this gap by alleviating the burden of oral disease for underserved populations.

Many advocate for change in the delivery of oral health services for the underserved¹⁷⁻²⁵ although the solutions vary. The Canadian Dental Hygienists Association (CDHA) has long supported the vision of increased access to oral health care for all Canadians, with a specific focus on those who experience the highest rates of oral disease. To this end, CDHA contracted a study to explore the re-establishment of dental therapy abilities within Canadian postsecondary education as a strategy to improve access to care for underserved populations.

Since the closure of the Canadian 20-month diploma dental therapy program in Saskatchewan in 2011, there have been increasing discussions at the national and provincial levels regarding the re-establishment of a dental therapy program and/or integrating dental therapy abilities into the scope of dental hygiene practice with the goal of supporting cost-effective educational opportunities to increase access to care. Exploring opportunities to increase the capacity and flexibility of the oral health workforce is viewed as important for access.²⁶⁻²⁸ While health promotion and disease prevention are essential for oral health,^{26,29} there is a need for practitioners complementary to dentists who can provide therapeutic services to alleviate pain and restore function to the dentition for underserved populations.^{30,31}

METHODOLOGY

The central question of this study asked: How might dental therapy abilities best be integrated into Canadian postsecondary education?

A purposeful sampling process was used to gain a sample of 73 people for an interview. The email invitations

were organized into 3 groups based on people's roles in organizations and practice:

- *General key informants* (n = 26). The inclusion criteria for this group were roles within Health Canada, provincial and territorial health administration, public health or working with underserved populations and/or regulators from provinces where dental therapists are recognized.
- *Canadian educational administrators and educators* (n = 17). The inclusion criteria for this group were educators and/or administrators in Canadian postsecondary institutions within dental hygiene, dentistry or past dental therapy programs.
- *International educators from Australia, the Netherlands, New Zealand, United Kingdom or the United States* (n = 30). The inclusion criteria for this group were international educators and/or administrators in combined dental hygiene/dental therapy programs from countries selected based on the similarity of their oral health care practitioners and regulatory and legislative structures to Canada's.

The data collection involved semi-structured interviews in early 2017 guided by the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* (<http://ethics.gc.ca/eng/index/>). The questions pertained to dental therapy abilities, educational models, and enabling and disabling factors regarding the re-establishment of a provider with dental therapy abilities; the anchor questions were included in the email invitation. One follow-up message was sent after the initial letter of invitation. The interviews were largely conducted by telephone but also included in-person interviews and email discussions. The interviews ranged from 40 to 90 minutes.

The analysis of textual data from notes and emails was based on grounded theory methodology.³²⁻³⁴ It involved multiple stages of thematic analysis to examine similar and divergent views through the process of coding and recoding. The first stage of analysis was conducted individually by the 3 researchers involved in the interviews. Subsequently teleconference meetings were held over a 2-month period to compare the themes and their relationships. The analysis included an iterative process as the data, codes, and associated analyses were questioned, revised, and explored in more depth. A feedback loop was conducted to gain respondents' consent for quotes to be used in publications.

RESULTS AND DISCUSSION

The overall response rate was 74% (n = 53) with the following breakdown of respondents in each category:

- General key informants (GKI): 81% (n = 21)
- Canadian educational key informants (EKI): 88% (n = 15)
- International key informants (IKI): 57% (n = 17)

Respondents had a wide range of professional backgrounds and roles within their respective organizations and practices. Twenty-four were involved in public health practice, 14 of whom worked with Indigenous people. Twenty-four had an administrative role within their organization, and 27 had an educational role. Ten respondents were clinical practitioners working with Indigenous and other vulnerable populations. All general key informants, with the exception of the 3 regulators, were working or had worked with underserved populations as a clinician or in an administrative capacity. Participants often had multiple and overlapping roles, with 58% (n = 21) of the Canadian respondents having a role related to public health.

This study provides insight into the views of the respondents regarding the re-establishment of dental therapy abilities in Canadian postsecondary education. However, these viewpoints do not necessarily reflect the opinions of all interest groups as the sample was not designed to be statistically representative. Another group might have provided different views. Nonetheless, the data help to broaden our understanding of oral health education and are, therefore, worthy of consideration and debate.

The interview respondents provided rich data about dental therapy and the elements that are needed for any educational model to be viable. Enabling and disabling factors were included in the overall research question as described in the methodology section. These factors proved to be a large area of discussion for respondents. In their opinion an educational model would be neither viable nor sustainable without essential elements of practice being addressed.

This article examines the elements that respondents identified as essential to the re-introduction of dental therapy abilities. A description of the educational models arising from the study is found in the Canadian Dental Hygienists Association's position statement, *Filling the Gap in Oral Health Care* (<https://files.cdha.ca/profession/DualProviderPositionPaper-EN.pdf>). The main themes that emerged from the analysis of essential elements to support such education are presented in the following sections.

Gap in oral health care

Respondents described the gap in oral health care from multiple perspectives.

"There is a gap in services for poor rural, northern, indigenous, seniors and refugees." (GKI)

"Kids become so used to the pain that they stop complaining about it. ...It becomes a way of life...Children of all ages are embarrassed about the look of their teeth. They know what healthy smiles look like." (GKI)

"[Dentistry] can't keep putting its head in the sand; ... [the gap in oral health care] is getting bigger as insurance policies are becoming weaker

and employment situations less stable. It is starting to affect lower middle class individuals. They are visiting their dentist less frequently and children are not going for their first dental visits early enough" (EKI).

Canadian reports on health and oral health support these views.^{13,19,20,25,35,36} The gap in oral health services for some groups is increasing while the overall health status of Canadians has improved.

It's the right thing to do!

There was unanimous support for the re-establishment of dental therapy abilities in Canada. The following quotes provide a sense of the support:

"The current system is not working and we need to come up with a new solution." (GKI)

"There is an absolute need for an oral health provider with such abilities." (EKI)

"It is the right thing to do if we are focused on the needs of patients." (IKI)

Several government respondents indicated that they would support this initiative as long as it resulted in "increased access to care for Canadians at a lower cost" (GKI).

"If there is an increase in front-line oral health care workers and it could be demonstrated that the First Nations and Inuit populations would be better served, then we will provide support." (GKI)

Educating professionals with dental therapy abilities was viewed as important as long as these practitioners provide services for underserved populations. This challenge to meet the oral care needs of underserved populations is not unique to oral health care in Canada.^{22,37}

Do it for the patients!

Respondents provided insight into their support for reintroducing dental therapy abilities in Canada. They expressed concerns about the state of health care, oral health care, and dental education; they suggested the need for some fundamental change.

"The whole system of health care is fundamentally flawed". (IKI)

"Dentistry as a whole has failed to have an impact on the oral health status of populations." (EKI)

"We are not teaching the prevention and health promotion aspects in enough depth ... but just placing value on the clinical abilities." (EKI)

"We need to get beyond our comfort zone as educators and blow up the curriculum." (IKI)

The respondents challenged oral health educators to reconceptualise oral health education in general by placing people at the centre of such an analysis. We need “to come together and do it for the patients” (IKI).

Respondents also challenged educators, professionals, regulators, and policy makers to focus on the needs of underserved people and facilitate the shift from treatment to prevention and health promotion. These have been long-standing messages in oral health care.²⁹⁻³¹ The creation of a dually qualified provider was viewed as a positive step towards supporting the relief of oral pain for underserved people while at the same time supporting a shift towards more preventive and health promotion services.

“[We] need prevention versus treatment of disease, so need a multi-skilled person.” (IKI)

“[We need a provider with] oral health promotion, education and preventive services as well as restorative and extraction [abilities].” (GKI)

Respondents, echoing the opinions of others in the literature,²⁹⁻³¹ advocated for the reorientation of education towards health promotion and disease prevention, while

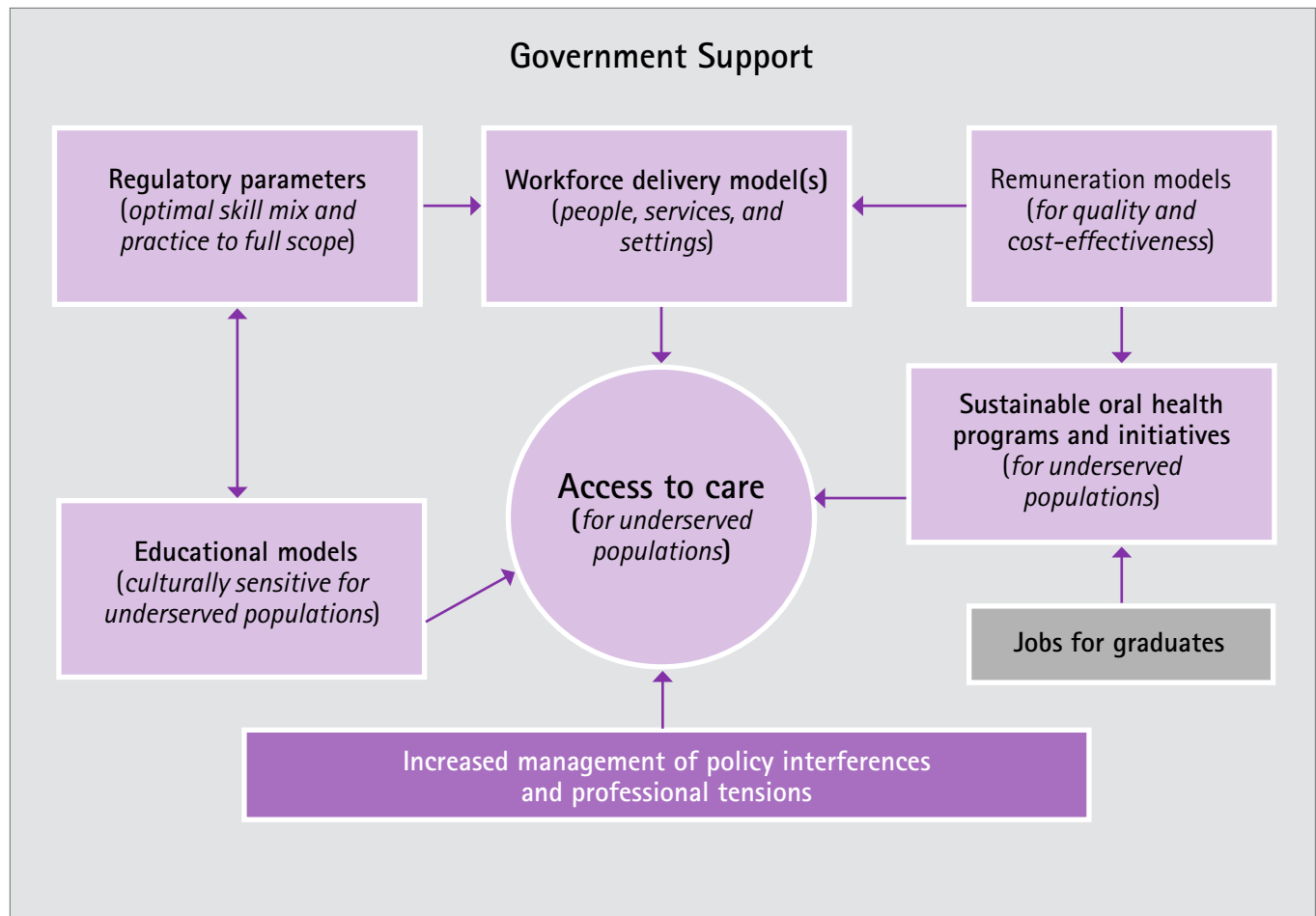
also recognizing the need to treat dental infections and alleviate pain.³⁰ This direction aligns with the call for change in the delivery of both health and oral health services for the underserved.^{13,19,20,22,26,30,38}

While there was strong support for the re-establishment of dental therapy abilities, respondents identified elements that were essential for any educational model to be viable and sustainable (Figure 1). Respondents identified the need for:

- innovative workforce delivery models
- diverse remuneration models to support quality care and cost-effectiveness
- supportive regulatory parameters
- government support for sustainable oral health programs and initiatives
- government support for positions for graduates
- increased management of policy interferences and professional tensions

Respondents’ views were grounded in the belief that all interest groups need to collaborate and come together to meet the needs of underserved populations. These elements were viewed as necessary for any multiskilled provider to have a positive impact on the oral health status of Canadians.

Figure 1. Supporting access to care through increased collaboration



Innovative workforce delivery models

Respondents talked about the need to have a clear workforce delivery model that included clarification of the practitioners involved, the services, and settings.

“Basically one needs a workforce model, a delivery system model and associated positions, and a regulatory framework. Without these assumptions being a reality, there is really no sense in exploring educational programs.” (EKI)

Respondents identified the need for providers with multiple abilities to support underserved populations (GKIs; IKIs).

“Dental hygienists bring the education, advocacy and promotion pieces into the mix.” (GKI)

“[We need providers who have the ability to] focus on removal of decay, restoration of function, relief of pain and disease diagnosis.” (GKI)

“The ideal clinician is a dental hygiene based therapist.” (IKI)

Given the focus of this study, the discussion about other providers was limited. The literature adds to this exploration of delivery models and suggests that not only should other health professionals^{26,31,38-40} be involved in oral health services, but the responsibility for promoting oral care also needs to be shared among teachers, cultural and religious leaders as well as the media in the community.^{31,41}

With regard to services, respondents expressed the need for a continued shift towards prevention and health promotion. *“[We need] a multi-tiered, prevention based approach to oral health care.” (IKI)* However, such a shift was viewed as a complex endeavour. Respondents talked about the policy contradictions between prevention and health promotion, and restorative care.

“It is the demands placed on them [dental therapists] once they get into a community that prevent the full use of these [prevention] abilities. The same demands from the community and managers will prevent expanded duty hygienists from delivering those same services.” (EKI)

This respondent was referring to productivity being counted in terms of restorative procedures. “Dollars for the band dental care are reimbursed based on restorative therapies (GKI).” Incentives are often directed to restorative services; a treatment approach predominates^{29,31,42} despite policy discussions about the need to increase health promotion efforts.⁴³ Data from the United Kingdom suggest that incentives can influence the provision of more preventive services and greater use of dental therapists.⁴⁴⁻⁴⁶ Remuneration policies influence the services provided.

Respondents provided diverse input on the settings for oral health services. The need for full-time practitioners

in remote areas was emphasized. Our current approach was described as “a fire fighter approach” (EKI) in which clinicians are flown in and out of communities. Lenaker⁴⁷ also underscored the importance of having full-time providers in remote communities. Other respondents emphasized the need to provide services where clients live. “There is a reliance on clients making appointments and physically going to an office. ... Once the client is not mobile, even if they have been a client for many years, the practitioner has no further interaction” (GKI).

The need to have varied practitioners in diverse practice settings is supported in dialogues about health care reform.^{26,38} Continued innovation is important.^{22,26,35,41,48-52} For example, with the shared risk factors of many chronic diseases, such as dental caries and diabetes, there are opportunities to work collaboratively with others.^{30,52} Oral health care should be holistic and reflect its connection to systemic health.

Remuneration models for quality and cost-effectiveness

A related discussion focused on the need for different remuneration approaches to the current fee-for-service model.

“We need to move away from that delivery model [fee-for-service] when caring for underserved populations ... it is just too expensive to provide care within that remuneration structure.” (GKI)
“Fee-for-service doesn’t work in this instance [providing care for underserved].” (GKI)
The services need “to be cheaper than those of a dentist. Remuneration is based on a biomedical model ... we need a public health] care model.” (IKI)

The limitations of the fee-for-service model are the subject of ongoing discussion in health care literature. This model is described as resulting in quality care but also having the potential to promote over-treatment.^{26,44,53-56} In contrast, per capita payment approaches are described as possibly leading to under-treatment^{26,57,58} and the selection of clients with minimal oral health needs.²⁶ The lack of valid clinical markers for severity of oral disease makes it more challenging to apply performance indicators based on oral health outcomes⁵⁹ as a remuneration approach. However, the use of a combination of approaches, including salaried positions and practitioner-selected contracts, is suggested as a possible means of containing costs.²⁶ For example, school-based dental programs using salaried providers have been found to be more cost effective when compared to private practice services.⁶⁰

Studies reveal that the needs of many underserved groups can be largely met by practitioners with the abilities of dental hygienists and dental therapists.^{37,47,60-69} These data combined with comparisons of average annual earnings of dentists, dental hygienists, and dental therapists suggest that role substitution of services could

be more affordable for individuals and communities.^{63,70} Data from the Alaska experience with such substitution provide evidence about improved oral health outcomes in remote communities.^{47,64} Between 2009 and 2014 there were significant changes in the type of oral care services provided. In 2009, 38% of services provided by the Yukon Kuskokwim Health Corporation were emergency services compared to 24% in 2014.⁴⁷ At the same time preventive services increased from 28% to 40%.

Other respondents talked about remuneration from the context of incentives for living in remote areas:

“Devise ways to attract people to work in the north.” (GKI)

“Need to establish programs such as travel support, continuing education opportunities, and northern allowances.” (GKI)

“[Practitioners need] ‘reasonable compensation’ [for working in northern communities and other settings such as residential care;] otherwise you cannot expect them to work there.” (EKI)

However, another respondent who conducts research on physician incentives stated that “money helps but it is not the answer” (GKI). The most important variable was “to guarantee gainful employment for the spouse.” Some also talked about the importance of recruiting “young providers who are more interested in the opportunities of living in the north.” Others described the need to recruit students from northern communities (GKIs); this was often presented from the perspective of role models in the community. “That’s what starts people into the program. They see this person who has an interesting job with a good salary and suddenly there is an interest in the community to also have such a position” (EKI). The Dental Health Aide Therapist program in Alaska is an example of such an approach^{47,71}; the students are sponsored by tribes during their education and provided employment upon graduation. Such an approach has also been suggested in the Canadian context.⁷² Role models and collaboration at the community level appear to support recruitment of learners and also promote improvements in the oral health status of remote communities.^{47,73} McKinnon et al.⁷⁴ use the term “workforce contingent financial aid” (WCFA) to describe such policies designed to encourage oral health graduates to work in underserved communities. People in communities “do not need the same person, but they need a person there” on a full-time basis; the critical element is the presence of the person in the community.⁴⁷ Other incentives could include loan forgiveness programs, increased basic income tax exemptions upon graduation, travel costs, and remote living stipends (GKIs, IKIs).

Supportive regulatory parameters

While acknowledging the need for professional regulation for public protection, some respondents viewed regulation as a barrier. Canada was described as having a “siload

regulatory approach” (GKI) compared to other countries, such as Australia and New Zealand, with one national regulatory organization for dental practitioners that was described as facilitating labour mobility (IKIs). Canada has multiple regulatory organizations not only within health care, but also within provincial and territorial boundaries. The nursing professions in British Columbia were commended for having recently organized under one provincial regulatory organization (GKI).

Telehealth was identified as a service that is hindered by regulatory barriers at an interprovincial level. “So you are in one province and providing care to a person in another province ... which regulatory standard do you follow?” (GKI) Respondents also talked about regulation challenges in the north. It all “goes back to who will license and oversee in the territories because the regulatory colleges in the north cannot provide this oversight” (GKI). Conflicts of interest were also raised. “There are too many conflict of interest issues in having them [multi-skilled providers] regulated by dentistry” (GKI).

Others have raised concerns about regulatory parameters negatively influencing access to care.^{26,42,75-78} Wing and Marier⁷⁵ found that less practice autonomy for dental hygienists resulted in approximately 12% higher costs for services. Langelier et al.⁷⁶ found there was a significant, positive association between population oral health and increased autonomy of dental hygienists. Maxey et al.⁷⁷ found that federal health centres working with underserved populations delivered more dental services in states that provided professional independence for dental hygienists. Proposed regulatory recommendations include the need to expand professional scopes of practice, to liberalize supervision requirements, and to allow for increased direct access to health professionals.^{26,42,75-78}

Sustainable oral health programs

The government role in supporting access to oral care was emphasized. Respondents noted the importance of establishing an oral health services safety net for underserved people and the creation of employment opportunities for the most cost-effective delivery of services. Essentially, “oral health needs to be taken seriously” (EKI) by governments. The following quotes reflect this need:

“The Ministry of Health needs to be serious about oral health being a component of overall health.” (EKI)

“Without government support there will be no change in the oral health status of underserved groups.” (IKI)

All levels of government need to make a commitment to reducing inequalities in oral health. Opening policy windows requires collaboration among political interest groups to support policy makers in effecting change as demonstrated in the Minnesota dental therapy legislation.⁷⁹

Employment opportunities

Employment opportunities were also emphasized. “If we build it [educational program] will they come?” and if they come “will they be employed?” (IKI) Education was viewed as being of little value if the graduates did not have the opportunity to provide care.

“The big issue – positions for these people once they graduate. Without such positions being available the program would not be sustainable.” (EKI)

“It would be helpful to move forward in tandem with the educational and the employment piece.” (EKI)

Many respondents viewed these providers as increasing access in the public sector. “These people need to be in the public health/quasi-public health sector” (EKI). However, others recommended that they be integrated within all practice settings. “Include the ability to be in private practices as well” (EKI). Regardless of the setting, the providers were viewed as self-initiating clinicians. “They should be able to work independently” (EKI). “To send a dentist as well, that is cost prohibitive” (EKI). These views align with international trends in Australia, the Netherlands, New Zealand, and the United Kingdom for self-initiation of multiskilled providers. These quotes reflect the need for governments to provide employment opportunities for multiskilled providers in strategic geographic locations to support underserved people. The “skill mix” of Canadian oral health providers needs to be analysed to ensure that the providers can provide the services most needed by underserved populations in a cost-efficient manner. Brocklehurst and Macey⁴⁴ refer to this as the mix being assessed for “fit-for-purpose” to support human resource planning.

Respondents highlighted the fact that it is unrealistic to expect private sector providers to accept responsibility for the access to care issue for vulnerable populations. As one respondent indicated, “we have to look at access to care beyond volunteer programs and charity” (EKI). There is a need for society to take action on oral health reform not just to improve oral health but to realize economic gains and overall public health improvements.^{3-12,80}

Policy interference and professional tensions

Coherence and clarity are often not distinguishing features of policies given that they normally reflect negotiated decisions among a plethora of interest groups with varying levels of influence and power.^{81,82} One policy can often interfere with other policies in unproductive and unintended ways.^{71,82,83}

Respondents identified several policy interferences, including the regulatory issue and the policy contradiction between preventive and restorative services described earlier. As another example, respondents talked about unfilled dental therapy positions.

“There are [unfilled positions] and these positions are taken by other departments when they are not staffed for a long period of time.” (GKI)

[We have] “12 positions and 4 filled. Government is now giving these positions to other health professions such as mental health nurses.” (GKI)

While positions exist, there are currently no educational pathways in Canada to acquiring the abilities for these positions; this was viewed as being counterproductive.

Another variable in the management of policy interferences related to ongoing professional tensions.^{26,79,84} Respondents described such tensions:

“Dentists are not keen in moving the debate forward. They will be resistant to this sort of development.” (EKI)

“Professional competition is still prevalent; there is an ongoing fight with dentistry.” (IKI)

“No one should underestimate the influence of dentistry within governments. [There is a need for] a strategy to deal with organized dentistry ...a professional and respectful one, but a strategy nonetheless.” (EKI)

Others identified the “need to be complementary to each other” (IKI). As previously noted we need to “come together and do it for the patients” (IKI). Focusing on access to care could provide a common goal for all professionals to work towards.⁷⁹ “If done right this could be an opportunity for increased collaboration among oral and other health professions, to demonstrate shared goals, to increase access, to lower costs and to increase patient satisfaction” (GKI). Bullock and Firmstone⁸⁴ suggest that “tribalism” is one of several factors affecting policy decisions about the dental safety net. They recommend a shift from such tribalism to liberalism—the acceptance of providers with dental therapy abilities within the context of oral health care.

Policy contradictions were also viewed as windows of opportunity. Canada’s health care system was described as both a challenge and an opportunity. There can be situations where some “cracks” in the system open up. “It is going to take some time and we should not be looking for overnight success” (GKI). Respondents urged educators and governments to work closely with regulatory organizations in this initiative (GKIs). Such an endeavour requires “patience and courage” (GKI-1). The need for collaboration among policy makers across government sectors has been an ongoing discussion.^{42,74,79,81-83} Concerted and cooperative approaches are needed in all sectors including the health professions, education, research, and social services as well as community advocacy groups so that changes can be institutionalized.

CONCLUSION

There was unanimous support for the re-establishment of dental therapy abilities in Canada. While an educational model was deemed necessary, it was not viewed as sufficient for integrating dental therapy abilities. Other key elements were considered critical for any educational model to be viable and sustainable. These elements include workforce delivery models, remuneration models for cost-effectiveness, supportive regulatory parameters, sustainable oral health programs, employment opportunities for graduates, and increased management of policy interferences and professional tensions. A collaborative effort is required to have an impact on improving access to oral care for underserved populations in Canada.

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CONFLICTS OF INTEREST

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Effectiveness, safety, and acceptance of silver diamine fluoride therapy and its implications for dental hygiene practice: Position paper and statement from the Canadian Dental Hygienists Association

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ABSTRACT

Background: This study reviews the literature on the short- and long-term effectiveness, safety, and acceptance of silver diamine fluoride (SDF) therapy for children and adults with carious lesions and/or dentinal hypersensitivity as it applies to dental hygiene practice. **Methods:** Using the scoping review methodology by Levac (2010), the authors retrieved 662 records from 7 electronic databases, 3 clinical trial registries, and Google. Thirty-eight publications met the following inclusion criteria: clinical application of SDF on human subjects; published in English between 2000 and 2017. Results were synthesized under categories defined by the principles of a health technology assessment. **Results:** Data regarding clinical and prospective trials of SDF were available for 3 indications: arresting carious lesions (age range: 3 to 8 years), arresting root carious lesions (age range: 65 to 85 years), and reducing dentinal hypersensitivity (age range: 43 to 44 years). The longest follow-up period was 36 months. Adverse events and parent/caregiver acceptance were reported in most studies. **Discussion:** A broad range of evidence on the effectiveness, safety, and acceptance suggests that SDF could be used within the dental hygiene armamentarium. Current evidence and guidelines support the use of SDF for arresting carious lesions in primary dentition, but there is limited evidence for the use of SDF to arrest root caries or reduce dentinal hypersensitivity. Gaps in research on training requirements, treatment protocols, and long-term effectiveness and safety were also identified. **Conclusion:** Evidence suggests that SDF could be an effective and safe therapy to add to the dental hygiene clinical armamentarium for the management and arrest of coronal caries in primary dentition, with further research required to support its use for other clinical applications.

RÉSUMÉ

Contexte : La présente étude examine la documentation sur l'efficacité et la sécurité à court et à long terme, ainsi que l'acceptation de la thérapie au fluorure d'argent diamine (FAD) chez les enfants et les adultes ayant des lésions carieuses ou de l'hypersensibilité dentinaire, tel qu'elle s'applique à la pratique d'hygiène dentaire. **Méthodologie :** En se servant de la méthodologie de l'examen de la portée par Levac (2010), les auteurs ont repéré 662 dossiers de 7 bases de données électroniques, 3 registres d'essais cliniques et Google. Trente-huit publications ont répondu aux critères d'inclusion suivants : application clinique du FAD sur des sujets humains, publiés en anglais entre 2000 et 2017. Les résultats étaient synthétisés en catégories définies par les principes d'une évaluation des technologies de la santé. **Résultats :** Les données provenant d'essais cliniques et prospectifs du FAD étaient accessibles selon les 3 indicateurs suivants : l'arrêt des lésions carieuses (intervalle d'âge : de 3 à 8 ans), l'arrêt des lésions carieuses radiculaires (intervalle d'âge : de 65 à 85 ans), et la réduction de l'hypersensibilité dentinaire (intervalle d'âge : de 43 à 44 ans). La période de suivi la plus longue était de 36 mois. Des événements indésirables et l'acceptation parentale ou du soignant ont été signalés dans la plupart des études. **Discussion :** Une vaste gamme de preuves sur l'efficacité, la sécurité et l'acceptation suggère que le FAD pourrait être utilisé au sein de l'arsenal thérapeutique de l'hygiène dentaire. Ces données probantes et les lignes directrices courantes appuient l'utilisation du FAD pour arrêter les lésions carieuses dans la dentition primaire, mais les preuves sont limitées lorsqu'il s'agit de l'utilisation du FAD pour arrêter la carie radiculaire ou réduire l'hypersensibilité dentinaire. Les lacunes en matière de recherche sur le plan des exigences de formation, des protocoles thérapeutiques et de l'efficacité et de la sécurité à long terme étaient aussi définies. **Conclusion :** Les données probantes suggèrent que le FAD pourrait être une thérapie efficace et sécuritaire à ajouter à l'arsenal thérapeutique de l'hygiène dentaire clinique pour la gestion et l'arrêt des caries coronaires de la dentition primaire, exigeant de la recherche supplémentaire pour en appuyer l'usage dans d'autres applications cliniques.

Key words: adverse effects, caries arrest, coronal caries, dentinal sensitivity, root caries, silver diamine fluoride

CDHA Research Agenda category: risk assessment and management; capacity building of the profession

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CANADIAN DENTAL HYGIENISTS ASSOCIATION POSITION STATEMENT

Silver diamine fluoride (SDF) is a non-invasive, clinically applied treatment that has been used as an interim therapy for managing active coronal and root caries and reducing dentinal hypersensitivity. In 2017, SDF was approved by Health Canada as a natural health product and anticaries agent for children 3 years or older and adults. Research on SDF is of moderate quality but demonstrates comparable effectiveness of SDF to fluoride varnish and dental sealants in preventing and arresting coronal caries in primary dentition. The most common side effect of SDF is black staining of treated teeth.

Dental hygienists are encouraged to provide high-quality, evidence-based, and individualized care for their clients. While permanent restorations remain the gold standard for managing active caries, evidence suggests that SDF would be beneficial in low resource settings, especially in populations with limited access to dental care where comprehensive dental treatment is not available. The Canadian Dental Hygienists Association (CDHA) recommends that SDF be used as an interim therapy for children and monitored until permanent treatment is available. While there are gaps in evidence regarding the effectiveness of SDF in adults and in medically compromised populations, dental hygienists are encouraged to use their discretion and review the benefits and risks of SDF—including effectiveness, safety, and cost—in their process of care. CDHA continues to support education and research initiatives to enhance and inform the use of SDF in dentistry.

INTRODUCTION

Silver diamine fluoride (SDF) is used around the world primarily for reducing dentinal hypersensitivity and arresting carious lesions.^{1,2} It was recently introduced in North America, and in 2017, was approved by Health Canada as a natural health product and anticaries agent for children 3 years or older and adults.³ The emergence of SDF in North America has provoked interest within the dental community in understanding its use in practice.

SDF is hypothesized to prevent or arrest coronal caries, arrest root caries, and reduce dentinal hypersensitivity. Although ongoing studies are being carried out to understand its exact mechanism of action, evidence has shown that SDF inhibits dentin demineralization, preserves collagen and inhibits its breakdown, and increases dentin hardness.⁴ In laboratory studies, silver ions have been shown to degrade bacterial cell walls, disrupt DNA synthesis and replication, and disrupt intracellular metabolic activity.⁵ When applied to dentin, silver increases resistance to acid dissolution and enzymatic digestion.^{4,5} In addition to the therapeutic effect of silver, free silver ions can turn carious lesions black when exposed to environmental oxygen, which has been recognized as a common side effect of SDF.¹

The combined action of antimicrobial silver with the remineralization effects of fluoride suggests that SDF would be effective at arresting carious lesions and reducing dentinal hypersensitivity. Earlier claims suggest that SDF has the potential to control pain and infection, is easy and simple to use, affordable, requires minimal personnel time and training, and is non-invasive.¹ Thus, SDF could be a valuable addition to the armamentarium for dental hygiene care. However, no review has systematically evaluated these claims,⁵⁻¹³ and there remains lack of clarity on the practical aspects of SDF, including safety, cost, and effectiveness, for the management of carious lesions and dentinal hypersensitivity.

Dental hygienists practising in various settings, as well as regulators, professional groups, and the public, require practical information on SDF in order to understand its role in clinical care. A health technology assessment

(HTA) is well suited to address this need as it involves a systematic evaluation of relevant knowledge of the properties and effects of health care therapies within the context of their intended use.¹⁴ The HTA process combines evidence-based medicine, economics, organizational aspects, and social, ethical and legal considerations to produce information that will help guide future decision making in a health care field.¹⁵ Therefore, the purpose of this study is to review the published literature on the short- and long-term effectiveness, safety, and acceptance of SDF therapy for children and adults with carious lesions and/or dentinal hypersensitivity.

METHODOLOGY

A scoping review was carried out and guided by the principles of HTA. Health technology is defined as the practical application of knowledge in the form of devices, medicines, procedures, and/or systems to improve individual and population health.¹⁶ HTA involves “examining and reporting properties of a medical technology used in health care, such as safety, efficacy, feasibility, and indications for use, cost, and cost-effectiveness, as well as social, economic, and ethical consequences, whether intended or unintended.”¹⁷ Scoping reviews examine the extent, range, and nature of research on a specific topic by reviewing literature of varying study designs.¹⁸ Thus, this scoping review was developed to address the following objectives:

1. To review the effectiveness of SDF in preventing and arresting coronal and root carious lesions, and in reducing dentinal hypersensitivity in child and adult population groups;
2. To describe outcomes related to client/patient, parent/caregiver, and provider acceptance of SDF treatment in a dental setting;
3. To identify the indications, contraindications, and treatment protocol associated with SDF use for the prevention and treatment of coronal and root caries lesions and dentinal hypersensitivity in child and adult population groups.

The systematic search protocol received approval from the Canadian Dental Hygienists Association Silver Diamine

Fluoride Steering Committee in August 2017. Ongoing consultations on the results of the search strategy and manuscript were conducted with the steering committee until March 2018.

Data sources

Seven electronic databases that encompass a broad range of international literature on SDF therapies were searched: MEDLINE (biomedical sciences), EMBASE, Cochrane Library, Google Scholar, CINAHL, Web of Science, and the Latin American and Caribbean Health Sciences Literature (LILAC) database. Records from the World Health Organization International Clinical Trials Registry Platform, the clinical trial registry at the National Institute of Health, and the International Prospective Register of Systematic Reviews (PROSPERO) were also screened for relevant studies. This review was supplemented by reviewing reference lists of relevant studies and the first 200 hits from Google.

Search strategy

Key search terms were derived from a broad PICO framework (Table 1), and the search strategy was reviewed with a librarian at the Faculty of Dentistry, University of Toronto, Ontario, Canada. The strategy did not include restrictions on age but was limited by date (2000–2017), language (English), and to studies involving humans. Given the objectives of this scoping review, the search excluded population, comparison or outcome terms as they were assumed to limit the scope of the search. A sample search strategy is outlined in Supplementary Table 1 (available online at www.cdha.ca/cjdh). The full search was carried out in October 2017, followed by a second search in late November 2017. Databases were monitored until December 2017 to ensure that all relevant resources were captured for the review.

Screening and data extraction

Search results were imported into EndNote software and duplicate publications were removed prior to review. Two authors (JF and SS) independently reviewed abstracts for 25% of eligible studies using inclusion and exclusion criteria outlined in Table 2. The authors achieved very good agreement (κ 0.844; CI: 0.751 to 0.87)¹⁹; the remainder of eligible abstracts and full texts were screened by the primary author (JF). Both randomized and non-randomized studies were included in order to explore the full scope of potential benefits and harms associated with SDF, including societal and client perspectives. Studies that involved application of SDF in non-humans or in therapies considered outside the scope of dental hygiene practice, such as endodontic treatment, were excluded. If no abstract was available, the source was included for full-text review. Uncertainties related to study selection were discussed and resolved in consultation with other co-authors. A justification for study exclusion at the full-text review stage was documented for each source and is provided in Supplementary Table 2 (available online at www.cdha.ca/cjdh). The primary author (JF) extracted data from included studies using the standardized data extraction form, with final outputs reviewed by all co-authors and members of the steering committee prior to publication.

Quality appraisal and data synthesis

Quality appraisals were performed by reviewing study adherence to reporting guidelines for the specific type of study design. These included the following checklists: Assessing the Methodological Quality of Systematic Reviews (AMSTAR),²⁰ Consolidated Standards of Reporting Trials (CONSORT),²¹ Strengthening the Reporting of Observational studies in Epidemiology (STROBE),²² Consolidated Health

Table 1. Silver diamine fluoride scoping review PICO framework

PICO framework	Description
Population	<ul style="list-style-type: none"> • Clients/patients or parents or caregivers of clients/patients receiving treatment • Age groups (children, adults) receiving treatment • Dentition type (primary, permanent) receiving treatment • Tooth surface (coronal^a, root surfaces) receiving treatment
Intervention(s)	<ul style="list-style-type: none"> • Silver diamine fluoride (SDF) at different concentrations • Silver nitrate and fluoride at different concentrations, if applicable^b
Comparison	<ul style="list-style-type: none"> • No treatment • Fluoride varnish, atraumatic restorative therapy (ART), interim restorative therapy (IRT), interim stabilization therapy (IST), and dental sealants
Outcome	<ul style="list-style-type: none"> • Therapeutic benefit (prevention of caries; caries arrest; reduction in dentinal hypersensitivity) • Safety/adverse effects • Client/patient-important outcomes (acceptance, cost, quality of life)
Setting and context	<ul style="list-style-type: none"> • Dental hygienists • Traditional and non-traditional practice settings (long-term care, public health, rural and remote communities)

^aIncludes approximal surfaces

^bStudies with silver nitrate and fluoride only included for non-therapeutic outcomes (e.g., client/patient or caregiver acceptance, cost-effectiveness)

Table 2. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> • Years: 2000 to present • English language • Systematic reviews, randomized controlled trials (RCT), observational studies, technical reports • Studies involving application of SDF in a dental setting • Studies with at least one-week follow-up for clinical outcome measures 	<ul style="list-style-type: none"> • Animal, in vivo, ex vivo or in vitro studies • Abstracts, posters or conference proceedings • Editorials or commentaries • Duplicate studies • Studies involving SDF application outside the scope of dental hygiene practice in Canada (e.g., restorations, endodontic treatment)

Economics Evaluation Reporting Standards (CHEERS),²³ and CAse REport guidelines (CARE).²⁴ Quality scores were not calculated, but assessments were reviewed by all co-authors to determine study inclusion. Only one study was excluded at this stage due to unclear reporting of methods and results.²⁵

To synthesize evidence on the effectiveness of SDF in preventing and arresting coronal and root carious lesions, and dentinal hypersensitivity in child and adult population groups, data on effect sizes were extracted from available systematic reviews, meta-analyses, and primary studies. Performing a meta-analysis was considered beyond the scope of this review. Outcomes related to client/patient, caregiver, and provider acceptance of SDF treatment in a dental setting were obtained from clinical studies that reported adverse events, client/patient or caregiver satisfaction, and ease of application. To identify the indications, contraindications, and treatment protocol associated with SDF use, data contained in the methods section of primary studies and recommendations reported from clinical guidelines were extracted. This data included reporting information on operator characteristics, clinical settings, as well as education and training requirements, when available.

RESULTS

Description of search results

A total of 662 sources were retrieved. After eliminating duplicate studies and screening full-text articles for eligibility ($n = 79$), the authors identified 38 studies that met the criteria for inclusion (Figure 1). The 38 studies included 3 peer-reviewed policies and clinical guidelines,^{5,7,26} 1 technical report that assessed the clinical effectiveness and cost-effectiveness of SDF,¹¹ and 5 systematic reviews that provided unique information about SDF.^{6,9,10,12,27} The search also yielded 2 systematic reviews that were excluded as they were out of date or overlapped with other sources.^{28,29} There were 18 unique clinical studies reported across 23 sources that were included in this review; 12 of these studies were randomized controlled trials (RCT),³⁰⁻⁴¹ 3 were prospective controlled clinical trials,⁴²⁻⁴⁴ and 3 were pilot studies.^{25,45,46} Most clinical trials or pilot studies investigated the caries arresting properties of SDF

in primary dentition^{31,32,34,35,38,40-42} or in permanent first molars.^{34,43-45} Other trials include 3 RCTs that investigated root caries prevention or arrest^{33,37,39} and one RCT that investigated the effect of SDF in reducing tooth sensitivity in an adult population.³⁰ The remaining studies included in this review comprised 5 observational studies,⁴⁷⁻⁵¹ 2 economic evaluations,^{52,53} and 1 case report.⁵⁴

Quality of included studies

Results of reporting checklists for included studies are provided in Supplementary Tables 3 to 7 (available online at www.cdha.ca/cjdh). The majority of the systematic reviews searched at least 2 electronic databases, but only 1 review performed an exhaustive search of grey literature.⁶ When performed, meta-analyses did not assess for publication bias or sources of funding.^{30,31,33,41} There were no reports of subgroup analyses to assess the variation in effect size based on SDF concentration, application frequency or risk of bias.⁸⁻¹⁰

Most RCTs did not clearly report on allocation concealment and assignment. Only 3 of the 12 RCTs provided details on the type of analyses conducted, which were intention-to-treat analyses.^{31,32,41} Four RCTs appeared to be underpowered at the time of the final follow-up,^{33,36,38,39} and no clinical trial provided information on how missing data were analysed. Of the 3 prospective controlled clinical trials, 2 calculated a priori sample sizes^{43,44} but did not provide baseline demographic characteristics or reasons for loss to follow-up.⁴²⁻⁴⁴ Thus, it is difficult to discern the quality of these clinical trials. Results from the quality appraisal checklists for observational studies, economic evaluations, and case reports revealed no major sources of bias for these studies.

Description of outcomes

Clinical effectiveness of SDF

Primary studies involving the clinical application of SDF varied by recipient age, health characteristics, and country. Included studies were conducted in Hong Kong,^{31-34,37,39,41,42,55} China,⁴⁰ Nepal,³⁸ Phillipines,⁴⁴ Cuba,⁴³ Brazil,^{35,45,56} Peru,^{30,46} and the United States.³⁶ Most clinical trials reported background fluoride exposure, including community water fluoride (CWF) levels. Three clinical studies in primary dentition were conducted in communities with fluoridation levels ranging from 0.03 ppm to 0.5 ppm,^{31,38,42,57} 1 study in permanent dentition was conducted in a community with CWF at 0.09 ppm,⁴³ and 2 of the 3 studies on root surfaces were conducted at CWF levels of 0.5 ppm.^{33,39}

Prevention and arrest of carious lesions in primary dentition. The majority of clinical studies assessed the effectiveness of SDF in arresting or preventing primary carious lesions (Tables 3 and 4). Study participants ranged in age from 3 to 8 years.^{31,32,36,38,39,41,42,47} Most studies that assessed caries arrest used visual inspection and tactile detection,^{31,32,36,38,40-43,49} but only 2 reported the use of standardized criteria,^{31,38} such as the ICDAS.³¹ Clinical studies on primary dentition compared SDF to sodium fluoride

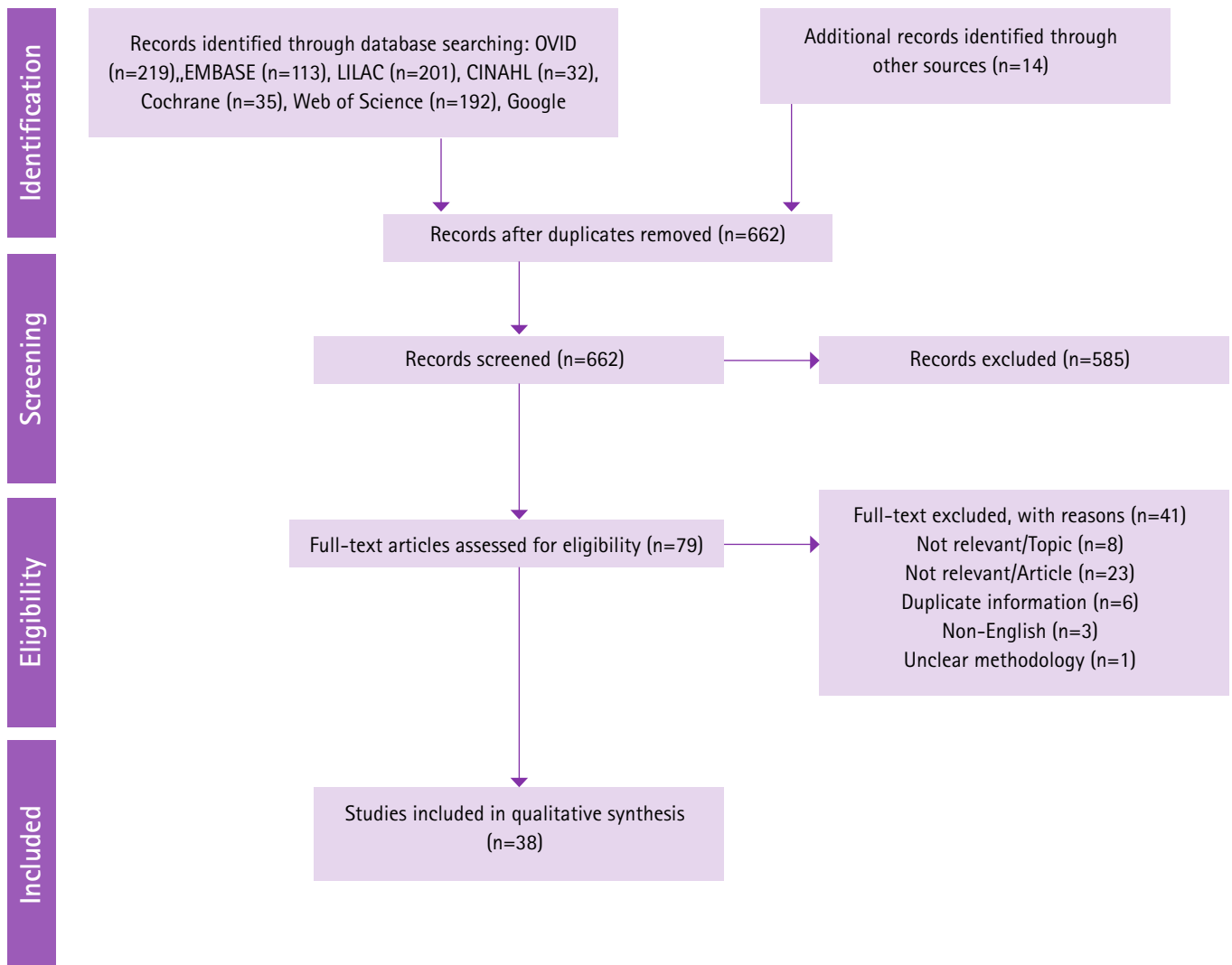


Figure 1. PRISMA flow diagram for systematic search strategy (adapted from Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med.* 2009;6(7): e1000097. doi:10.1371/journal.pmed1000097)

varnish,^{31,42} minimally invasive restorative treatments, such as glass ionomer cement,³⁹ atraumatic restorative therapy (ART),⁴⁷ and no treatment.^{36,42} The combined effect of SDF with a reducing agent was also assessed in one study, which revealed a lower proportion of study participants with black stain and similar effectiveness when adding potassium iodine as a reducing agent compared to SDF alone (93% and 90% caries arrest rate, respectively) at 30 months.³⁸ Based on results of one systematic review and one policy document,^{6,26} SDF had more favourable results compared to fluoride varnish and ART for arresting carious lesions in primary dentition (Table 5).

Prevention of carious lesions in permanent first molars.

Two clinical trials assessed the caries prevention effects of SDF on occlusal surfaces of permanent first molars in children.^{34,43} Llodra compared SDF to no treatment whereas Liu compared SDF to no treatment, sealant or 5% sodium fluoride varnish (NaF) for the prevention of new carious lesions.^{34,43} Both studies used visual-tactile

detection to assess their outcome. These studies revealed superiority of sealants to SDF,³⁴ comparable findings of SDF to sodium fluoride,³⁴ and higher prevented fraction with SDF compared to no treatment.⁴³ One pilot study also measured the caries arresting effect of SDF on occlusal surfaces of first molars compared to toothbrushing and glass ionomer cement used as a sealant.⁴⁵ Based on a sample size of 20 teeth per group and use of bitewing radiographs to assess caries activity, Braga and colleagues found comparable caries arrest rates in all 3 groups at 30 months.⁴⁵ No systematic review reported results exclusively for the effect of SDF in permanent first molars or in permanent dentition.

Prevention of root caries in adults. Three studies assessed the effectiveness of SDF in preventing root caries in adults as an adjunct to oral hygiene instruction or in comparison to soda or sterile water.^{33,37,39} Other comparisons were to chlorhexidine varnish and 5% NaF.³⁷ Study participants ranged in age from 65 to 85 years. Outcomes were assessed

Table 3. Overview of primary studies involving clinical application of SDF (n = 18)

	Clemens 2017 ⁴⁹	Duangthip 2018 ^{31,57}	Fung 2017 ^{32,41,55}	Zhi 2012 ⁴⁰	Chu 2002 ⁴²	Milgrom 2018 ³⁶	Yee 2009 ³⁸	dos Santos 2012 ²⁵	Mattos-Silveira 2015 ³⁵	Barreto 2017 ⁴⁷	Braga 2009 ⁴⁵	Monse 2012 ⁴⁴	Llodra 2005 ⁴³	Liu 2012 ³⁴	Li 2016 ³³	Tan 2010 ³⁷	Zhang 2013 ³⁹	Castillo 2011 ³⁰	Total
Dentition type																			
Primary	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									10
Permanent											✓	✓		✓	✓	✓	✓	✓	7
Both													✓						1
Tooth location																			
Anterior					✓														1
Posterior									✓	✓	✓	✓		✓				✓	6
Both	✓	✓	✓	✓		✓	✓	✓					✓		✓	✓		✓	11
Tooth surfaces																			
Occlusal										✓	✓	✓		✓					4
Interproximal									✓	✓									2
Buccal																			✓
All of the above	✓	✓	✓	✓	✓	✓	✓	✓					✓						9
Root surfaces															✓	✓	✓		3
Comparison groups																			
Variation of SDF treatment		✓	✓	✓	✓		✓								✓		✓		7
Fluoride varnish		✓												✓		✓			3
Chlorhexidine																✓			1
Dental sealant														✓					1
GIC dental sealant				✓					✓		✓								3
Atraumatic restorative therapy								✓		✓		✓							3
Placebo						✓			✓		✓			✓	✓	✓	✓		7
No treatment							✓					✓	✓					✓	4
No comparison	✓																		1
Clinical outcomes investigated																			
Caries arrest	✓	✓	✓	✓	✓	✓					✓		✓		✓		✓		10
Caries incidence							✓					✓	✓	✓		✓	✓		6
Discomfort									✓	✓									2
Reduction in pain																		✓	1
Abscess, toothache, fistula								✓											1
Detection																			
Visual-tactile	✓	✓	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓	✓	✓	13
Visual-tactile and radiographs						✓													1
Not applicable								✓	✓	✓								✓	4
Adverse effects investigated																			
Black stain		✓	✓	✓	✓		✓				✓		✓		✓				8
Tooth pain/toothache			✓					✓										✓	3
Gum pain			✓			✓													2
Gum bleaching			✓			✓							✓						3

Table 3 continued...

	Clemens 2017 ⁴⁹	Duangthip 2018 ^{31,57}	Fung 2017 ^{32,41,55}	Zhi 2012 ⁴⁰	Chu 2002 ⁴²	Milgrom 2018 ³⁶	Yee 2009 ³⁸	dos Santos 2012 ²⁵	Mattos-Silveira 2015 ³⁵	Barreto 2017 ⁴⁷	Braga 2009 ⁴⁵	Monse 2012 ⁴⁴	Llodra 2005 ⁴³	Liu 2012 ³⁴	Li 2016 ³³	Tan 2010 ³⁷	Zhang 2013 ³⁹	Castillo 2011 ³⁰	Total	
Damage to gingiva																		✓	1	
Satisfaction	✓		✓	✓																3
Systemic toxicity			✓			✓														2
Follow-up period																				
Same day									✓	✓										2
7 days																			✓	1
14 to 21 days						✓														1
3 months	✓							✓												2
18 months		✓										✓								2
24 months				✓			✓						✓					✓		4
30 months			✓		✓						✓				✓					4
36 months													✓			✓				2

Table 4. Description of primary studies involving clinical application of silver diamine fluoride

Age group and sample size	Type of dentition	SDF brand, concentration, and frequency ^a	Setting	Provider	Follow-up	Clinical outcome/ Adverse effects	Reference
CHILDREN							
2 to 5 years old Mean = 3.6 years (+/-0.6) 30 children	Primary dentition	Advantage Arrest (38%) a. One application, with option of second application	Community clinic	Dentist	3 months	Caries arrest rate = 98.0% (CI = 95,100) • No comparison group • No adverse effects	Clemens 2017 ⁴⁹
3 to 4 years old Mean = 41 months (+/-4.0) 275 children	Primary dentition	Cariestop (30%) a. Every 12 months b. Three applications at weekly interval	School setting	Dentist	18 months 30 months	Caries arrest rate (30 months) a. SDF = 44% (109/246) b. SDF = 45% (97/218) NaF = 51% (95/185) • Black stain on dentine surface • No other adverse effects	Duangthip 2016 ³¹ Duangthip 2017 ⁵⁶
3 to 4 years old Mean = 3.8 years (SD = 0.6) 834 children	Primary dentition	Cariestop (12%) a. Every 6 months b. Every 12 months Saforide (38%) c. Every 6 months d. Every 12 months	School setting	Clinician/ trained dentist	18 months 30 months	Mean number of arrested caries at 30 months (SD) a. 12% SDF = 2.59 (2.94) b. 12% SDF = 2.85 (2.91) c. 38% SDF = 3.20 (3.71) d. 38% SDF = 3.49 (3.27) • Black stain on dentine surfaces (36.7% to 76.3%) • Tooth/gum pain discomfort (3.7% to 7.0%) • Gum swelling (1.5% to 2.9%) • Gum bleaching (3.0% to 5.7%) • No reports of systemic toxicity	Fung 2016 ⁴¹ Fung 2017 ³² Duangthip 2017 ⁵⁵

Table 4 continued...

Age group and sample size	Type of dentition	SDF brand, concentration, and frequency ^a	Setting	Provider	Follow-up	Clinical outcome/ Adverse effects	Reference
3 to 4 years old Mean = 3.8 years (+/-0.6) 181 children	Primary dentition	Saforide (38%) a. Every 6 months b. Every 12 months	Community setting	Dentist	24 months	Caries arrest rates a. SDF(6 mo) = 90.7% b. SDF(12 mo) = 79.2% GIC = 81.8% • Black stain on treated carious lesions	Zhi 2012 ⁴⁰
3 to 5 years old Mean = 4.0 years (SD = 0.8) 375 children	Primary dentition	Saforide (38%) a. Every 12 months with excavation (exc.) b. Every 12 months no exc.	School setting	Dentist	30 months	Mean number of arrested caries (SD) a. SDF + exc. = 2.49 (0.27) b. SDF = 2.82 (0.30) 5% NaF + exc. = 1.45 (0.19) 5% NaF = 1.54 (0.27) Control = 1.27 (0.19) • No adverse effects	Chu 2002 ⁴²
3.5 to 5.6 years old Mean = 4.8 years (+/-0.6) 55 children	Primary dentition	Advantage Arrest (38% silver; 5.5% fluoride) a. One application	Community-based dental clinic	Dental provider	14 to 21 days	Caries arrest rate (21 days) SDF = 100% (15/29) Placebo = 2.9% (1/35) • No gingival or soft tissue stomatitis or ulcerative lesions were identified. • Adverse events (diarrhea or stomach ache) were reported by participants in a supplemental table.	Milgrom 2017 ³⁶
3 to 9 years old Mean = 5.2 years (SD=1.2) 624 children	Primary dentition	Bees Brand (38%) a. One application with reducing agent (tea) b. One application no reducing agent PROBEM (12%) c. One application no reducing agent	School setting	Trained primary health workers supervised by dentist	24 months	Mean number of arrested caries (SD) 38% SDF = 2.1 (0.3) 38% SDF + tea = 2.2 (0.3) 12% SDF = 1.5 (0.3) Control = 1.0 (0.2) • Black discoloration of carious dentin	Yee 2009 ³⁸
5 to 6 years old 50 children	Primary dentition	Cariestop (30%) a. One application	University dental clinic	Not specified	3 months	• No clinical outcome reported • No toothache, abscess or fistula reported in SDF group at 3-month follow-up	dos Santos 2012 ⁵⁶
5 to 7 years old 22 children	Primary dentition	Cariostatic (10%) a. Two applications within one-week interval	University dental clinic	Dentist	30 months	• No difference in number of active caries lesion across SDF, non-treated, and GIC groups • Black staining	Braga 2012 ⁴⁵
Mean = 6.29 years (+/-0.48) 373 children	Primary and permanent dentition	Fluoroplat (38%) a. Every 6 months	School setting	Not specified	36 months	• Higher number of inactive caries surfaces in SDF groups compared to control for primary and permanent teeth • Small, mildly painful white lesion in the mucosa, which disappeared at 48 hours without treatment (3 participants)	Llodra 2005 ⁴³
3 to 10 years olds Mean = 6.56 years (+/-1.69) 141 children	Primary dentition	Cariestop (30%) a. One application	School setting	Pediatric dentist	Same day	• Clinical outcome not reported • No adverse effects • See Table 6	Mattos-Silveira 2015 ³⁵

Table 4 continued...

Age group and sample size	Type of dentition	SDF brand, concentration, and frequency ^a	Setting	Provider	Follow-up	Clinical outcome/ Adverse effects	Reference
6 to 8 years old 94 children	Primary dentition	Not specified a. One application	School setting	Not specified	Same day	<ul style="list-style-type: none"> • Clinical outcome not reported • No adverse effects • See Table 6 	Barreto 2017 ⁴⁷
6 to 8 years old Mean = 6.7 years (+/- 0.7) 704 children	Permanent dentition	Saforide (38%) a. One application	School	School nurses who received one-day training; supervised by dentist	18 months	<ul style="list-style-type: none"> • Greater caries increment in non-treated groups than SDF groups. Greater caries increment in SDF groups compared to dental sealant group • No adverse effects 	Monse 2012 ⁴⁴
Children in grades 2 and 3 Mean = 9.1 years 485 children	Permanent pit and fissure of first molars	Saforide (38%) a. Every 12 months	Portable dental chair in school setting	Dentist	24 months	<ul style="list-style-type: none"> • New dentin caries compared to control (prevented fraction) SDF = 41% 5% NaF = 41% Sealant = 60% • Transient bitter taste • No adverse effects 	Liu 2012 ³⁴
ADULTS							
Mean = 43 to 44 years 126 adults	Permanent dentition	Saforide (38%) Assumed a. One application	Dental clinic	Clinician (unspecified)	7 days	<ul style="list-style-type: none"> • Greater change in mean VAS score for pain in SDF group compared to controls ($p < 0.05$). • No adverse effects 	Castillo 2011 ³⁰
23 to 52 years old Mean = 36.2 years 6 adults	Permanent dentition	Saforide (38%) a. One application	Dental clinic	Not specified	1 day	<ul style="list-style-type: none"> • Clinical outcome not reported • No adverse effects 	Vasquez 2012 ⁴⁶
Mean = 72.2 years (+/-5.8) 67 adults	Permanent dentition (root surfaces)	Saforide (38%) a. Every 12 months b. Every 12 months with potassium iodide (KI)	Portable dental chair in community setting	Dentist	30 months	<ul style="list-style-type: none"> • Root caries arrest rate a. SDF = 90.0% b. SDF + KI = 92.5% Control = 45.0% • Black stain on arrested root surface • No adverse effects 	Li 2016 ³³
60 to 89 years old Mean = 72.5 years (+/-5.7) 227 adults	Permanent dentition (root surfaces)	Saforide (38%) a. 3 applications every 12 months	Dental hospital	Dentist	24 months	<ul style="list-style-type: none"> • Mean number of arrested root caries surfaces (SD) • OHI = 0.04 (0.02) • OHI + SDF = 0.28 (0.06) • OHI + SDF + OHE = 0.33 (0.10) • No adverse effects • Specified that follow-up was too short to support or refute possible long-term adverse effects 	Zhang 2013 ³⁹
Mean = 78.8 years (+/-6.2) 203 adults	Permanent dentition (root surfaces)	Saforide (38%) assumed a. Every 12 months	Portable dental chair in residential and nursing homes	Dentist	36 months	<ul style="list-style-type: none"> • Risk of developing new root caries compared to oral hygiene instruction • OHI + SDF RR = 0.19 (0.07-0.46) • OHI + 5% NaF RR = 0.26 (0.10-0.63) • OHI + CHX RR = 0.27 (0.11-0.66) • No adverse effects 	Tan 2010 ³⁷

^aTreatment groups distinguished by letter

Table 5. Effectiveness of silver diamine fluoride across systematic reviews and select primary studies

Indication	Reported outcomes			Quality assessment	
Caries arrest in primary dentition	Caries arrest at 30 months ⁹ (SDF vs other treatments) RR = 1.48 (1.32 to 1.66)		Caries arrest ⁶ (SDF vs fluoride or ART) ^a RR = 1.66 (1.41, 1.95)	Very low to low ²⁶	
Caries arrest in permanent first molars	Mean caries score at 30 months ⁴⁵ SDF = 1.0 ^b GIC = 1.3 ^b CTT = 1.4 ^b	Dentin caries increment at 18 months compared to no treatment ⁴⁴ SDF brushing group ^c RR = 0.71 (0.12/0.17) SDF no-brushing group ^c RR = 1.13 (0.09/0.08)	New dentin caries at 24 months ³⁴ (SDF vs control) ^d RR = 0.59 PF = 41%	Mean number of inactive caries at 36 months ⁴³ (SDF vs control) RR = 0.35 PF = 65%	Unclear Not assessed in existing systematic reviews ⁹
Root caries prevention and arrest	Prevention of new caries (OHI + SDF vs OHI + placebo) ³⁷ NNT = 2.5 ^e RR = 0.19 ^e (OHI + SDF vs OHI + placebo) ³⁹ NNT = 3.3 RR = 0.75 (OHI + SDF + OHE vs OHI + placebo) ³⁹ NNT = 1.59 RR = 0.53		Arrest of root surface caries (OHI + SDF vs OHI + placebo) ³⁹ NNT = 4.17 RR = 7.0 (OHI + SDF + OHE vs OHI + placebo) ³⁹ NNT = 3.45 RR = 8.25 (OHI + SDF vs OHI + placebo) ³³ NNT = 1.8 RR = 2.09	Unclear Not assessed in existing systematic reviews ¹²	
Tooth sensitivity	Mean change in visual analog score for pain after 7 days ³⁰ (SDF vs no treatment) Lima study site = -35.58 (-97, 12) vs 0.4 (-38,33) Cusco study site = -23.4 (-56, 24) vs -5.5 (-77, 18)			Unclear No systematic review available	

^aSubgroup analysis used due to heterogeneity in silver materials studied; ^ball groups reported mean caries scores of 3 at baseline; ^csealants were more favourable than SDF; ^dno difference compared to fluoride varnish, but lower PF than sealants; ^ethe effect of SDF was more favourable than chlorhexidine or 5% sodium fluoride. RR = risk ratio: the rate of the event in the exposed (SDF) group compared to the rate in the unexposed group. PF = prevented fraction: the proportion of the total load of the disease that has been prevented by exposure to SDF. NNT = number needed to treat: The number of persons needed to be treated in order to prevent one event (e.g., decayed tooth surface).⁶⁴

Table 6. Acceptance and adverse events associated with silver diamine fluoride

Aspect	Outcome
Children's reported discomfort with treatment	Approximately 22% of all children 3 to 10 years old reported some level of discomfort. SDF and control group reported less discomfort than resin infiltrant group. RR = 0.29 (SDF group compared to resin infiltrant group). ³⁵
Children's anxiety scores while receiving treatment	34% of all child participants (6 to 8 years old) reported some anxiety with ART or SDF treatment. No significant difference in anxiety levels of children treated with ART or with SDF. ⁴⁷
Adverse effects reported in clinical studies (randomized and non-randomized)	Black stain reported in clinical trials ^{31-33,38,40-43,45,54,57} 3 participants reported small, mildly painful white lesion in the mucosa that disappeared at 48 hours without treatment ⁴³ One participant reported transient bitter taste ³⁴ No reports of toothache, abscess or fistula in children 5 to 6 years old who received SDF (n = 25) ⁵⁶
Caregiver actual and perceived acceptance of SDF treatment	Most parents of children (age 3.6 years +/-1.0) receiving SDF treatment strongly agreed with statements about the ease of SDF application (63.3%), their comfort with discolouration of teeth (53.3%), painlessness of the process (70.0%), and taste of SDF (63.3%) ⁴⁹ 46.6% of parents who were asked about the option of receiving SDF treatment for their children reported SDF to be unacceptable on anterior teeth, whereas most were somewhat accepting of it on posterior teeth (45.8%). There was greater acceptance by parents of children who needed treatment under general anaesthesia than those who had uncooperative or upset children. ⁵⁰
Dental professional perceptions of SDF treatment	Dental hygienists were asked about their perceptions of SDF use in non-traditional practice. Most dental hygienist participants felt that the advantages of SDF outweighed the disadvantages for their patient populations (88%). Most respondents felt that SDF was within the dental hygiene scope of practice (>60%). The majority of respondents were familiar with SDF but had not used the product. ⁴⁸ The majority of graduate pediatric dentistry program directors in the US surveyed agreed, strongly agreed or very strongly agreed with concerns regarding parental acceptance (91.8%), reimbursement (73.0%), standard of care (67.5%), evidence base (63.5%), off-label use (59.4%), cost (58.1%), and adequate training (55.4%). ⁵¹

Table 7. Overview of potential clinical indications and contraindications for SDF

	Clinical guidelines (Horst ⁵ and AAPD ²⁶)		Inclusion/exclusion criteria of primary studies	
	Indications	Contraindications	Inclusion	Exclusion
Population characteristics	<ul style="list-style-type: none"> Inability to tolerate standard treatment Precooperative child Frail elder Individuals with severe cognitive or physical disabilities Dental phobias Patients without access to dental care Extreme caries risk Salivary dysfunction, Sjören syndrome, polypharmacy, aging, methamphetamine use 	<ul style="list-style-type: none"> Silver allergy Pregnant women Women in their first 6 months of breastfeeding Stomatitis Desquamative gingivitis or mucositis 	<ul style="list-style-type: none"> Generally healthy^{31,32,34,40,41,55,57} Elders with basic self-care ability^{33,37,39} Not reported 	<ul style="list-style-type: none"> Systemic disease⁵⁷ or serious medical problems^{33,37,39} Long-term medications⁵⁷ Underweight (<5 kg)³⁶ Uncooperative^{6,49} or children with negative behaviours⁴⁷ Known sensitivity to silver³⁰ Salivary gland function significantly affected by disease, medication or treatment such as radiotherapy³³ Ulceration or leukoplakia³⁰
Tooth/site characteristics	<ul style="list-style-type: none"> Active cavitated caries lesions Difficult to treat dental carious lesions 	<ul style="list-style-type: none"> Clinical signs of pulp involvement 	<ul style="list-style-type: none"> Enamel caries defined as ICDAS score of 2³⁴ or 3³⁶ Active initial caries without cavitation on occlusal surfaces⁴⁵ Dentin caries^{32,41,42,47} Active caries not involving pulp⁴⁰ 	<ul style="list-style-type: none"> Pulp involvement or non-vital teeth (obvious discolouration premature hypomobility)^{40,42} Grossly broken down, crown missing, abscess or a sinus, spontaneous or elicited pain from caries⁴⁹ Hypoplastic defects, restorations or sealants⁴⁵

Table 8. Reported SDF applications for treatment of coronal and root caries, and tooth sensitivity across primary studies

		Caries prevention and arrest		Root caries arrest (n = 5)	Tooth sensitivity (n = 1)	Total
		Primary dentition (n = 18)	Permanent dentition (n = 4)			
Concentration ^b	10% to 12%	3	1	0	0	4
	30%	4	0	0	0	4
	38%	10	3	1	1	15
	Not specified	1	0	0	0	1
Technique ^b	Excavation	3	1	0	0	4
	No excavation	8	0	0	0	8
	Not specified	7	3	1	1	12
Application time ^b	<1 minute	2	0	0	1	3
	1 minute	4	1	0	0	5
	2 minutes	4	0	0	0	4
	3 minutes	2	2	0	0	4
	Not specified	6	1	5	0	12
Number of applications ^b	Once	7	1	0	1	9
	More than once	11	3	0	0	14
Frequency ^b	Weekly	1	1	0	0	2
	3 weeks or 3 months	1	0	0	0	1
	Every 6 months	3	1	0	0	4
	Every 12 months	6	1	1	0	8
	Not applicable	7	1	0	1	9

Table 8 continued...

		Caries prevention and arrest		Root caries arrest	Tooth sensitivity	Total
		Primary dentition (n = 18)	Permanent dentition (n = 4)	(n = 5)	(n = 1)	
Provider ^a	Dentist/clinician	11	1	1	1	14
	Health worker	3	3	0	0	6
	School nurse	0	0	0	0	0
	Not specified	4	1	0	0	5
Setting ^c	Clinic	4	0	2	1	7
	Portable clinic	0	2	3	0	5
	School	6	0	0	0	6
	Community	1	0	0	0	1
	Not specified	7	0	0	0	7

^aTrials reported across multiple studies recorded once; ^btrials including multiple SDF groups recorded separately; ^ctrials including multiple SDF groups recorded once

by visual–tactile detection and reported by Hendre in a systematic review.¹² Results indicate that SDF performed more favourably, with higher prevented fraction, than chlorhexidine or 5 % NaF.¹² Li and colleagues also revealed similar root caries arrest rates between SDF alone and SDF with potassium iodine (KI).³³ Due to heterogeneity in study outcomes, no meta-analyses were performed to report the pooled effect of SDF in arresting root caries.¹²

Reduction in dentinal hypersensitivity. One study assessed the effectiveness of SDF in reducing tooth hypersensitivity on permanent cuspid and bicuspid teeth of middle-aged adults (mean age = 43 to 44 years).³⁰ Castillo and colleagues reported greater reduction in pain based on a visual analog score, in the SDF group compared to no treatment (Table 5).³⁰

Safety and adverse events

All included clinical trials provided a statement regarding adverse events during the trial period; these events are listed in Table 4. Only one study provided a supplemental list of adverse events for each study participant.³⁶ Milgrom and colleagues reported moderate adverse events, including diarrhea and stomach ache, which were claimed to be unrelated to the SDF product.³⁶ One preliminary study evaluated safety and toxicity of SDF among a group of adults.⁴⁶ Vasquez and colleagues noted that maximum serum fluoride concentrations did not exceed those found from using fluoridated toothpaste, and concluded that SDF posed no toxic risk either from fluoride or silver exposure.⁴⁶ Castillo assessed damage to the gingiva as a primary outcome, and found greater prevalence of erythema, as indicated by redness with bleeding on probing, in the SDF group compared to control group at 24 hours after application to root surfaces. However, results were not statistically significant after 7 days.³⁰

Black staining was reported as an adverse outcome of SDF application across all types of clinical trials, including studies on primary and permanent dentition, root surfaces,

and dentinal hypersensitivity (Table 4). One clinical trial evaluated adverse events as a secondary outcome, including tooth pain, gum pain, gum bleaching, and systemic toxicity, between annual and semiannual applications of SDF at 12% and 38%.⁵⁵ Their findings revealed a low prevalence of adverse events across all SDF groups (most less than 10%), with no report of systemic toxicity by any participant. Duangthip and colleagues reported that gum pain resolved without treatment within 2 days,^{32,57} and a greater proportion of black stain was found in groups receiving 38% SDF (annual and semiannual applications) than in 12% SDF groups.⁵⁷

Acceptance

Perspectives from clients/patients and caregivers. A total of five studies evaluated participant or caregiver acceptance either as a primary or secondary outcome (Table 6).^{35,47,49,50,55} Of the studies that assessed participant or caregiver acceptance as a primary outcome, one randomized control trial assessed participant discomfort during SDF application in comparison to a control group,³⁵ and one cross-sectional analysis of a randomized control trial from Brazil measured anxiety levels between groups of children who received SDF or ART.⁴⁷ Both studies reported no difference in the levels of anxiety or discomfort between groups.^{35,47}

Three studies assessed parental acceptance of treatment through self-reported questionnaires.^{49,50,55} From 2 clinical studies, the majority of parents (>60%) reported satisfaction with their child's dental appearance at follow-up visits. However, anterior teeth had a lower rate of satisfaction compared to posterior teeth.^{49,55} A cross-sectional study by Crystal and colleagues asked parents about their opinions of using SDF to treat dental caries for their children on anterior and posterior teeth.⁵⁰ Most parents reported higher preference for SDF use in posterior teeth, due to cosmetic concerns with black staining. No information on adult recipient perspectives of application was available.

Perspectives from dental professionals. Perceptions of SDF among dental professionals were assessed in 2 studies.^{48,51} Chhokar and colleagues administered an online survey to dental hygienists in alternative practice settings (e.g., clinic care, education, and administration) in California.⁴⁸ Their findings revealed that most respondents did not feel clinical staining was a barrier to treatment (<15%), but parental acceptance may be an issue (50%).⁴⁸ In 2015, Nelson and colleagues conducted a survey of pediatric program directors in the United States to identify concerns and barriers to implementation of SDF. The majority of respondents agreed with concerns that parental acceptance, standard of care, evidence base, and reimbursement mechanisms were barriers to implementation.⁵¹

Cost

Two studies explored costs associated with the application of SDF in a dental setting.^{52,53} Hansen and colleagues assessed the impact of silver nitrate and fluoride varnish on future dental care utilization and cost in the United States.⁵² They identified higher overall dental care costs in the silver nitrate + fluoride varnish group than non-silver group.⁵² Schwendicke and colleagues compared SDF for the prevention of root caries to no treatment, fluoride rinse or chlorhexidine varnish.⁵³ Their simulation analysis revealed that SDF was cost effective for root caries prevention compared to other treatments.

Description of treatment protocols

Indications and contraindications

Clinical indications and contraindications for using SDF in a dental setting were outlined in 2 clinical guidelines.^{5,26} Indications and contraindications from North American guidelines and from inclusion and exclusion criteria identified in clinical studies are provided in Table 7. Indications for the use of SDF to arrest or prevent carious lesions include consideration for caries risk level, access to dental care, and behavioural or medical challenges with client/patient management.^{5,26} Other clinical indications reported by Horst and from clinical trials suggest that SDF only be applied to cavitated carious lesions that do not exhibit signs of pulpal involvement.⁵ In terms of therapeutic implications, the American Academy of Pediatric Dentistry (AAPD) has provided conditional recommendations on the use of SDF for arresting caries lesions only in primary teeth.²⁶ No recommendation for or review of the use of SDF in permanent dentition was identified in this review.

Concentration, frequency, and application of silver diamine fluoride. Table 8 provides an overview of clinical protocols used in primary studies. The majority of studies assessed the effect of SDF at 30% to 38% concentrations,^{30-37,39-44,46,49} 3 studies reported across 4 articles compared or assessed SDF at 10% to 12% concentration,^{32,38,41,45} and 1 study did not specify the concentration of SDF.⁴⁷ Five studies explicitly stated that they did not excavate prior to application of SDF,^{31,38,42,43,56} and 1 study indicated that soft decayed tissues were

removed by hand excavation.⁴⁰ Studies that applied SDF to root surfaces of teeth did not involve excavation or prior prophylaxis.^{33,37,39} In terms of application time, Clemens assessed application time and lesion arrest rate and found no difference in the length of application time and proportion of arrested lesions.⁴⁹

In terms of frequency of SDF application, 9 studies assessed one-time application of SDF,^{25,30,35,36,38,44,46,47,49} 4 articles reported application of SDF every 6 months,^{32,40,41,43} 7 studies reported across 8 articles applied SDF every 12 months,^{31,32,34,37,39-42} and 2 studies applied SDF at weekly intervals.^{31,45} As mentioned previously, due to heterogeneity among studies, no meta-analyses have been performed to assess the effectiveness by concentration or frequency. Recommendations on the technical application of SDF were available from 2 protocols. The University of California San Francisco (UCSF) protocol for arresting caries, developed by Horst, suggests isolating and drying affected teeth prior to application, but no need for excavation,⁵ and the AAPD suggests that clinical application should not deviate from manufacturer recommendations.⁷

Context and training

Most clinical studies were conducted in non-traditional practice settings such as schools,^{31,32,35,38,41-44,47} portable clinics,^{33,34,37} and other community settings (Table 8).⁴⁰ In 12 studies, SDF was applied by a dentist or clinician in a dental setting,^{31-37,39-42,45,49} 2 studies involved application of SDF by trained school nurses or primary health workers who were supervised by a dentist,^{38,44} and 5 studies did not specify the provider.^{25,30,43,46,47} In terms of training requirements, school nurses received one day of training.⁴⁴ Results from a 2015 cross-sectional survey of pediatric dental program directors revealed that 79.7% and 25.7% of pediatric dental programs in the United States teach silver diamine fluoride through didactic or clinical courses, respectively. No other sources identified training requirements for SDF in dental practice.

DISCUSSION

This scoping review synthesizes the research on the effectiveness of SDF, compared to other agents, in preventing or arresting caries (and reducing tooth sensitivity). Based on this synthesis, recommendations can be made for dental hygiene practice in Canada.

Research on the effectiveness, safety, and acceptance of SDF has increased over the past 20 years, which has facilitated a better understanding of the use of SDF in dentistry. Unfortunately, this review did not identify any study that assessed the effect of SDF for any indication on permanent dentition in individuals 10 to 60 years old. The authors would also like to draw attention to potential issues around the transferability of evidence to the North American context due to differences in demographics, caries risk status, and oral hygiene behaviours between populations.

The findings presented in this scoping review suggest

that SDF may be useful in managing incipient to cavitated carious lesions in primary dentition or exposed or carious root surfaces in permanent dentition. Clinical studies on the use of SDF in primary dentitions suggest that SDF may be superior to fluoride treatment in arresting caries lesions.^{6,9,26} Due to the scarcity of research, this review could not confirm the effect of SDF in arresting coronal caries or reducing dentinal hypersensitivity in permanent dentition. In addition, due to heterogeneity in outcomes and timepoints used to assess effectiveness, the superiority of SDF over other treatment modalities such as ART or sealants using glass ionomer cement cannot be confirmed. Overall, the scope of evidence presented in this review is similar to evidence for most preventive therapies in dentistry, such as fluoride varnish, gels, and ART. In general, this research focusses on investigating the efficacy of preventive therapies in healthy children and elderly groups and seldom assesses their application in adult or special needs populations.⁵⁸⁻⁶¹

Research on provider type and practice setting suggests that SDF may be a suitable provisional therapy in resource-limited settings. This review highlighted that SDF is a safe and acceptable therapy that can be delivered by trained and supervised non-dental personnel, such as nurses or primary care workers. This review, however, did not identify any detailed training protocols for clinicians interested in applying SDF. Currently, there are 2 clinical protocols available in North America^{5,7}; both sources acknowledge that there is no established frequency for SDF application and insufficient evidence for the types and depths of carious lesions that can be arrested successfully.⁷ Thus, it is expected that clinical protocols will evolve as research continues in these areas.

This review did not identify any major risks or harm related to SDF when used in healthy population groups and applied directly to carious lesions. The majority of reported adverse effects and parental concerns related to staining of treated teeth and discomfort that resolved over time.^{49,50,55} Given the low incidence of adverse events reported in clinical trials, evidence suggests that SDF is a safe therapy for healthy individuals. However, the therapeutic benefits and risks of SDF may not be transferable to individuals excluded from clinical studies, such as individuals with compromised immune systems or other systemic conditions. For example, Lewis and colleagues suggest that SDF may not be suitable for older adults with thinner gingiva, as its application could cause gingival burn or irritation.⁶² However, no trial has confirmed or refuted this claim. Evidence of long-term adverse effects of SDF material from longitudinal trials is limited to 3-year timeframes, which may not be long enough to support or refute long-term benefits or harms.³⁹

The findings from this review show that SDF is not used as a replacement for the generalized application of fluoride or remineralization agents, but rather as a site-

specific application for indicated teeth. The results also do not suggest that SDF replaces any existing therapy within the scope of dental hygiene practice, but evidence supports its use as an interim therapy for managing coronal caries when permanent restorative treatment is not available. As with any therapy, providers interested in applying SDF should familiarize themselves with the indications, contraindications, benefits, and risks of using SDF as outlined in this review, and keep abreast of changes to these aspects as evidence continues to emerge. Further, providers should practise professional discretion and relay relevant information as part of the informed consent process if they intend to use SDF in practice.

Overall, there is a notable gap in research on the use of SDF in dentistry. In terms of population groups, no information is available for adolescents and young to middle-aged adults. This gap also exists in research on the effect of topical fluorides in dentistry.⁵⁹ As stated previously, due to inconsistencies in treatment protocols across clinical studies, there is no evidence either to support any particular application frequency, or to show the superiority of SDF over existing therapies. Therefore, this review does not provide definitive conclusions about the effect of SDF in adolescents and adults or medically compromised groups or treatment recommendations. Nonetheless, promising results among children encourage the use of SDF in population groups where definitive treatment is not readily available, when coupled with consistent monitoring until definitive treatment is available. Approval from Health Canada also provides more opportunities for its wider use in both public and private sectors.

This review suggests that more research on the effectiveness of SDF in different population groups and in comparison to other minimally invasive treatments, such as ART or interim stabilization therapy, is warranted. Further steps within the HTA framework should also be carried out to determine the economic, ethical, and social implications of adopting SDF in clinical practice. These steps include an assessment of the potential benefits and harms associated with providing SDF therapy to different client/patient groups, and whether SDF could affect later provision of care.⁶³ Finally, future research should also incorporate client/patient-important outcomes, such as function, pain/discomfort, and esthetics to better understand the impacts of SDF from the recipient's perspective.

This scoping review has some limitations. For example, the inclusion criteria were restricted to studies reported in English, and meta-analyses beyond those reported in existing systematic reviews were not performed. Despite these limitations, this scoping review uncovered a broad range of evidence on the effectiveness, safety, acceptance, and implications of SDF use in primary dentition that can be used to inform dental hygiene practice.

CONCLUSIONS

This scoping review assessed the use of SDF for prevention

and arrest of coronal and root caries, and treatment of tooth sensitivity. Current evidence and guidelines support the use of SDF for arresting carious lesions in the primary dentition, but limited evidence is available to support the use of SDF in arresting root surface caries and reducing dentinal hypersensitivity. Based on available evidence, SDF may be a suitable therapy to add to the dental hygiene clinical armamentarium for managing carious lesions in the primary dentition. However, more research is needed to establish the frequency for SDF application and the types and depths of carious lesions that can be arrested successfully. It would also help answer practical questions related to the application and acceptance of SDF by recipients and dental providers.

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CONFLICTS OF INTEREST

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Understanding the factors influencing the Aboriginal health care experience

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ABSTRACT

Background: The Aboriginal population in Canada experiences significant health disparities due to the enduring traumas of colonization. While oral health also suffers as a result of social inequities, there is limited knowledge of the factors influencing oral health care experiences as current research focuses on early childhood caries and accessing general health services. **Objective:** This review aims to identify the factors affecting Aboriginal peoples' attitudes towards and experiences in accessing oral health services in Canada in an attempt to contribute to the discussion of how oral health professionals can better support this population's oral health. **Discussion:** Major influencing factors include racism, culture, access to health information, and the approach of the health care provider. Past experiences result in a fear of encountering racism in health care settings and the internalizing of socially constructed prejudices. Culturally based health beliefs contribute to a desire to receive services from an Aboriginal practitioner and indicate a need for culturally safe care. Challenges in navigating the health care system include a lack of transportation, language differences, literacy, and knowledge. The approach of the health care provider greatly shapes health care experiences and influences health outcomes. **Conclusion:** There is a need for research focusing specifically on the Aboriginal population's experiences in and attitudes towards accessing dental services. Oral health providers should adopt a holistic approach to care by deconstructing social norms and considering this population's unique social and economic challenges. Practitioner–client interaction is crucial in developing a trusting relationship that will improve oral health care experiences.

RÉSUMÉ

Contexte : La population autochtone du Canada subit des inégalités importantes en santé en raison des traumatismes persistants dus à la colonisation. Bien que la santé buccodentaire souffre aussi à cause des inégalités sociales, les connaissances des facteurs qui influencent les expériences de soins de santé buccodentaire sont limitées puisque la recherche actuelle est axée sur la carie de la petite enfance (CPE) et sur l'accès en matière de services généraux de santé. **Objectif :** La présente étude vise à cerner les facteurs qui influent sur l'attitude du peuple autochtone envers l'accès aux services de santé buccodentaire au Canada, ainsi que leur expérience avec ceux-ci, afin de tenter de contribuer à la discussion visant à déterminer comment les professionnels de la santé buccodentaire peuvent mieux appuyer la santé buccodentaire de cette population. **Discussion :** Les principaux facteurs déterminants comprennent le racisme, la culture, l'accès à l'information sur la santé et l'approche du prestataire de soins de santé. Les expériences antérieures se traduisent par une crainte d'être confronté au racisme dans les milieux de soins de santé et l'intériorisation des préjugés attribués par la société. Les croyances fondées sur la culture contribuent au désir de recevoir des services d'un praticien autochtone et signalent un besoin de soins sécuritaires sur le plan culturel. Les défis de naviguer dans le système de soins de santé comprennent le manque de transport, les différences linguistiques, la littéracie et le savoir. L'approche du prestataire de soins de santé façonne grandement les expériences liées à la santé et influence les résultats sur la santé. **Conclusion :** Il existe un besoin pour la recherche axée précisément sur les expériences du peuple autochtone en matière d'accès aux services dentaires, ainsi que sur leurs attitudes envers cet accès. Les prestataires de soins de santé buccodentaire devraient adopter une approche holistique en matière de soins en déconstruisant les normes sociales et en considérant les défis sociaux et économiques uniques de cette population. L'interaction entre le praticien et le client est primordiale lorsqu'il s'agit d'établir des relations de confiance qui amélioreront les expériences en matière de soins de santé buccodentaire.

Key words: Aboriginal Peoples, accessibility, attitudes, dental care, dental services, disparities, experiences, First Nations, health services, oral health

INTRODUCTION

In 2011, 1.4 million Aboriginal individuals accounted for 4.3% of Canada's total population, likely a gross underestimation due to self-identification and self-reporting methods.¹⁻³ Comprising First Nations, Inuit, and Métis peoples, the Aboriginal population experiences extreme health disparities due to social, economic, and political factors.³⁻⁹ Of particular importance are the historical

influences that have defined this population's relationship and feelings towards the nation and its leadership.⁴ The implementation of the reserve and residential school systems resulted in significant health consequences and emotional distress.^{4,10} These enduring traumas continue to affect Aboriginal people today, influencing health care encounters and subsequent health outcomes.¹⁰

CJDH STUDENT ESSAY AWARD

The *Canadian Journal of Dental Hygiene's* Student Essay Award competition, proudly sponsored by PHILIPS Sonicare, encourages students in a diploma, baccalaureate or degree-completion program to develop a love for writing and research and to recognize the possibilities that such endeavours offer for personal and professional growth. The editorial board is delighted to publish the winning entry from its 2017–2018 competition, which ably addresses the Canadian Dental Hygienists Association's 2015–2018 dental hygiene research agenda category of "access to care and unmet needs."

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Health and oral health

Research has identified that the Aboriginal population exhibits significantly higher rates of chronic illnesses, such as diabetes, cardiovascular disease, musculoskeletal conditions, cancer, mental illness, and HIV/AIDS, when compared to the general population.^{2-6,8} The social determinants of health contributing to these disparities include housing, employment, education, environment, and income.^{2,4} Correspondingly, poor oral health is also a result of social inequities and historical stresses.^{2,5,11-12} Thus far, the majority of Aboriginal-specific oral health research has focused on the high prevalence of early childhood caries—up to 98% in some northern communities—to inform population-centred interventions and programs.^{2,11} However, since oral disease prevention relies on adequate access to care, the lack of current literature evaluating the factors influencing dental experiences indicates a need for more research in this area.^{9,13}

Accessing health services

In 2012, approximately 69% of surveyed Aboriginal individuals reported having contact with a dental professional in the past 3 years.¹⁴ This is most likely due to the federal government's non-insured health benefits (NIHB) program that covers 90% of dental costs for registered First Nations and Inuit peoples.^{2-3,13} However, the program continues to limit access to dental care for a large portion of this population by excluding Métis and non-registered First Nations peoples.^{2-3,13,15-16} In addition, some eligible registrants choose not to utilize their benefits to avoid racist encounters in the dental setting.¹⁰

Other challenges in accessing specialty services include transportation, poor health literacy, language barriers, and fears of stigma and discrimination.^{3,9,13,17} Preferences for Aboriginal health care providers also underscore this population's desire for culturally centred care and highlight a need for both improved cultural awareness and increased numbers of Aboriginal providers.⁹⁻¹⁰

Current literature

The Aboriginal population's experiences in accessing and receiving dental services is not fully understood, and over 134,000 individuals are still not accessing care.¹⁴ In addition, the outcomes from cultural competence and safety training in many health professions have not been thoroughly evaluated to determine their effectiveness.^{4-6,8-9}

Due to the scarcity of research specific to oral health, investigations within medical and nursing literature must be utilized to assist in identifying factors influencing Aboriginal individuals' attitudes towards and experiences in accessing oral health services.^{4,6,9,13,18} This review identifies the factors affecting Aboriginal peoples' attitudes towards and experiences in accessing oral health services in Canada in order to contribute to the discussion of how oral health professionals can better support this population.

METHODS

The electronic databases of Google scholar, EBSCO/CINAHL, and PubMed were searched for relevant literature using the key terms oral health, dental services, dental care, health services, attitudes, experiences, accessibility, disparities, Aboriginal peoples, and First Nations. The search included English full-text articles and reviews available online from peer-reviewed publications. The reference lists of the identified articles were evaluated for relevant resources, and some literature not meeting the inclusion criteria was used for contextual information and understanding. A total of 9 articles meeting the inclusion criteria were evaluated, including 4 research studies, 3 literature reviews, 1 systematic review, and 1 commentary.

RESULTS

Understanding the Aboriginal population's attitudes towards and experiences in accessing health services will assist in identifying and addressing the factors unique to the Aboriginal health care experience. The Anderson-Newman Framework of Health Services Utilization identifies 3 main factors influencing health care: predisposing, enabling, and need factors.¹⁹ Predisposing factors are sociocultural characteristics such as age, gender, culture, education, social structure, and health beliefs influenced by physical, political, and economic environments.¹⁹ Enabling factors determine accessibility to care and include knowledge of services, availability of services, psychological status, and supportive resources.¹⁹ Finally, need for health services is determined by individual perceived need and practitioner evaluation.¹⁹

The literature reviewed demonstrated that the factors influencing Aboriginal peoples' attitudes and experiences fall within all 3 categories and are strongly interdependent; they include racism, culture, access to health information, and the approach of the health care provider. While the majority of qualitative data describes negative health care interactions, there are some positive encounters that provide valuable data to inform approaches aimed at improving these experiences. Finally, cost is not a significant influencing factor due to the dental insurance benefits of the NIHB.^{5,9}

DISCUSSION

Major factors influencing the Aboriginal health care experience

Racism

Critical race theory (CRT) examines the relationship between race and power as defined by historical, economic, group, and contextual factors.²⁰ Society's normalization of cultural discrimination allows the socially constructed concept of race to adapt to the dynamic social, economic, and political environments.²⁰ This makes racism a challenging problem to address and is reflected in the judgment, oppression, and abuse experienced in the 19th and 20th centuries that the Aboriginal community continues to face today.³

Racism is a predisposing factor that affects physical, mental, emotional, and spiritual health.^{3,5,9} Aboriginal individuals experience significant psychological distress surrounding dental treatment due to fear of racism or past negative experiences.^{3,5,7} Aboriginal individuals commonly report experiencing racism when asked to pay for dental services despite having NIHB, or when receiving dental care off-reserve.³ Wardman et al. found that 83.1% of 267 Aboriginal respondents cited a fear of racism as a barrier to accessing health services, and Browne and Fiske noted that Aboriginal women anticipated experiencing racism in health care encounters.⁹⁻¹⁰ Racism and its association with gender influences health care encounters as Aboriginal women experiencing both racism and sexism have greater feelings of vulnerability that result in the internalizing of negative judgments.^{4,10}

Since race plays a large role in individuals' health care decisions, there is a need for culturally focused approaches to providing individualized care.²¹ The concept of trauma-informed care acknowledges that individuals with a history of traumatic experiences require unique considerations in the provision of health services.²² These individuals may avoid preventive medical services, including dental hygiene, due to feelings of distrust and fear from the power differential of the provider-client relationship.²³⁻²⁴ Oral health practitioners should not only consider societal norms, cultural history, and individual values when providing culturally competent care, but also recognize the pervasiveness of traumatic experiences. Attempts to build trust and rapport will create a safe environment to better support the health care experiences of those with a history of traumatic encounters.²²

Culture

The attempts to assimilate Aboriginal peoples into European-Canadian culture imposed a culturally based trauma affecting many generations.³ Despite the residual effects of colonialism, many Aboriginal individuals continue to embrace their cultural identities and values and, in turn, have an increased probability of experiencing racism.³⁻⁴ In addition, the cultural differences in defining health among different Aboriginal groups also contribute to the tendency to seek care from a local practitioner.^{3-4,8-11} Understandably, individuals with a history of trauma are more comfortable interacting with providers with similar characteristics, mannerisms or experiences.²⁴ Critically evaluating the client-provider dynamic through culturally and trauma-informed approaches will work towards reducing the racism and developing an egalitarian relationship to support client autonomy.^{7,10,24}

The internalizing of cultural prejudices leads to the acceptance of socially constructed stereotypes and anticipation of negative interactions in the health care system.^{3-5,21} These fears prompt Aboriginal individuals to change their appearance or to conform to societal expectations to avoid culturally motivated prejudices.^{5,10}

Health care providers must consider the diversity of health values and beliefs within the Aboriginal population, and support clients' cultural identity and pride to increase feelings of respect, validation, and a sense of being understood.¹⁰

Access to health information

The concept of "navigation" describes one's awareness of available services and their influencing factors.⁷ The Aboriginal population faces challenges in navigating the health care system due to a lack of enabling resources including transportation, language, literacy, and knowledge of how to access services.^{5,7,9-11} Individuals living in poor conditions often do not have access to phones, taxis, vehicles or public transportation; communication barriers also result in reluctance to seek health information due to fear of misunderstanding or being viewed as needy and troublesome.^{5,10}

Interestingly, some Aboriginal individuals report informational support being readily available.³ Access to information can be influenced by many variables including location, the presence or absence of other enabling supports or individual differences.³ In cases where health information is accessible, the different channels and approaches to sharing knowledge must be considered to ensure understanding.⁷ For example, language, literacy, and the implicit power differential in the provider-client relationship can all influence the effectiveness of health communications.⁷

To overcome these challenges, practitioners in a community setting must connect with the population to establish a collaborative strategy for delivering health information appropriately.^{9,11} In an individual practice setting, practitioners must consider the social determinants influencing access to ensure appropriate and supportive care.

Approach of the health care provider

Health care providers play a pivotal role in determining health experiences and outcomes, in turn shaping attitudes towards health services.^{3-5,7-10,21} Practitioners can contribute to health disparities through racial profiling, discrimination, and a lack of knowledge surrounding the delivery of culturally competent care.^{8,21} Some practitioners feel the health care system unfairly provides superior care to marginalized populations in an attempt to rectify previous inequities or to avoid appearing discriminatory.²¹ While this belief is based on the egalitarian principle of equitable access, it disregards pervasive historical influences and fails to acknowledge that these health disparities are embedded in enduring discriminatory policies rather than personal decisions.²¹

Other examples include a focus on the biomedical model approach and the inappropriate use of Westernized scientific language in communicating health information.^{4,7-8} These are most common among non-Aboriginal providers who assume disparities are due to culturally based decisions

rather than a result of external social and historical influences.^{5,8,21} CRT argues that this flawed perception fails to recognize the significance of colonialism and social inequities responsible for the Aboriginal population's feelings of intimidation and distrust towards the health care system.⁵ Past encounters of racism and institutional challenges influence attitudes towards seeking health services and as a result perpetuate health disparities.^{3,5,7,9-10,21}

Dismissal by the health care provider and a failure to acknowledge the exceptional social and economic challenges this population faces are commonly reported.^{5,10} These experiences also contribute to this population's desire for an Aboriginal practitioner to rebalance the power differential in the client-provider relationship.^{3,5,7-9} However, the number of Aboriginal students in the health care field represents only a fraction of the Aboriginal peoples in the Canadian population.²⁴ While professional organizations and postsecondary institutions have established policies to encourage Aboriginal student enrollment, further expansion to include more health care disciplines has the potential to greatly improve this population's experiences in the health care system.²⁵

CONCLUSION

Aboriginal individuals continue to experience racism, cultural conflict, and barriers to accessing appropriate health information. Health care providers often hold egalitarian assumptions and fail to consider the persisting external factors that determine this population's health status and influence their access to care. The Aboriginal population's fear of racialization and continued preference to receive care from an Aboriginal provider illustrate the importance of the health care providers' approach in shaping the health care experience and a need for more Aboriginal health care practitioners.

While there is a need for research focusing specifically on the Aboriginal population's attitudes towards oral health, the current literature offers many recommendations to improve delivery of care that can be followed by oral health professionals. These recommendations include taking a holistic approach to culturally safe care by deconstructing social norms, and considering the historical factors influencing the social determinants of health. Further development of trauma-informed education is needed to facilitate positive interactions, as is the need to increase the representation of Aboriginal health care providers across the country. It is vital for the oral health professional to develop a trusting practitioner-client relationship that will produce positive health outcomes and improve access to care.

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CONFLICTS OF INTEREST

The author declares no conflicts of interest in this review.

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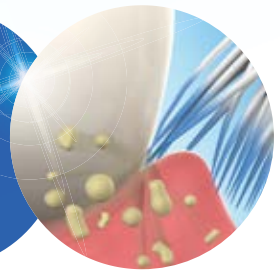
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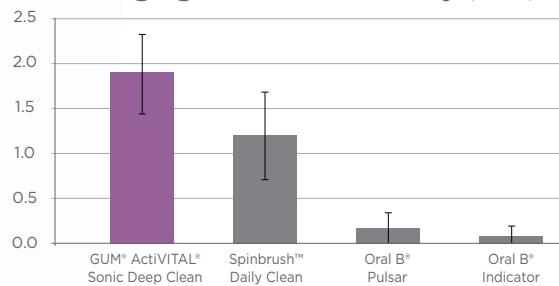
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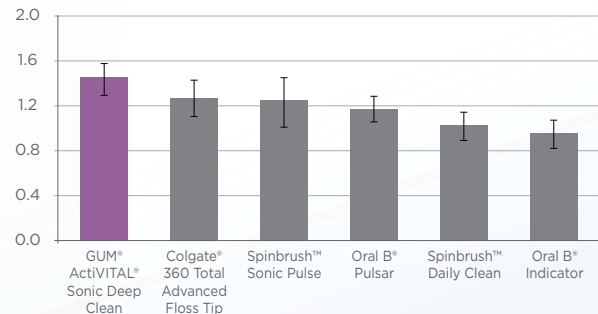
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Community oral health practice for the dental hygienist, 4th edition

By Christine French Beatty, RDH, MS, PhD

St. Louis (MO): Elsevier; 2017. 332 pp. with index

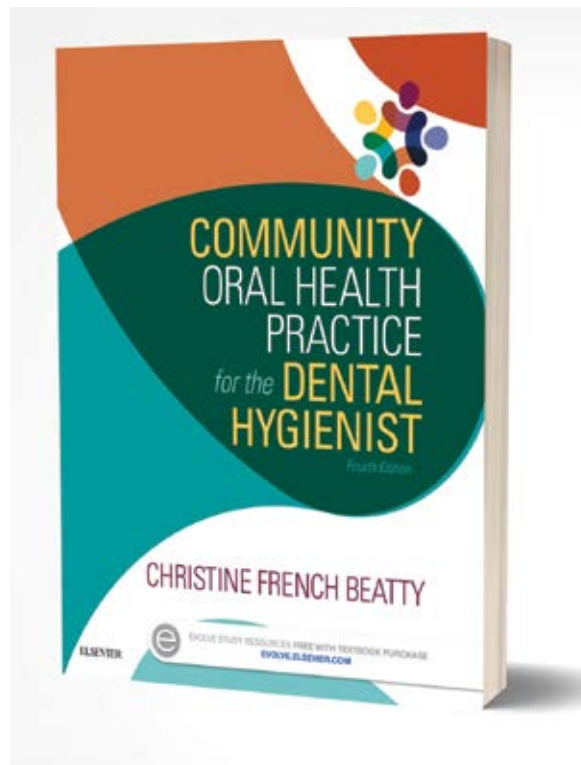
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OVERVIEW

Community Oral Health Practice for the Dental Hygienist is a widely used and comprehensive textbook on the topic of dental public health. This book is written primarily for dental hygiene students but can be well utilized by interested dental hygienists or dental hygiene faculty who have special interest in this area and wish to have a significant document for reference in their own library.

Fully revised and updated, this 4th edition textbook is divided into 12 chapters focusing on concepts, issues, assessments, methods, and techniques related to dental public health. It speaks to the assessment of factors that affect the oral health of populations and communities and the development of policies in response to a population's needs. The book also provides information regarding oral health promotion and oral health maintenance.

In this newly designed edition, the textbook uses diverse visual aids to drive home the points of interest. From bar graphs to pie charts and colourful images, the new look provides the reader with a wide range of tools designed to further an understanding of the dental concepts discussed. At the end of each chapter, students can use knowledge-based activities and community cases with questions to test their knowledge and stimulate the process of critical thinking, self-assessment, and reflective practice. These case questions would also be helpful when preparing for any board exams. Towards the back of the book are appendices with supplemental information on websites, community organizations, government agencies, dental hygiene competencies, ideas for forming community



partnerships, assessment tools, program evaluation, research, and a glossary.

The author, Christine French Beatty, is a dental hygienist, educator, and researcher with more than 50 years of experience in community dental hygiene practice. A more detailed biography would have been helpful to highlight her expertise, qualifications, and experiences.

PURPOSE

The purpose of this textbook is to deliver everything you need to know to succeed in community dental hygiene practice. Topics addressed include principles and practices of public health; oral health inequalities; assessment of population oral health needs and demands; and community-based strategies for disease prevention.

CONTENT

This 4th edition acknowledges that the lack of access to adequate oral health care services is an ongoing problem in the US, and many barriers to accessing those services exist for individuals, communities, and populations. New content updates review American initiatives to address the problem, including Healthy People 2020, teledentistry, the Affordable Care Act, oral health workforce models, and interprofessional practice. While the textbook examines dental public health from an American perspective, many of the issues raised and recommendations made are applicable to the Canadian context.

For example, organizations such as the Canadian Dental Hygienists Association (CDHA), the American Dental Hygienists' Association (ADHA), and the Association of State and Territorial Dental Directors (ASTDD) all advocate

for better access to care by recommending an expanded scope of practice for dental hygienists. This expanded scope, with further education and advanced training, would allow dental hygienists to have similar procedural roles to a dental therapist and dentist, initiating treatment based on their own dental hygiene assessments, operating mobile clinics in the community, and billing directly for services.

In addition, a new concept, teledentistry, is the practice of diagnosis, consultation, and treatment via technology rather than personal contact. In remote areas, teledentistry will help reduce costs and improve access to care and quality of life by reducing inequalities in health care.

Applying community health knowledge to dental hygiene

At the community level, the public dental hygienist is a leader who plays a role in assessing the oral health needs of a community, planning and implementing evidence-based oral health programs, and evaluating their effectiveness. Because support and funding from the public, non-profit agencies, government, and private partners are essential to the success of any community oral health initiative, the public dental hygienist should be well versed in epidemiology. Whether it is to promote water fluoridation, to develop the most effective programs to prevent caries in schools, or to change regulations in extended care facilities, the dental hygienist must rely on the scientific method to compile reliable, measurable data and propose evidence-based solutions to reduce oral health disparities. This textbook outlines the framework to do so.

The textbook also emphasizes the importance of improving the public's oral health knowledge and literacy through education. This can be accomplished with oral

presentations, discussions, school-based programming, conferences, and social media. Chapter 11 notes that dental hygiene students can be valuable resources in this effort. By involving them in community outreach, public dental hygienists give students an opportunity to apply classroom knowledge to real-life situations while reaching as many people as possible in the community.

Another important piece of the puzzle in addressing oral health and its impact on people's overall health is interprofessional collaboration. Recently, to give just one example, ADHA, CDHA, and the Oral Cancer Foundation have come together to raise awareness of the importance of early detection in preventing and treating oral cancer. Dental hygienists are ideally placed to provide oral cancer screenings and refer people for further assessment and treatment.

CONCLUSION

This textbook helps the dental hygienist to become acquainted with community oral health practice and what the oral health needs of their communities might be. The author discusses how available oral health programs, funding, resources from the local, state, and national levels, and effective program planning can provide an opportunity for dental hygienists to have a positive impact on the overall health of their communities. The knowledge one will gain will ultimately be an asset to the profession and contribute to the prevention of oral disease and promotion of oral health.

*Chandra Madsen, RDH, works in community health
and private practice in Williams Lake,
British Columbia, Canada*



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PATIENT CASE: SARAH



Sarah, a 28-year old female patient presents for her Hygiene recall visit.

She describes having pain and points to her upper right side premolars and canine. The pain is very short in duration and is often caused by cold liquid, air or even the bristles of her toothbrush.

Sarah used to experience pain infrequently, but now it could occur every day, if she is not careful. Upon examination, gingival recession of about 1mm was observed in the area surrounding the first and

second premolar and canine, with inflammation and plaque buildup.

The rest of her mouth is plaque free with no observed inflammation. Sarah admits to avoiding the area when she brushes, anticipating it will cause pain. She responded to an airblast and a sweep of the probe on the root surface. Her pain was 7 - 8 on a 10 point scale. No decay was observed.

Dentin Hypersensitivity

Sarah's symptoms are in keeping with Dentin Hypersensitivity (DH), a transient, short, sharp tooth pain arising from exposed dentin in response to a stimulus that cannot be attributed to any other form of dental defect or pathology.^{1,2} Sarah is not alone. An estimated 36% of adults report having sensitive teeth associated with temperature, air or tactile stimuli.³ Dentin Hypersensitivity often presents as an acute problem, but when it starts to occur on a chronic basis can lead to neglecting oral hygiene, failing to comply with instructions and avoiding dental appointments.^{4,5}

Diagnosis, Mechanism and Management

Symptoms experienced by patients with dentin pain/sensitivity may also be associated with the following conditions, which should be diagnosed by examination:

- Dental Caries, Cracked Teeth, Fractured Teeth and Post-Treatment Neuralgias²
- Ruling out these causes of pain and confirming Dentin Hypersensitivity may take multiple visits

Mechanism of Dentin Hypersensitivity:

- Dentin is exposed, open tubules form at the exposed surface (Figure 1a) and trigger pulpal nerves in response to a stimulus³
- The Hydrodynamic Theory is the most accepted mechanism for Dentin Hypersensitivity. Rapid movement of fluid in open tubules results in nerve stimulation with a short sharp pain (Figure 1b)³
- Tubules must be open to the oral cavity and the pulp³



Figure 1a: Open tubules formed in dentin allowing for rapid fluid movement resulting in nerve stimulation^{3,7}



Figure 1b: Fluid in tubules extending from exposed dentin triggers nerve stimulation^{3,7}

Treatment Modalities include:

- Nerve depolarization using potassium-based products to prevent repolarization and thus reducing the transmission of the impulse⁶
- Tubule occlusion where a layer forms over and in the tubules, which blocks the movement of dentinal fluid and prevents the nerve stimulation⁶

Evolution of Tubule Occlusion Products

The body has a natural defense mechanism for surface demineralization and erosion of enamel by delivering a supersaturated solution of calcium (Ca) and phosphorous (P) in saliva. It has been demonstrated that supplying an additional Ca and P load in the form of amorphous calcium phosphate (ACP) slows the process and may block open tubules.

However the ACP could not remain at the surface for sufficient time for definitive reactions to proceed. To improve substantivity and surface retention, Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP) was added. NovaMin (calcium sodium phosphosilicate) is one of the latest technologies for enhanced bonding of minerals to the surface. NovaMin demonstrated surface substantivity and bonding by delivering and retaining both calcium and phosphate to the sensitive area.

NovaMin Technology

NovaMin is a glass ceramic replacement material, developed for bones that were damaged due to traumatic injury (e.g. accidents, weapon trauma, cancer, etc.).⁸ As such it was formulated to bond to both bone and soft tissue and was used in dentistry as a particulate for periodontal pocket bone regeneration.⁹ Modification of the particulate size enhanced the ability of the material to penetrate the tubules, interact with the dentinal fluid and form a seal over and within the tubules effectively stopping fluid flow.¹⁰ The hydroxy-apatite like occluding layer is harder than the underlying dentin and is resistant to acid challenges to the tooth surface.¹¹ Incorporating NovaMin with fluoride into a stable toothpaste formulation can effectively deliver desensitizing effects while maintaining the anti-cavity benefits.



*Forms a protective layer over the sensitive areas of the teeth. Brush twice a day for lasting sensitivity protection.
†Benefits observed with twice daily brushing.

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REVISIT SARAH

Making a recommendation in line with preventative dental practice

Sarah needs ongoing protection against the pain of sensitive teeth. She can achieve this by consistently using a toothpaste that repairs* the sensitive areas of her teeth, by releasing calcium and phosphate, the building blocks of teeth.¹²

Sensodyne is a dentist recommended dentifrice containing 5% w/w NovaMin, to†:

- Provide clinically-proven long-lasting protection against DH¹²
- Starts working from week 1¹²
- Offers effective protection against the pain of sensitive teeth, and with continued use, helps prevent it from coming back¹²
- Effectively clean teeth to help maintain gingival health¹²
- Provide fresh minty taste to leave mouth feeling fresh and clean¹²

To help Sarah receive continued protection against the pain and recurrence of sensitive teeth, recommend brushing with Sensodyne Repair & Protect twice daily.¹²



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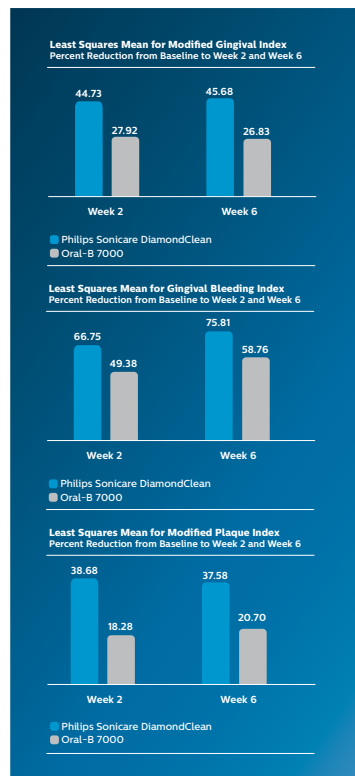
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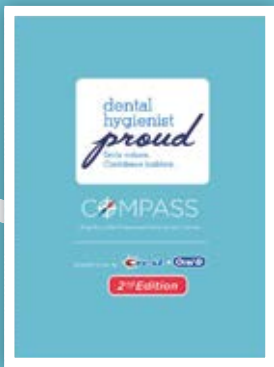
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