An Evaluation of Permit L Local Anesthesia within Dental Hygiene Practice in Massachusetts

Katherine A. Soal, CDA, RDH, MSDH; Linda Boyd, RDH, RD, EdD; Susan Jenkins, RDH, MS, CAGS; Debra November-Rider, RDH, MSDH; Andrew Rothman, MS, EIT

Abstract

Purpose: The purpose of this descriptive study was to assess data pertinent to the Permit L local anesthesia license among practicing dental hygienists in Massachusetts, providing an overview of characteristics, practice behaviors, barriers for obtaining the permit and self-perceived competency.

Methods: A convenience sample of dental hygienists (n=6,167) identified through a publically available data base were invited to participate in a web-based survey. The survey consisted of demographic and Permit L specific questions. Items regarding opinions were rated using a 5-point Likert scale while frequencies and percentiles were used to evaluate demographics and practice-based information. Spearman's Rank correlation was performed to determine association between variables.

Results: A 10% (n=615) response rate was attained with (n=245) non-Permit L holders and (n=370) Permit L holders. Respondents reported significant differences in demographics and opinions between non-Permit L holders and Permit L holders ($p<0.01$) and between those certified through continuing education or curriculum based programs ($p<0.01$). Significant relationships were found in demographics ($p<0.01$) and practice ($p<0.05$) items in relation to the length of time the Permit L has been held. Themes from the data and comments indicate multiple factors influencing obtaining or not obtaining the Permit L.

Conclusion: The results of this study provide an overview of Permit L local anesthesia administration that is generally comparable to previous studies and offers new insights into why some Massachusetts dental hygienists choose not to pursue certification. This study highlights the potential to increase the prevalence of the Permit L, address barriers to pursuing the Permit L, and further evaluate self-perceived barriers.

Keywords: local anesthesia, dental hygienists, continuing education, professional delegation

This study supports the NDHRA priority area, **Professional Education and Development:** Investigate curriculum models for training and certification of competency in specialty areas (e.g., anesthesiology, developmentally disabled, forensics, geriatrics, hospital dental hygiene, oncology, pediatrics, periodontology, and public health).

Introduction

It is widely known that dental hygienists can be effectively taught expanded functions and those functions can be delivered effectively and safely.[1] During1972 to 1974, the Forsyth Experiment code named "Project Rotunda," gathered data demonstrating safety and efficacy of dental hygienist administered local anesthesia. A total of 19,173 local anesthetic administrations were given during the project with only 3 minor short-term adverse reactions and a 92% first attempt success rate.[2]

The body of literature relating to the administration of local anesthesia by dental hygienists is lacking in more recent studies. Early studies were aimed at evaluating the safety and efficacy of dental hygiene administered local anesthesia along with use, impact, and provider and dentist perceptions. In 1992, Cross-Poline et al conducted a survey of Colorado dental hygienists who completed a continuing education course in local anesthesia administration.[3] Levels of education were reported as 8% certificate, 45% Associate, and 45% Bachelor degrees with 76% in general practice and 17% in a periodontal practice. In a self-reported post course questionnaire 88% (n=96) were administering local anesthesia as needed for patient care and the remaining 12% (n=12) stated reasons for not administering including; employer resistance, patient resistance, and practice type.[3]

In 2000, DeAngelis and Goral reported the results of a quantitative survey designed to assess Arkansas dental hygienists' use of local anesthesia.[4] Certification was held by 97% for at least 1 year, and of those, 92% were in general practice and 7% in periodontal practice. Levels of education were reported as 8% certificate, 23% Associates, 67% Bachelors and 2% Master's degrees. Delegation of local anesthesia for dental hygiene procedures was reported at 94% (n=109) and 68%

(n=109) for dental procedures. When the dental hygienists were asked their opinion regarding the statement, "Local anesthesia is not needed for dental hygiene procedures," 90% (n=284) of those certified either disagreed or strongly disagreed. A significant correlation ($p<0.001$) was found when the same question was asked of those with and without certification.[4]

Anderson evaluated use of local anesthesia by dental hygienists who completed continuing education course in Minnesota during 1996.[5] The self-reported data revealed a 95% delegation rate for dental hygiene procedures and a 65% delegation rate for the dentist' patients with 89.6% (n=242) in general practice and 7.8% (n=21) in periodontal practice. Associate degrees were held by 90% (n=204) and Bachelor degrees by 9% (n=25) with no significant relationship between educational level and successful injections ($p=0.87$). The value of local anesthesia administration in practice was reported as very valuable by 58%, and 87% believed the skill would have value when seeking employment. Success was measured by achieving adequate anesthesia, and rates of 90 to 100% were reported by 76% with no significant relationship between years since graduation and level of success ($p=0.24$). The most frequently reported complication was hematoma by 5.9% (n=16) with 87.8% (n=239) reporting no complications and 86% aspirate all the time.[5]

In a 2005 survey by Schofield et al, information was requested from state licensing boards (n=26) regarding disciplinary actions against dental hygienists involving the administration of local anesthesia.[6] The number of disciplinary actions against dental hygienists involving the administration of local anesthetics reported by all participating state licensing boards (n=18) was zero.[6]

In 2011, Boynes et al conducted a randomized nationwide survey of dental hygienists (n=1,200) evaluating dental hygiene local anesthesia education and administration.[7] The results reveal 86.4% (n=431) dental hygienists perceived a need for local anesthesia for dental hygiene procedures with 76.1% in general practice, 7.8% periodontal practice and 8.4% in an academic setting. Of those administering local anesthetics, 67.3% were trained in a curriculum-based program and 32.3% in a continuing education program.[7] The study established 5 regions in the U.S. to evaluate local anesthesia use. Region 5 included the western states of Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon, Utah and Washington. This region reported 93.8% of dental hygienists administer local anesthesia and 61% also administered anesthesia to the dentist's patients. Region 1 consisting of the northeastern states of Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont reported 32.1% of dental hygienists administering and 30.4% administering for the dentists' patients.[7] The mean year of implementation of dental hygiene administered local anesthesia for region 5 is 1978 and 2003 for region 1.

Despite the findings of several studies demonstrating safety and efficacy of dental hygiene administered local anesthesia,[3-5,8] Massachusetts remained behind the majority of states in legalizing the practice. Washington State was the first to pass legislation allowing the administration of local anesthetics by a dental hygienist in 1971, followed by New Mexico in 1972 and the majority of states west of the Mississippi River by the late 1990s.[9] It was not until 2004 that Massachusetts approved dental hygiene administered local anesthesia under direct supervision via the Permit L local anesthesia license.[9] The Permit L local anesthesia license allows dental hygienists to administer local anesthesia by nerve block and infiltration and is obtained after successful completion of a continuing education or curriculum-based training course. A minimum of 35 hours of instruction including no less than 12 clinical hours are required to satisfy the requirements set forth by the Massachusetts Board of Registration in Dentistry.[10]

To date, there has not been a statewide evaluation of the Permit L except for a single local anesthesia question posed in the 2007 "A Report on the Commonwealth's Dental Hygiene Workforce."[11] This survey revealed 12% (n=381) of dental hygienists are Permit L holders. Of the non-Permit L holders (n=4,114) 64.4% (n=2,650) reported they did not intend to become certified. The main reasons cited were lack of interest (32.9%, n=871), increased liability (28.2%, n=747), no monetary compensation (14.1%, n=373), cost (13.4%, n=355) and fear (11.5%, n=304).[9] As Massachusetts is a latecomer to the national local anesthesia arena and after practicing for so long without the Permit L, an evaluation of the perceived barriers and motivating factors surrounding obtaining or not obtaining the Permit L will provide insight into its impact.

The purpose of this study was to gather data pertinent to Permit L practice among dental hygienists in Massachusetts providing an overview of the characteristics of Permit L holders and indicate self-perceived barriers to obtaining the Permit L. This study assessed 2 research questions:

1. What are the characteristics of Permit L holders in Massachusetts?
2. What are the self-perceived barriers to pursuing the Permit L?

Methods and Materials

Research Design

This cross-sectional, one point in time, descriptive web-based survey research evaluated Permit L and non-Permit L holding dental hygienists in Massachusetts. The survey was designed to include only those dental hygienists who were currently practicing in Massachusetts and residing in Massachusetts, Connecticut, New Hampshire or Rhode Island, and further identified 3 independent variables: those with and without the Permit L. Those who did have the Permit L were separated by type of Permit L training program they attended; either continuing education-based or curriculum-based. The survey administered to non-Permit L holders consisted of 6 demographic questions and 12 Permit L specific questions. Four of the 12 questions that requested opinions were rated using a 5-point Likert scale. After identifying which Permit L training program they attended the Permit L holders were asked 20 questions related to the Permit L, 5 of which were rated using a 5-point Likert scale. Based upon the literature,[12,13] content validity indexes were obtained from a panel of 6 experts to ensure content validity of the survey instrument. An S-CVI score of 0.87 was obtained for non-Permit L holder questions and 0.8 was obtained for the Permit L holder questions. The study received IRB approval with an exempt status from Human Subject Committee of MCPHS University.

Sample Inclusion/Exclusion Criteria

All dental hygienists who were registered in Massachusetts and residing in Massachusetts, Connecticut, New Hampshire or Rhode Island at the time of the survey were invited to participate (n=6,167). The mailing addresses were obtained from the Massachusetts Board of Registration in Dentistry via a publically available database. The inclusion criteria to participate were: currently practicing hygienists in Massachusetts and, if a current Permit L holder, training at an accredited program in Massachusetts. The total number of Permit L holders registered in Massachusetts and residing in the aforementioned states (n=2,180) represented 35% of the potential sample of permit L holders.

Data Collection

A postcard invitation to participate in the web-based survey was mailed to all dental hygienists (n=6,167) in September 2013. Concurrently, an invitation was posted on the Massachusetts Dental Hygienists' Association (MDHA) website and participants were recruited in-person at the MDHA annual session. A blast e-mail was delivered by MDHA with a follow-up e-mail reminder three weeks later.

Data Analyses

Data were collected on-line via SurveyMonkey®, downloaded as Excel spreadsheets and imported into STATA® version 12 statistical analysis software. Descriptive data summarized demographic characteristics and Likert-scaled questions. Spearman's Rank correlation testing was used to determine association between variables and the level of significance for all data analyses was set at <0.05.

Results

Demographics

An overall response rate of 10% (n=615) was attained with 245 non-Permit L holders and 370 Permit L holders. The non-Permit L holding responders (n=245) represented 6.1% of the 3,987 non-Permit L holders and the Permit L holding responders (n=370) represented 16.9% of the 2,180 Permit L holders currently licensed in Massachusetts and residing in Massachusetts, Connecticut, New Hampshire or Rhode Island. The majority in both categories were female (98%), the Permit L holders were generally younger with 61% (n=227) aged 45 or under and 87% (n=212) of non-Permit L holders were aged 41 or over. The number of years in practice was fairly evenly distributed except for those who had been in practice for 1 to 5 years accounting for 20% (n=121) of the respondents of which 90% (n=109) were Permit L holders. Thirty-seven percent (n=135) of Permit L holders anticipated being in practice longer than 20 years compared to 15.7% (n=39) non-Permit L holders. Associate degree holders were more prevalent in the non-Permit L holder category (70%) while Bachelor (38%) and Master (14%) degrees were more prevalent in the Permit L holder category. Most (67%) worked in general practice, and of those stating an academic work setting 93% (n=41) were Permit L holders. Other practice types reported (n=50) included multi-specialty, oral surgery, hospital/rehab, community health center, and corporate settings. Demographic data are reported in Table I.

Opinions and Descriptive Data of Non-Permit L Holders

Table II shows the descriptive data for non-Permit L holders. The vast majority (99.5%) of the non-Permit L holders reported the Permit L was not a condition of employment, and 79% (n=172) were not planning to become certified. The main reasons for not becoming certified were: not needed in type of practice (17.5%), not planning to stay in practice long enough to use (14.5%), fear of administering local anesthetics (14%), cost (12.25%) and no financial gain (13%). Employer resistance and

no value in practice ranked lowest at 2.25% (n=4) each. Dominant themes from the comments (n=21) provided in relation to not becoming certified were related to the aforementioned reasons. Of those planning to take the certification course (n=45), 53% (n=25) cited staying competitive in the job market, and 40.5% (n=19) cited self-improvement as the reason. The primary reason for not obtaining the Permit L after taking a certification course was waiting beyond the 2 year deadline (38%) and other reasons (n=6), such as not wanting the liability and letting the Permit L lapse. When asked if their employers would allow them to administer local anesthetics if they obtained the Permit L, 59.5% (n=143) strongly agreed/agreed. In regards to self-perceived ability 77% (n=188) strongly agreed/agreed with the statement, "I feel as though I would be able to complete the certification course, pass the NERB exam and obtain the Permit L." Table III shows the Likert-scaled opinions of non-Permit L holders.

Opinions and Descriptive Data of Permit L Holders

Descriptive data for Permit L holders are shown in Tables IV and V. The Permit L as a condition of employment was reported by 22% (n=80), and 42% (n=153) reported holding the Permit L longer than 5 years, of which 65% (n=100) attended a continuing education-based program. Although 72% (n=263) were administering local anesthetics, 28% (n=104)

Table I: Demographics of Dental Hygienists Practicing in Massachusetts

	Non-Permit L Holders (0)	Permit L Holders (0)	Total
	n (Percent)	n (Percent)	n (Percent)
Gender			
Female	244 (99%)	361 (97.5%)	605 (98%)
Male	1 (<1%)	9 (2.5%)	10 (2%)
Age			
<21	0 (0%)	1 (0.25%)	1 (0.25%)
21 to 25	0 (0%)	36 (9.75%)	36 (6%)
26 to 30	13 (5%)	47 (12.5%)	60 (9.75%)
31 to 35	9 (3.5%)	52 (14%)	61 (10%)
36 to 40	11 (4.5%)	40 (11%)	51 (8%)
41 to 45	25 (10%)	51 (13.75%)	76 (12%)
46 to 50	46 (19%)	50 (13.5%)	96 (15.5%)
51 to 55	55 (22.5%)	47 (12.75%)	102 (16.5%)
56 to 60	53 (22%)	26 (7%)	79 (13%)
61 to 65	26 (10.5%)	11 (3%)	37 (6%)
>66	7 (3%)	9 (2.5%)	16 (3%)
Years in practice			
<1	0 (0%)	21 (6%)	21 (3.5%)
1 to 5	12 (5%)	109 (29%)	121 (20%)
6 to 10	21 (9%)	69 (19%)	90 (15%)
11 to 15	20 (8%)	34 (9%)	54 (9%)
16 to 20	18 (7.5%)	22 (6%)	40 (6%)
21 to 25	33 (14%)	31 (8%)	64 (10.5%)
26 to 30	28 (11.5%)	28 (7.5%)	56 (9%)
31 to 35	41 (17%)	26 (7%)	67 (11%)
36 to 40	47 (19%)	20 (5.5%)	67 (11%)
>40	22 (9%)	10 (3%)	32 (5%)
Anticipated number of years remaining in practice			
<1	3 (1.25%)	3 (1%)	6 (1%)
1 to 5	49 (20%)	36 (10%)	85 (14%)
6 to 10	57 (23%)	63 (17%)	120 (19.5%)
11 to 15	63 (26%)	61 (16%)	124 (20%)
16 to 20	34 (14%)	70 (19%)	104 (17%)
21 to 25	23 (9.25%)	32 (9%)	55 (9%)
26 to 30	7 (3%)	44 (12%)	51 (8%)
31 to 35	4 (1.5%)	29 (8%)	33 (5.5%)
36 to 40	4 (1.5%)	20 (5%)	24 (4%)
>40	1 (0.5%)	10 (3%)	11 (2%)
Highest level of education			
Associates'	171 (70%)	177 (48%)	348 (57%)
Bachelors'	58 (23.5%)	139 (38%)	197 (32%)
Masters'	14 (6%)	52 (14%)	66 (10.75%)
PhD	1 (0.5%)	0 (0%)	1 (0.25%)
Type of practice			
General	173 (70.5%)	236 (64%)	409 (67%)
Academic	3 (1%)	41 (11%)	44 (7%)
Periodontal	12 (5%)	26 (7%)	38 (6%)
Public health	6 (2.5%)	18 (5%)	24 (4%)
Pedodontic	13 (5.5%)	12 (3.25%)	25 (4%)
Prosthodontic	5 (2%)	7 (2%)	12 (2%)
PHDH	7 (3%)	5 (1.25%)	12 (2%)
Other	26 (10.5%)	24 (6.5%)	50 (8%)

were not administering local anesthetics with 37% (n=38) of those reporting administration was not needed in the type of practice where they were employed. Other reasons for not administering (n=29) included: not practicing under direct supervision, working in an academic setting, lack of opportunity and practice policy. Delegation of local anesthesia by the supervising dentist was reported at 85% (n=305) for dental hygiene procedures and 42% (n=150) for operative or surgical procedures. The types of injections administered were generally distributed evenly except for the greater palatine, nasopalatine, and infraorbital. Other injection types (n=18) included anterior middle superior alveolar nerve block, Gow-Gates and papillary. A successful injection was defined as one that achieves the desired level of anesthesia on the first attempt with 68.5% (n=197) reporting success rates of 95 to 100%. No local or systemic patient complications were reported by 81% (n=241) with tachycardia the most frequently reported complication at 6% (n=18). Other complications (n=13) included patient anxiety, trismus, nausea, trauma or hematoma localized to the injection site, and numbness of the mandible after a posterior superior alveolar injection. Frequency of aspiration prior to deposition of local anesthetics was reported to be 100% by 79% (n=229). Safe needle recapping using a single hand technique or recapping device was used by 94% (n=282), and incidence of percutaneous needle sticks was zero for 87% (n=260). Needle breakage was experienced by 1% (n=4) and formal complaints to the Board of Registration in Dentistry were reported by 2.5% (n=9).

The self-perceived opinions of the Permit L holders are shown in Table VI with similar results reported between the 2 educational forums. Among the Permit L holders, 84% (n=310) strongly agreed/agreed the Permit L was valuable when seeking employment, and 88% (n=322) strongly agreed/agreed the Permit L was valuable in practice. Local anesthesia as necessary for non-surgical periodontal therapy (NSPT) was strongly agreed/agreed to by 97% (n=356), and 81% (n=290) strongly agreed/agreed they felt competent in their local anesthesia administration. The type of educational program attended for training adequately prepared most with 89% (n=322) strongly agreeing or agreeing.

Correlations

Spearman's Rho correlations used to assess relationships between demographics, practices, and opinions are shown in Tables VII to IX. Significant relationships were found between demographics and opinions of non-Permit L holders and Permit L holders. The Permit L holders are likely to be: younger ($p<0.01$), have been in practice for fewer years ($p<0.01$) and have more years remaining in practice ($p<0.01$). They are also more likely to agree than disagree that local anesthesia is necessary for some dental hygiene procedures ($p<0.01$)

Table II: Descriptive Statistics of Non-Permit L Holders

	n (Percent)
Was the Permit L a condition of employment?	
Yes	1 (0.5%)
No	242 (99.5%)
Have you taken the Permit L course?	
Yes	26 (11%)
No	219 (89%)
What type of course did you take?	
Curriculum based	14 (54%)
Continuing education based	10 (38%)
Both	2 (8%)
Have you taken the NERB exam?	
Yes	8 (34%)
No	16 (67%)
If you have taken the certification course and do not have the Permit L, what is your primary reason?	
Waited too long	10 (38%)
In application process	6 (23%)
Failed NERB exam	2 (8%)
Employer resistance	1 (4%)
Did not need	1 (4%)
Other	6 (23%)
Are you planning to take the certification course?	
Yes	45 (21%)
No	172 (79%)
If you are planning to take the certification course, what is your primary reason?	
Stay competitive in the job market	25 (53%)
Self improvement	19 (40.5%)
Current employment requirement	1 (2%)
Other	2 (4.5%)
If you are not planning to take the certification course, what is your primary reason?	
Not needed in type of practice	30 (17.5%)
Not planning to stay in practice long enough	25 (14.5%)
Fear of administering local anesthetics	24 (14%)
No financial gain	23 (13%)
Cost	21 (12.25%)
Increased liability	12 (7%)
Too long out of school	8 (5%)
Employer resistance	4 (2.25%)
No value in practice	4 (2.25%)
Other	21 (12.25%)

Table III: Opinions of Non-Permit L Holders

		SA	A	U	D	SD
	n	n (Percent)	n (Percent)	n (Percent)	n (Percent)	n (Percent)
The Permit L is valuable in practice	245	42 (17%)	98 (40%)	65 (26.5%)	33 (13.5%)	7 (3%)
Local anesthesia is necessary for some procedures such as NSPT	245	104 (42.5%)	107 (43.5%)	14 (6%)	14 (6%)	6 (2%)
My supervising dentist would allow me to administer local anesthetics if I obtained the Permit L	241	64 (26.5%)	79 (33%)	53 (22%)	30 (12.5%)	15 (6%)
I feel as though I would be able to complete the certification course, pass the NERB exam and obtain the Permit L	244	87 (36%)	101 (41%)	38 (16%)	15 (6%)	3 (1%)

Likert Scale used: 1=Strongly Agree (SA), 2=Agree (A), 3=Undecided (U), 4=Disagree (D), 5=Strongly Disagree (SD)

Table IV: Descriptive Statistics of Curriculum(1) and Continuing Education (2) Based Permit L Holders

	CU Based	CE Based	Total
	n (Percent)	n (Percent)	n (Percent)
How long have you held the Permit L?			
<1 year	18 (10%)	9 (5%)	27 (7%)
1 to 3 years	74 (41.5%)	42 (22%)	116 (31.5%)
4 to 5 years	33 (18.5%)	39 (20.5%)	72 (19.5%)
>5 years	53 (30%)	100 (52.5%)	153 (42%)
Was the Permit L a condition of employment?			
Yes	39 (22%)	41 (22%)	80 (22%)
No	138 (78%)	149 (78%)	287 (78%)
On average, how often are you administering local anesthetics?			
At least once a day	23 (13%)	20 (10.5%)	43 (12%)
1 to 3 times a week	42 (24%)	63 (33%)	105 (29%)
4 to 6 times a month	54 (30%)	61 (32.5%)	115 (31%)
Not administering	59 (33%)	45 (24%)	104 (28%)
If you are not currently administering, what is your primary reason?			
Not needed in type of practice	25 (43%)	13 (28%)	38 (37%)
Do not feel confident	8 (14%)	6 (13%)	14 (13%)
Employer resistance	13 (22%)	10 (22%)	23 (22%)
Other	12 (21%)	17 (37%)	29 (28%)
Does your supervising dentist delegate local anesthesia for dental hygiene procedures?			
Yes	143 (82%)	162 (87.5%)	305 (85%)
No	31 (18%)	23 (12.5%)	54 (15%)
Does your supervising dentist delegate local anesthesia for operative or surgical procedures?			
Yes	68 (39%)	82 (45%)	150 (42%)
No	105 (61%)	101 (55%)	206 (58%)
Have there been any formal complaints filed in relation to your administration of local anesthetics?			
Yes	6 (3.5%)	3 (1.5%)	9 (2.5%)
No	169 (96.5%)	179 (98.5%)	348 (97.5%)
How soon after obtaining the Permit L did you feel confident in your ability to safely and effectively administer local anesthetics?			
Immediately	89 (51%)	75 (41%)	164 (46%)
Within 3 months	33 (19%)	60 (33%)	93 (26%)
4 to 12 months	24 (14%)	30 (16%)	54 (15%)
Over one year	28 (16%)	18 (10%)	46 (13%)

Table V: Local Anesthesia Practice Statistics of Curriculum (1) and Continuing Education (2) Based Permit L Holders

	CU Based	CE Based	Total
	n (Percent)	n (Percent)	n (Percent)
On average, what is the success rate of your local anesthesia administration?			
95 to 100%	89 (68%)	108 (69%)	197 (68.5%)
85 to 94%	28 (21%)	35 (22%)	63 (22%)
75 to 84%	10 (8%)	9 (6%)	19 (6.5%)
51 to 74%	4 (3%)	5 (3%)	9 (3%)
<50%	0 (0%)	0 (0%)	0 (0%)
What patient complications, local or systemic, have you encountered as a result of your local anesthesia administration?			
None	110 (81%)	131 (81%)	241 (81%)
Tachycardia	6 (4%)	12 (7.5%)	18 (6%)
Extensive IA or PSA hematoma	3 (2%)	7 (4%)	10 (3%)
Syncope	5 (3.5%)	3 (2%)	8 (2.5%)
Temporary paresthesia	3 (2%)	4 (2.5%)	7 (2.5%)
Allergic reaction	1 (<0.5%)	0 (0%)	1 (<0.5%)
Local anesthetic overdose	0 (0%)	0 (0%)	0 (0%)
Vasoconstrictor overdose	0 (0%)	0 (0%)	0 (0%)
Permanent paresthesia	0 (0%)	0 (0%)	0 (0%)
Facial paralysis	0 (0%)	0 (0%)	0 (0%)
Other	8 (7%)	5 (3%)	13 (4.5%)
What types of injections do you administer?			
Infiltration	125 (70%)	148 (78%)	273 (74%)
MSA	123 (69%)	134 (70.5%)	257 (70%)
IA	119 (67%)	127 (67%)	246 (67%)
ASA	116 (65%)	127 (67%)	243 (66%)
PSA	109 (61%)	118 (62%)	227 (62%)
Long buccal	101 (57%)	119 (63%)	220 (60%)
Mental/incisive	93 (52%)	113 (59%)	206 (56%)
GP	38 (21%)	65 (34%)	103 (28%)
NP	37 (21%)	57 (30%)	94 (25%)
IO	36 (20%)	49 (25%)	85 (23%)
Not administering	42 (23%)	25 (13%)	67 (18%)
Other	5 (3%)	13 (7%)	18 (5%)
How frequently do you aspirate prior to deposition of local anesthetics?			
100%	103 (77%)	126 (82%)	229 (79%)
95 to 99%	17 (13%)	11 (7%)	28 (10%)
85 to 94%	6 (5%)	3 (2%)	9 (3%)
75 to 84%	1 (0.5%)	5 (3%)	6 (2%)
51 to 74%	2 (1%)	0 (0%)	2 (0.5%)
>50%	4 (3%)	7 (4%)	11 (1.5%)
Never	1 (0.5%)	3 (2%)	4 (1.5%)
Do you practice safe needle recapping using a one-handed technique or recapping device?			
Yes	130 (92%)	152 (95%)	282 (94%)
No	11 (8%)	8 (5%)	19 (6%)
How many times have you received a percutaneous needle stick while administering local anesthetics?			
Never	117 (84%)	143 (90%)	260 (87%)
1	18 (13%)	15 (9%)	33 (11%)
2	3 (2%)	0 (0%)	3 (1%)
3	0 (0%)	2 (1%)	2 (0.5%)
4	2 (1%)	0 (0%)	2 (0.5%)
How many times have you experienced needle breakage during deposition of local anesthetics?			
Never	137 (98%)	159 (99.5%)	296 (99%)
1	2 (1.5%)	0 (0%)	2 (0.5%)
2	1 (0.5%)	1 (0.5%)	2 (0.5%)

Table VI: Opinions of Permit L Holders

	Curriculum Based					
	n	SA	A	U	D	SD
		n (Percent)	n (Percent)	n (Percent)	n (Percent)	n (Percent)
The permit L is valuable when seeking employment	178	93 (52%)	56 (31.5%)	19 (11%)	9 (5%)	1 (0.5%)
The Permit L is valuable in practice	178	101 (57%)	51 (28%)	14 (8%)	12 (7%)	0 (0%)
Local anesthesia is necessary for some procedures such as NSPT	177	124 (70%)	47 (26%)	3 (2%)	3 (2%)	0 (0%)
I feel competent in my administration of local anesthetics	175	79 (45%)	57 (33%)	22 (12%)	10 (6%)	7 (4%)
The type of training program I attended adequately prepared me to administer local anesthetics	176	104 (59%)	50 (29%)	18 (10%)	4 (2%)	0 (0%)
	Continuing Education Based					
	n	SA	A	U	D	SD
		n (Percent)	n (Percent)	n (Percent)	n (Percent)	n (Percent)
The permit L is valuable when seeking employment	189	100 (53%)	61 (32.25%)	25 (13.25%)	2 (1%)	1 (0.5%)
The Permit L is valuable in practice	188	110 (58.5%)	60 (32%)	12 (6.5%)	4 (2%)	2 (1%)
Local anesthesia is necessary for some procedures such as NSPT	190	135 (71%)	50 (26%)	2 (1%)	2 (1%)	1 (<1%)
I feel competent in my administration of local anesthetics	182	75 (41%)	79 (43.5%)	11 (6%)	14 (8%)	3 (1.5%)
The type of training program I attended adequately prepared me to administer local anesthetics	184	107 (58%)	61 (33%)	7 (4%)	6 (3%)	3 (1%)

Likert Scale used: 1=Strongly Agree (SA), 2=Agree (A), 3=Undecided (U), 4=Disagree (D), 5=Strongly Disagree (SD)

and the Permit L is valuable in practice ($p<0.01$). Among non-Permit L holders, those who are more likely to agree than disagree that their supervising dentist would allow them to administer local anesthetics are younger ($p<0.05$), have been in practice for fewer years ($p<0.05$) and have more years remaining in practice ($p<0.05$). The non-Permit L holders who are older ($p<0.01$), have more years in practice ($p<0.01$), and fewer years remaining in practice ($p<0.01$) are more likely to disagree than agree with a positive self-perceived ability to obtain the Permit L.

The Permit L holders demonstrated no significant differences between the curriculum and continuing education-based training programs in regards to practice and opinion items. Significant correlations were found among the demographic data showing those trained in a curriculum program are likely to be younger ($p<0.01$), have fewer years in practice ($p<0.01$), have more years remaining in practice ($p<0.01$), have held the Permit L for longer ($p<0.01$) and report the Permit L was a condition of employment than those trained in a continuing education program. The length of time the Permit L has been held yielded significant correlations in several areas. Those who have held the Permit L for longer are more likely to be older ($p<0.01$), have more years in practice ($p<0.01$), have fewer years remaining in practice ($p<0.01$), hold a Bachelors' or Masters' degree, and less likely to report the Permit L as a condition of employment ($p<0.05$). They also report higher administration success rates ($p<0.05$) and higher delegation rates for operative and surgical procedures ($p<0.05$). Those who have held the Permit L for longer are more likely to agree than disagree that local anesthesia is necessary for some dental hygiene procedures ($p<0.05$) and are more likely to agree than disagree with a positive self-perceived competency in administering local anesthetics ($p<0.05$).

Discussion

The demographic characteristics of respondents in this survey were similar to the 2011 Massachusetts Department of Public Health profile of dental hygienists in regards to gender, age, years in practice and level of education.[14] At the time of this survey there were 2,345 Permit L holders representing 35.4% of all currently licensed dental hygienists in Massachusetts (n=6,616), which is similar to the

regional results of Boynes et al who reported 32.1% of dental hygienists administering in the Northeastern states.[6] Demographic and practice items such as gender, age and years in practice were similar to those reported by Anderson,[5] DeAngelis and Goral,[4] and Cross-Poline et al.[3] Practice types in this study differed from most in that 64% (n=236) worked in general practice whereas Anderson reported 89.6%,[5] Boynes et al 76.1%,[7] DeAngelis and Goral 92%,[4] and Cross-Poline et al 76%.[3] However, the greater variety of practice settings that have emerged may account for this difference. The levels of education in this study show significance among those who have held the Permit L for longer ($p<0.01$) which may be affected by the certification of faculty initially needed to teach the skill.

This study, when compared to the 2007 Massachusetts Department of Public Health survey,[11] reveals 79% (n=172) are not planning on becoming certified as compared to 64.4% (n=1,936) and finds similarity in the reasons for not becoming certified such as fear, cost and no monetary compensation. This survey also found fewer who cited increased liability (7% vs. 28.2%), with the main reasons for not becoming certified being not needed in type of practice (17.5%) and not planning to stay in practice long enough to use (14.5%). Employer resistance at 2.25% (n=4) ranks lowest along with no value in practice as reasons for not becoming certified. This study and DeAngelis and Goral[4] found significant differences in opinion regarding the necessity of local anesthesia between certified and not certified.

The primary reason for not administering reported by 28% (n=104) of the Permit L holders was not needed in type of practice (37%) and employer resistance (22%). Cross-Poline et al reported 12% of those certified were not administering due to employer or patient resistance, practice type, and patients' not needing anesthesia.[3] Anderson also reported similar reasons for not administering.[5] Delegation of local anesthesia for dental hygiene (85%) and dental (42%) procedures are below those reported by Anderson (95%, 65%)[5] and DeAngelis and Goral (94%, 68%),[4] but above the regional results of Boynes et al (32.1%, 30.4%)[7] that included states where dental hygienist administered local anesthesia was not legal. A significant relationship between delegation for dental procedures and length of time the Permit L has been held ($p<0.01$) was found by this study. Success achieving anesthesia on the first attempt 95 to 100% of the time was reported by 68.5% of the Permit L holders which is below the 92% overall first attempt success rate reported by Lobene[2] while Anderson[5] reported a success rate of 76%, 90 to 100% of the time. This study found a significant relationship between level of successful injections and length of time the Permit L has been held ($p<0.01$) but no relationship between success and educational level or years in practice which correlates with the findings of Anderson.[5] Aspiration rates of 100% were reported by 79% of Permit L holders whereas Anderson found 86% were aspirating all the time. This lower rate of aspiration may be the determining factor for tachycardia being reported as the most frequent complication.

The main differences between Permit L holders and non-Permit L holders lie within demographics of

Table VII: Selected Correlation Trend Tests Between Demographics and Opinions of Non-Permit L Holders and Permit L Holders

	Spearman's Rank Correlation Coefficient (p)
Age	-0.4**
Years In Practice	-0.45**
Years remaining in practice	0.28**
Local anesthesia is necessary for some dental hygiene procedures such as NSPT	-0.3**
The Permit L is valuable in practice	-0.45**

*p<0.05 for trend **p<0.01 for trend

Table VIII: Selected Correlation Trend Tests Between Demographics and Opinion Variables of Non-Permit L Holders

	Spearman's Rank Correlation Coefficient (p)		
	Age	Years in practice	Years remaining in practice
Local anesthesia is necessary for some dental hygiene procedures such as NSPT	0.07	0.02	-0.05
The Permit L is valuable in practice	-0.05	-0.09	-0.00
My supervising dentist would allow me to administer local anesthetics if I obtained the Permit L	0.13*	0.14*	-0.14*
I feel as though I would be able to complete the certification course, pass the NERB exam and obtain the Permit L	0.24**	0.29**	-0.3**

*p<0.05 for trend **p<0.01 for trend

Table IX: Selected Correlation Trend Tests Between Demographic, Practice, and Opinion Variables of Permit L Holders

	Spearman's Rank Correlation Coefficient (p)	
	Curriculum (1) and Continuing Education (2) Based Program	Years Permit L Held (<1 year, 1 to 3 years, 4 to 5 years, >5 years)
Age	0.61**	0.41**
Years in practice	0.78**	0.49**
Years remaining in practice	-0.37**	-0.22**
Years Permit L held	0.27**	-
Level of education	0.08	0.14**
Value of Permit L when seeking employment	-0.01	0.06
Permit L a condition of employment	0.2**	-0.13*
Frequency of administration	0.01	0.01
Delegation for DH procedures	0.08	0.00
Delegation for operative or surgical procedures	0.05	0.11*
Administration success rate	-0.02	0.14*
Frequency of aspiration	-0.04	0.01
Safe needle recapping	-0.06	-0.03
Frequency of needle stick	-0.09	0.01
Local anesthesia is necessary for some dental hygiene procedures such as NSPT	-0.01	-0.12*
The Permit L is valuable in practice	-0.03	-0.05
Self-perceived competence in administration	-0.002	-0.11*
Self-perceived efficacy of training program	-0.001	-0.01
Time to feel confident in administration	-0.04	-0.01

*p<0.05 for trend **p<0.01 for trend

age, years in practice and years remaining in practice, and differences in opinion regarding the value of the Permit L in practice and the need for local anesthesia during some dental hygiene procedures. The barriers to obtaining the Permit L also lie within demographics and opinions of value, but may be combinations of many factors as suggested by comments provided by non-Permit L holders.

The limitations of this study include the low response rate (10%) which may be primarily due to the single postcard invitation and the limitations of the MDHA email list. The accuracy of self-reported data with its potential for bias remains an issue throughout survey-based research and most likely also contributed to the limitations of this study. The use of social media for accessing the population of interest may improve the response rate in future studies and the use of social media in research studies may prove an interesting area of investigation. Areas for future research include surveying the dentists in Massachusetts to gather and evaluate opinions and practices in relation to the Permit L, its use, value, and factors influencing its low prevalence. Generating interest in local anesthesia administration with continuing education courses that directly address the reasons for not becoming certified or administering may increase the prevalence and use of the Permit L.

Conclusion

This current study of Massachusetts dental hygienists raises concern over prevalence and use of the Permit L as demonstrated by lower numbers of dental hygienists administering local anesthetics and lower delegation rates. Significant differences in opinions exist between non-Permit L holders and Permit L holders as to the value of the Permit L and the need for local anesthesia during some dental hygiene procedures.

Katherine A. Soal, CDA, RDH, MSDH, is an associate professor, Department of Dental Hygiene, Quinsigamond Community College. Linda Boyd, RDH, RD, EdD, is a professor. Susan Jenkins, RDH, MS, CAGS is an associate professor. Debra November-Rider, RDH, MSDH, is an adjunct assistant professor. Andrew Rothman, MS, EIT, is an adjunct faculty. All are at the Forsyth School of Dental Hygiene, MCPHS University.

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