

Fall 2018

# Endoscope Use to Improve Students' Periodontal Debridement Skills and Self-Efficacy

Sandra J. Walker

*Eastern Washington University*

Follow this and additional works at: <https://dc.ewu.edu/theses>



Part of the [Dental Hygiene Commons](#)

---

## Recommended Citation

Walker, Sandra J., "Endoscope Use to Improve Students' Periodontal Debridement Skills and Self-Efficacy" (2018). *EWU Masters Thesis Collection*. 541.

<https://dc.ewu.edu/theses/541>

This Thesis is brought to you for free and open access by the Student Research and Creative Works at EWU Digital Commons. It has been accepted for inclusion in EWU Masters Thesis Collection by an authorized administrator of EWU Digital Commons. For more information, please contact [jotto@ewu.edu](mailto:jotto@ewu.edu).

Endoscope Use to Improve Students' Periodontal  
Debridement Skills and Self-Efficacy

A Thesis

Presented in Partial Fulfillment of the Requirements for the

Degree of Master of Science

in

Dental Hygiene

in the

College of Graduate Studies

Eastern Washington University

by

Sandra J. Walker RDH, MS

Fall 2018

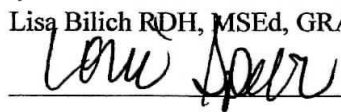
Major Professor Lisa Bilich RDH, MEd

THESIS OF SANDRA WALKER APPROVED BY

  
\_\_\_\_\_

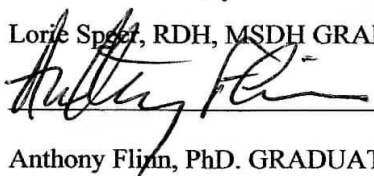
DATE 12/6/18

Lisa Bilich RDH, MEd, GRADUATE STUDY COMMITTEE

  
\_\_\_\_\_

DATE 12/6/18

Lorie Spitzer, RDH, MSDH GRADUATE STUDY COMMITTEE

  
\_\_\_\_\_

DATE 12/6/18

Anthony Flinn, PhD. GRADUATE STUDY COMMITTEE

**MASTER'S THESIS**

In presenting this thesis in partial fulfillment of the requirements for a master's degree at Eastern Washington University, I agree that the JFK Library shall make copies freely available for inspection. I further agree that copying of this project in whole or in part is allowable only for scholarly purposes. It is understood, however, that any copying or publication of this thesis for commercial purposes, or for financial gain, shall not be allowed without my written permission.

Signature Standra Walker

Date 12/12/18

## Human Subjects Approvals



# EASTERN WASHINGTON UNIVERSITY

Office of Grant & Research Development  
210 Showalter Hall, Cheney, WA 99004-2444  
509-359-6567

start something **big**

TO: Sandra Walker, Department of Dental Hygiene  
FROM: Ruth A. Galm, <sup>RG</sup>Human Protections Administrator  
DATE: June 13, 2018  
SUBJECT: Endoscope Use to Improve Students' Periodontal Debridement Skills and Self-Efficacy (HS-5573)

Human subjects protocol HS-5573 entitled "Endoscope Use to Improve Students' Periodontal Debridement Skills and Self-Efficacy" has been approved by an expedited IRB review subject to the following conditions.

- Before you begin, please make the following changes to your Cover Letter.
  1. Please identify yourself as the Principal Investigator and include your contact information.
  2. Please make clear in the opening paragraph that the study is intended to satisfy your thesis requirement for your masters' degree.
  3. Since you are offering the study results to participants, please provide instructions for how they are to request the results. An email request separate from the survey would be one solution. Just make sure that it is not linked to the survey reply.
  4. The last sentence needs to be made into two. They should read as follows: If you have any questions about the research study please contact Professor Lisa Bilich, the Responsible Project Investigator, at [lbilich@ewu.edu](mailto:lbilich@ewu.edu) or (509) 8828-1295. If you have any concerns about your rights as a participant in this research or any complaints you wish to make, you may contact Ruth Galm, Human Protections Administrator, at [rgalm@ewu.edu](mailto:rgalm@ewu.edu) or (509) 359-7971.

A signed and approved copy of your application is attached contingent upon the above conditions.

Student research qualifying for an expedited IRB review is valid for a period of one year. If subsequent to initial approval, the research protocol requires minor changes, the Office of Grant and Research Development should be notified of those changes. Any major departure from the original proposal must be reviewed through a Change of Protocol application submitted to the IRB before the protocol may be altered. Please refer to HS-5573 on future correspondence as appropriate as we file everything under this number.

Cc: HS-5573 file  
Prof. Lisa Bilich, RPI  
Prof. Ann O'Kelley Wetmore, Dept. Chair  
Graduate Office

**Application for Exempt Research  
EWU Institutional Review Board for Human Subjects Research**

**Return this form, signed + 2 copies (3 total) to the Office of Grant and Research Development, 210 Showalter (SHW)**

|  |  |                    |
|--|--|--------------------|
| Principal Investigator (PI): Sandra Walker<br>Title: Student<br><br>Department: Master of Science in Dental Hygiene<br>Address: 7510 Conover Drive, Yakima, WA 98908<br><br>Phone number: (509) 969-9693<br>E-mail: sjwalker65@eagles.ewu.edu  | <i>If PI is a student, complete this section:</i><br>Responsible Project Investigator (RPI)<br><i>(faculty/staff sponsor):</i><br>Lisa Bilich RDH, MEd<br>Department: Dental Hygiene<br>Campus address/Mail stop:<br>310 N. Riverpoint Blvd. Box E<br>Spokane, WA 99202<br>Phone number: (509) 828-1295<br>E-mail: lbilich@ewu.edu |                    |
| Project Title: Endoscope Use to Improve Students' Periodontal Debridement Skills and Self-Efficacy.  |  |                    |
| For students only: Is this research being done to meet a course, thesis or other academic requirement? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If yes, please specify: Master of Science in Dental Hygiene Thesis<br>If not, why is it being done?  |  |                    |
| Project anticipated starting date: June 15, 2018 <span style="float: right;">Anticipated termination date: June 15, 2019</span>  |  |                    |
| Funding: <input checked="" type="checkbox"/> Non-funded <input type="checkbox"/> Internal funding <input type="checkbox"/> External funding<br>Funding agency (if applicable):<br>Grant or Contract Number:  |  |                    |
| Check the type of exemption applicable to the project using the "Exemption Decision Aid" on the next page:<br><input type="checkbox"/> 1. <input checked="" type="checkbox"/> 2. <input type="checkbox"/> 3. <input type="checkbox"/> 4. <input type="checkbox"/> 5. <input type="checkbox"/> 6. <input type="checkbox"/> None   |  |                    |
| Rationale for exemption. Why should this project be exempt?<br>This project involves a survey that will keep the participants anonymous and will not place them at risk.   |  |                    |
| Please state the purpose and methodology of the research: This research is a non-experimental survey exploring dental hygienist (DH) self-efficacy, relationship to periodontal disease and confidence in instrumentation in relationship to prior use of a dental endoscope (DE). A Survey Monkey™ questionnaire related to the use of a DE will be sent to all alumni of the DH department from the years 2007 to 2014. These are the years that DH students utilized the DE.<br><br>Purpose is to determine if the use of a DE changes the way a DH views periodontal disease, if DE affects how DH understand instrumentation debridement skills, if DE increases DH self-efficacy and if DHs' self-efficacy improves with multiple use of the DE.<br><br>Methodology: Non-experimental research with a survey to collect demographic data, Likert scale items and open-ended questions that seek to determine the level of self-efficacy, instrumentation skills and views on periodontal disease |  |                    |
| Describe the procedures: what specifically will subjects do? If data are anonymous, describe the data gathering procedure for insuring anonymity.<br><br>The participants will fill out an online survey sent from the alumni office at EWU that is anonymous and there are no identifiers linked to the survey. The survey will also be placed on the EWU Dental Hygiene Facebook Page as a link to the SurveyMonkey survey. All of the survey information is on the PI's (student) password protected computer in a locked drawer and will only be available to the student and the statistician.<br>Attach all surveys, questionnaires, cover letters, information sheets, etc. including required IRB contact information (See "Procedure" on page 3)  |  |                    |
| I certify that the information provided above is accurate and the project will be conducted in accordance with applicable Federal, State and university regulations:<br><br>PI Signature: <u>Sandra Walker</u> <span style="float: right;">Date: <u>6/1/18</u></span><br>Submit page 1 of this original, signed + 2 copies (3 total) to the Office of Grant and Research Development, 210 Showalter (SHW)  |  |                    |
| <b>Recommendations and Action:</b>   |  |                    |
| RPI Signature:<br><i>(Needed only if PI is a student)</i>  | Date   | Approve/Disapprove |
| <u>Lisa Bilich</u>   | <u>6/1/18</u>  | (A) D              |
| IRB Rep. or Dept. Chair Print & Sign:<br><i>(Needed if PI is a student OR for faculty PI if required by department)</i>  | <u>Rita A. Halm</u>  | (A) D              |

Application for Exempt Research  
EWU Institutional Review Board for Human Subjects Research

IRB Signature:

A D

Subject to the following conditions: *per conditions on memo*

Approved from *6/13/18* to *6/12/19*

### Abstract

**Purpose:** The primary aim of this study was to determine if using the dental endoscope altered dental hygienists' perception of periodontal disease, changed their instrumentation skills, helped increase self-efficacy, and if multiple uses had an effect on participants' self-efficacy in debridement skills.

**Methods:** This mixed-method convenient sample study included dental hygienists ( $N = 34$ ) recruited from Eastern Washington University Bachelor of Science in Dental Hygiene or Master of Science in Dental Hygiene Program. EWU Alumni with at least one experience using the dental endoscope during patient care completed an anonymous self-efficacy survey through SurveyMonkey®. The survey included seven demographic questions, two binary questions, 12 5-point Likert scale items, and five open-ended questions.

**Results:** Results suggest use of the dental endoscope made a difference in dental hygienists' debridement skills and self-efficacy. There was a positive correlation between clinical debridement proficiency and multiple uses with the dental endoscope, ( $r = .26$ ) and statistical significance ( $p < 0.002$ ). There was a statistical significance with multiple uses of the dental endoscope influenced the modification of participants view of periodontal disease with ( $r = -0.371$  and  $p < .003$ ).

**Conclusion:** Results of this study suggest an increase in students' self-efficacy and instrumentation skills after utilizing a dental endoscope during periodontal debridement on a patient with periodontal disease.



### **Acknowledgements**

I would like to thank all the people who supported and guided me through this process.

First, I would like to thank my thesis committee chair, Lisa Bilich MSED, for her patience, guidance, and support. I am eternally grateful for her knowledge on the dental endoscope. Her dedication and contribution to this research continually navigated me in the right direction.

In addition to my advisor committee chair, I would like to give gratitude to my second and third committee members: Lorie Speer, MSDH and Anthony Flinn, PhD for all their insightful guidance, comments, and contribution to making my thesis complete.

I would also like to thank a previous instructor, Valerie Phillips (Maxey) MSDH, for all her encouragement and positivity in the last few years. She lifted me up when I fell and encouraged me to do better.

My most sincere thanks goes to Dr. David Line for helping me with my statistics. Without his expertise I could not have completed my research on time.

Finally, I want to thank Gina Dunn for her help and input. Thank you to my children and friends for carrying the load while I completed my thesis. I could not have done it without all your support and love.

## Table of Contents

|   |      |
|---|------|
| Abstract .....  | vii  |
| Acknowledgements.....                                 | viii |
| List of Figures .....                                 | xi   |
| List of Tables .....                                  | xi   |
| Introduction/ Literature Review.....                  | 2    |
| Introduction to Research Question.....                | 2    |
| Statement of the Problem.....                         | 2    |
| Research questions. ....                              | 2    |
| Overview of the Research.....                         | 3    |
| Gingivitis .....                                      | 4    |
| Periodontitis.....                                    | 7    |
| Periodontal disease treatment.....                    | 10   |
| Dental hygiene education. ....                        | 12   |
| Educational methodology.....                          | 14   |
| Dental Endoscope .....                                | 17   |
| Self-Efficacy .....                                   | 20   |
| Summary .....   | 23   |
| Methodology.....                                      | 24   |
| Research Method or Design.....                        | 24   |
| Procedures.....                                       | 24   |
| Human subject’s protection/Informed consent form..... | 24   |
| Variables.....  | 26   |
| Instruments. ....                                     | 26   |
| Equipment. ....                                       | 26   |
| Steps to implementation. ....                         | 26   |
| Summary .....   | 27   |
| Results.....  | 29   |
| Description of Sample .....                           | 29   |
| Statistical Analysis .....                            | 30   |
| Discussion.....                                       | 38   |

|  |    |
|--|----|
| Summary of Major Findings .....  | 38 |
| Discussion .....   | 39 |
| Did dental hygienists perceive that the use of the dental endoscope altered their perception on periodontal disease?.....          | 39 |
| Did the use of a dental endoscope affect how dental hygienists thought about their subgingival instrumentation skills?.....        | 40 |
| Did the use of a dental endoscope increase the dental hygienists' self-efficacy towards their periodontal debridement skills?..... | 42 |
| Did dental hygienists' self-efficacy improve with multiple use of the dental endoscope? .....                                      | 44 |
| Limitations.....   | 45 |
| Recommendations/Suggestions for Future Research .....  | 46 |
| Conclusions .....  | 47 |
| References .....   | 48 |
| Appendices.....  | 53 |
| Curriculum Vitae .....   | 57 |

## List of Figures

### Figures

|  |    |
|--|----|
| Figure 1: Gingivitis. ....   | 5  |
| Figure 2: Supragingival calculus .....   | 7  |
| Figure 3: Diagram showing the anatomic landmarks of the gingiva.....   | 7  |
| Figure 4: The junction of the cementum and the enamel.....   | 9  |
| Figure 5: Open-flap surgery .....  | 12 |
| Figure 6: Andragogy principles of learning.....  | 15 |
| Figure 7: Dental endoscope video monitor .....   | 18 |
| Figure 8: Participant response to I believe that I am proficient in overall clinical<br>debridement skills ..... | 32 |
| Figure 9: Participant response to if I can see calculus, I have the skills to<br>remove it .....                 | 33 |
| Figure 10: Summary of Research Question findings.....  | 38 |

### List of Tables

#### Tables

|  |    |
|--|----|
| Table 1: Guidelines for determining severity of periodontitis.....                         | 9  |
| Table 2: Dental endoscope survey demographic data.....                                     | 30 |
| Table 3: Participants dental endoscope usage.....  | 31 |
| Table 4: Participants' self-efficacy on removing debris.....                               | 34 |
| Table 5: Summary of survey open-ended question thoughts on dental endoscope.....           | 34 |
| Table 6: Summary of survey open-ended question dental endoscope to detect.....             | 35 |
| Table 7: Summary of survey open-ended question dental endoscope<br>affects skills.....     | 36 |
| Table 8: Summary of survey open-ended question dental endoscope modify<br>perspective..... | 37 |

## **Introduction/ Literature Review**

### **Introduction to Research Question**

Almost 50% of Americans 30 years or older have periodontal disease, near 64.7 million Americans (American Academy of Periodontology [AAP], 2017). Periodontal disease is an oral inflammatory condition affecting the specialized tissue and/or bone surrounding and supporting the teeth. Specialized tissue consists of gingiva: attached and free, periodontal ligament, cementum, and alveolar bone (Newman & Carranza, 2015).

Patients with periodontal disease may be treated by a dental hygienist, dentist, and/or periodontist. A periodontist is a dentist who specializes in diagnosing and treating periodontal disease (Takei & Carranza, 2015). Part of dental and dental hygiene (DH) education focuses on periodontal disease diagnosis and treatment (Commission on Dental Accreditation [CODA], 2018). When a student begins a DH program, they may have limited knowledge about dental anatomy and oral diseases. Having limited knowledge may affect the way a DH student understands and treats periodontal disease. In some DH programs, students are taught the use of a dental endoscope (DE) to perform periodontal debridement. Periodontal debridement includes removing calculus, plaque and other debris by a clinician, which may alter and reduce the bacteria (Takei & Carranza, 2015). A DE can assist the clinician in treatment of periodontal disease. An endoscope is a fiber-optic flexible instrument utilizing illumination to visualize areas within organs or tissue (Merriam-Webster, 2018). An endoscope used in the oral cavity is called a periodontal (dental) endoscope. With the DE, the clinician can see beneath the tissue and have a greater chance to find the problem source of the periodontal disease.

The DE has a magnification that allows the clinician to see debris that initiates inflammation. Using a DE may give DH students an additional tool to increase their periodontal debridement skills. The newly acquired skills may not only increase their chance of effective debridement, but also may improve their self-efficacy. Bandura defines self-efficacy as a persons' belief in their own ability to perform (1997). Self-efficacy is not about how well students do, but how well they perceive they do (Bandura, 1997).

### **Statement of the Problem**

There is limited research on DH students and the benefits of using a DE, especially to increase the clinician's self-efficacy. Research about the DE has exclusively shown how the DE helps to decrease perceived patients' pain (Poppe & Blue, 2014), its usage, benefits to the patient, limitations, and how well it works as a non-surgical procedure (Harrel & Wilson, 2014). However, no studies were found regarding dental hygienists' perception on if the DE affects their skills and techniques of periodontal debridement and if the DE assists in improved self-efficacy.

**Research questions.** Dental hygiene students must be competent addressing causes of oral disease and removing hard and soft deposits from above and under the gingiva, such as calculus and plaque that may cause oral diseases (CODA, 2018). Teaching DH students how to remove these deposits is difficult because the student cannot see their instrument placement under the gingival tissue. The DE allows DH students to visualize instrument placement and to adapt the instrument to difficult tooth morphology (Harrel & Wilson, 2014). Further complicating the process is the nature of students' learning process of developing tactile sense for discovering and removing

deposits under the tissue, as well as the complex nature of tooth root structure. Thus, learning about the oral disease process and understanding how important it is to help the patient prevent or halt the disease process is necessary for DH students. By using a DE with the increased magnification camera, DH students can view the subgingival complex root structure, tissue, and the source of disease. Likewise, the DE may help improve the DH students' debriding skills, which may increase self-efficacy when working without it (Harrel & Wilson, 2014). This research intended to answer the following questions:

- Did dental hygienists perceive that the use of the DE altered their perception on periodontal disease?
- Did the use of a DE affect how dental hygienists thought about their subgingival instrumentation skills?
- Did the use of a DE increase the dental hygienists' self-efficacy towards their periodontal debridement skills?
- Did dental hygienists' self-efficacy improve with multiple uses of the DE?

### **Overview of the Research**

Having periodontal disease is a problem that may affect a persons' quality of life. The loss of gingival tissue and bone can affect a person's self-confidence because they may not want to smile due to how their gingiva and teeth appear. Speaking and eating may become harder due to increased tooth mobility and pain caused by the disease. Ferreira, Dias-Pereira, Branco-de-Almeida, Martins, and Paiva (2017) reviewed 34 cross-sectional studies that used a quality of life assessment tool and questionnaires to assess how periodontal disease impacted the quality of life. Of the 34 studies, 25 showed periodontal disease had a negative impact on the participants' quality of life. There was



more of a substantial decrease in the quality of life of participants with severe periodontitis in comparison with less severe periodontitis. Likewise, a study by Moghadam et al. (2015) with participants ( $N = 700$ ) over the age of 35, determined those with severe periodontitis had a lower quality of life than those with less severe ( $p < 0.001$ ). Those participants with less than ten remaining teeth also had lower quality of life than those with more than 10 remaining teeth ( $p < 0.001$ ). Oral diseases are linked to other systemic diseases, which include diabetes and heart disease (Centers for Disease Control and Prevention [CDC], 2015). As oral health can have a significant impact on overall health, the burden of oral disease or perceived oral problems can affect ones' quality of life.

**Gingivitis.** Periodontal disease is broken down into classifications of gingivitis and periodontitis (Takei & Carranza, 2015). Gingivitis is the earliest stage of periodontal disease that may be caused by bacterial plaque accumulation. Gingivitis is inflammation limited to the soft tissue, not progressed to the periodontium, and is reversible, see Figure 1 (Takei & Carranza, 2015). According to Yamamoto (2011), the majority of gingivitis is typically associated with the bacterial plaque left on teeth due to poor oral homecare. Gingivitis may be reversed with good oral hygiene, which decreases the likelihood of disease progression to periodontitis. Prevention includes brushing teeth two times a day and flossing daily, as well as a regular supragingival and subgingival debridement by a licensed practitioner (American Dental Association [ADA], 2017). A licensed practitioner is a dentist or dental hygienist who has met all education requirements, written and clinical requirements, and obtained a license from the state where they practice (ADA, 2018). The term supragingival refers to the area above the gingiva and

clinically visible. However, subgingival refers to the area below the margins of the gingiva and is not clinically visible (Takei & Carranza, 2015). Plaque is found above the gingiva, as well as below the gingival margins.



*Figure 1.* Gingivitis. This image illustrates teeth with supragingival plaque on them and inflamed gingiva (Gold Bamboo, 2017).

Dental plaque or biofilm is a community of bacteria (microbes and their nutrients) increasing in complexity. Dental plaque may start to cause a chain of immune and inflammatory responses, which may start the inflammatory response that causes gingivitis (Georg, Preshaw, Donley, & Preshaw, 2014). Bacteria found in plaque produces proteases. Proteases typically break down the proteins that are the structure of periodontium (Takei & Carranza, 2015). Harmful substances are released from plaque found in the oral cavity, but mostly the extent of disease depends on the specific type of bacteria and the host response that causes the breakdown of periodontal tissue (Georg et al., 2014). Plaque includes over 500 various kinds of bacteria. Some of the bacteria may cause an inflammatory response that destroys the supporting tissue by causing periodontitis, bone loss, and tooth loss (Takei & Carranza, 2015). In chronic periodontitis there are an increased number of gram negative (90%) and anaerobic (75%)

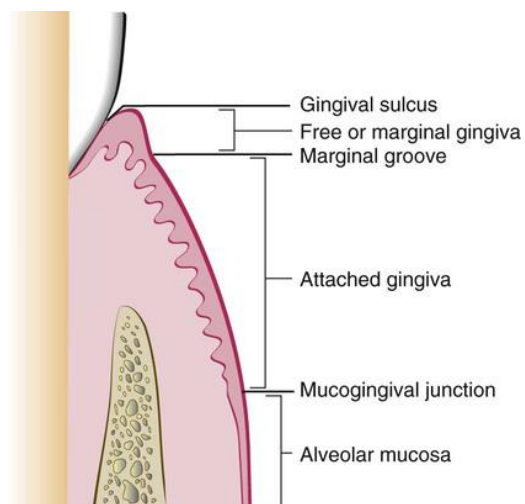
species of bacteria (Takei & Carranza, 2015). Most bacteria found in the mouth are harmless under normal situations. Genetics, presence of systemic disease, and quantity of bacteria affects if and how much attachment loss occurs (Takei & Carranza, 2015). Unbalanced bacterial colonies, also known as dysbiosis, may result in an increase of periodontitis. The bacteria that causes periodontal infections usually are anaerobes (not requiring oxygen) and few aerobic (requires oxygen) (Loesche, 1996). With chronic periodontitis, there is less oxygen in the area and an increased number of anaerobic bacterial species, which means the harmful bacteria are able to survive and cause more damage (Takei & Carranza, 2015).

In addition to dental plaque being a source of gingivitis, another source is calculus (see Figure 2). The soft plaque generally takes 1-14 days to harden into calculus (Takei & Carranza, 2015). Calculus is calcified dental plaque, which serves as a nidus or breeding ground for bacteria and coincides with periodontal diseases (Takei & Carranza, 2015). Just like plaque, calculus may be found supragingival and subgingival (Takei & Carranza, 2015). Subgingival plaque and calculus are found in the sulcus. The sulcus is a band of tissue not attached to the tooth but is more like a collar (see Figure 3). A healthy sulcus ranges in depth between 1 millimeter to 3 millimeters. Although, when the patient has periodontal disease, the sulcus may be 4 millimeters or greater (Takei & Carranza, 2015). When the calculus build-up is not removed, the gingivitis process may increase into periodontitis (Harrel & Wilson, 2014). The presence of calculus could

cause periodontitis to become more severe due to the complex bacterial composition of calculus (Takei & Carranza, 2015).



*Figure 2.* Supragingival calculus (Kazeko & Tarasenko, 2016).



*Figure 3.* Diagram showing the anatomic landmarks of the gingiva (Takei & Carranza, 2015).

**Periodontitis.** The body's inflammatory response to bacterial plaque may lead to a transition from gingivitis to periodontitis. Periodontitis has four disease classifications, which include slight, moderate, and severe chronic periodontitis, and aggressive periodontitis. The progression from gingivitis to periodontitis involves breakdown and

loss of the periodontal ligament and collagen attachment that connects the tooth to the bone (Takei & Carranza, 2015). This attachment loss may be just a few millimeters or the whole length of the tooth, up to approximately 20 millimeters depending on which tooth the disease has affected (Loesche, 1996).

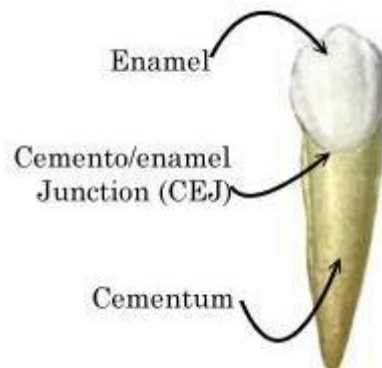
Classification and diagnosis of periodontitis is based upon many factors, which include presence of inflammation, severity, how rapid it progresses, and the extent of clinical attachment loss. Attachment loss can be classified as slight, moderate, and severe as shown on Table 1. Along with whether attachment loss is localized or generalized based on the percentage of sites involved. Also probing depth, bleeding on probing, and radiographic bone loss are used to classify and diagnose periodontitis (Armitage, 2015). Clinical attachment loss is the extent of root surface that has lost ligament attachment (Takei & Carranza, 2015). Slight attachment loss involves 1 to 3 millimeters of clinical attachment loss, while moderate involves 3 to 4 millimeters and severe involves  $\geq 5$  millimeters. Methods used to detect periodontitis include probing depths, percentage of areas of bleeding, bone loss (visual and radiographical), clinical exam, plaque levels, furcation involvement, and tooth mobility (Preshaw, 2015). Periodontitis is an increase of clinical attachment loss and is measured with an instrument called a periodontal probe. Within the sulcus, bacteria filled plaque accumulates and may cause more inflammation and tissue irritation (Loesche, 1996). There is a difference between clinical attachment level and depth of the sulcus. Depth of the sulcus is the distance between the margin of the gingiva and the bottom of the sulcus. Hence the clinical attachment level is from the

cementoenamel junction to the bottom of the sulcus, see Figure 4. The cementoenamel junction is the line between the root and the crown of the tooth (Takei & Carranza, 2015).

Table 1:

*Guidelines for determining severity of periodontitis (AAP, 2015)*

|                                       | Slight (Mild)                             | Moderate                    | Severe (Advanced) |
|---------------------------------------|---|-----------------------------|-------------------|
| Probing depths                        | >3 & <5 mm                                | ≥5 & <7 mm                  | ≥7 mm             |
| Bleeding on probing                   | Yes                                       | Yes                         | Yes               |
| Radiographic bone loss                | Up to 15% of root length or ≥2 mm & ≤3 mm | 16% to 30% or >3 mm & ≤5 mm | >30% or >5 mm     |
| Clinical attachment loss <sup>1</sup> | 1 to 2 mm                                 | 3 to 4 mm                   | ≥5 mm             |



*Figure 4.* The junction of the cementum and the enamel (ProProfs, n.d).

Periodontitis may also involve tooth mobility measured with a metal instrument and the clinician's finger (Takei & Carranza, 2015). Mobility is determined by how easily the tooth moves and is graded by class I-III. A tooth with class I mobility moves slightly, class II moves moderately, and class III has severe mobility towards the lip, tongue, side to side, as well as vertically into the tooth socket (Takei & Carranza, 2015). The amount of bleeding on probing is also an indicator of periodontitis. A clinician needs to include all factors when planning treatment needs for the patient with periodontal disease.

**Periodontal disease treatment.** Periodontal disease treatment methods may be classified as either surgical or non-surgical therapy. Both surgical and non-surgical treatments can be effective ways of treating and controlling periodontal disease. If the sulcus is still active with periodontitis, after close monitoring of the maintenance phase, some patients may require a combination of surgical and non-surgical therapies (Takei & Carranza, 2015). In Washington State, dental hygienists are taught and only licensed to use non-surgical therapy (Washington State Legislature, RCW 18.29.050, 2018).

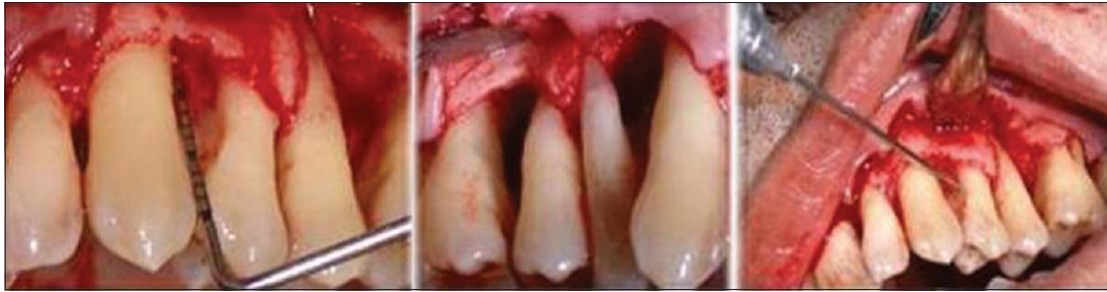
Non-surgical therapies may include: mechanical debridement of hard and soft deposits under and above the gingiva using hand instruments, ultrasonic, laser treatment, antimicrobial therapy and/or DE (Wilkins, 2017). The use of hand instruments and ultrasonic instruments are taught in DH programs for non-surgical periodontal debridement (Wilkins, 2017). Not all institutions include laser treatment and DE as part of their curriculum. In a study by Zarandi, Mostafapoor, and Keshefimehr (2016), participants ( $N = 30$ ) were scaled, patients ( $n = 15$ ) had hand instruments used (control) and patients ( $n = 15$ ) had hand and ultrasonic instruments used (test). Both control and test patients showed a significant decrease in periodontitis. In teeth with sulcus deeper than five millimeters, there was a greater decrease in periodontal pocket depth (PPD) with the use of the ultrasonic instruments. At baseline the PPD of test group was  $5.8 \pm 0.4$  and at the two-month re-evaluation PPD was  $3.1 \pm 1.1$  ( $p > 0.05$ ). Compared to the control group at baseline PPD was  $5.4 \pm 0.3$  to  $4.2 \pm 1.5$  with statistical significance ( $p > 0.05$ ). With non-surgical approach, closed subgingival scaling, only tactile sense is used to determine if all disease-causing sources are removed. Even though closed subgingival debridement has been found to improve overall health of diseased tissue, sometimes

results do not improve and can be due to residual calculus not tactically felt by the clinician (Harrel & Wilson, 2014). The DE, increases the opportunity to visually see a different aspect of periodontal disease and potentially can have a better outcome for the patient (Blue et al., 2013).

When non-surgical therapy is not sufficient, surgical therapy might also be needed. Surgical therapy may include open-flap surgery, as shown in Figure 5, bone regeneration techniques and tissue grafting. According to Armitage (2015), surgical techniques are costly due to time needed for procedures. Debridement with open-flap surgery allows direct visualization of the root and present any periodontal defects or debris that may be contributing to periodontal disease. With direct visualization, there may be a greater chance of removing the disease-causing problem. An incision is made that may extend over many teeth and after healing, may leave the patient with a food trap and tooth sensitivity (Harrel & Wilson, 2014). Food traps usually include increased probe depths and attachment loss, which often increases the chance of greater periodontal disease (Takei & Carranza, 2015). With both non-surgical and surgical techniques some of the calculus deposits are so small they may be missed.

By using a DE there is an option for a non-surgical periodontal treatment with better visualization than traditional debridement, due to the use of a magnified camera. The DE with the amplified magnification camera with light gives the dental hygienist the ability to know where the subgingival calculus and biofilm is located. The instrument allows the dental hygienist to visually detect calculus that may result in bleeding, inflammation, and bone loss (Mohan, Jain, & Rai, 2014).





*Figure 5.* Open-flap surgery. These images illustrate the clinical view of the intrabony defects during maxillary open-flap operation (Agrali, & Kuru, 2015).

**Dental hygiene education.** In order for DH students to learn about periodontal disease, CODA Standard 2-8c requires each DH program to teach “dental sciences...[which] include tooth morphology, head, neck and oral anatomy, oral embryology and histology, oral pathology, radiography, periodontology, pain management, and dental materials” (CODA, 2018, p. 22). Students learning these subjects are provided the knowledge needed to treat patients with periodontal disease. In addition, Standard 2-14 requires that DH “graduates must be competent in providing DH care for all types of classifications of periodontal disease including patients who exhibit moderate to severe periodontal disease” (CODA, 2018, p. 25). Students must have access to patients with all classifications of periodontal disease in addition to the training needed to treat them. To ensure DH students meet CODA standard 2-11, “the DH program must have established mechanisms to ensure a sufficient number of patient experiences that afford all students the opportunity to achieve stated competencies” (CODA, 2018, p. 23).

In conjunction with the periodontal disease classifications, there are level of difficulty that include how much calculus is present and the number of teeth and/or sites with calculus. Programs that meet the CODA standards assure students have experiences

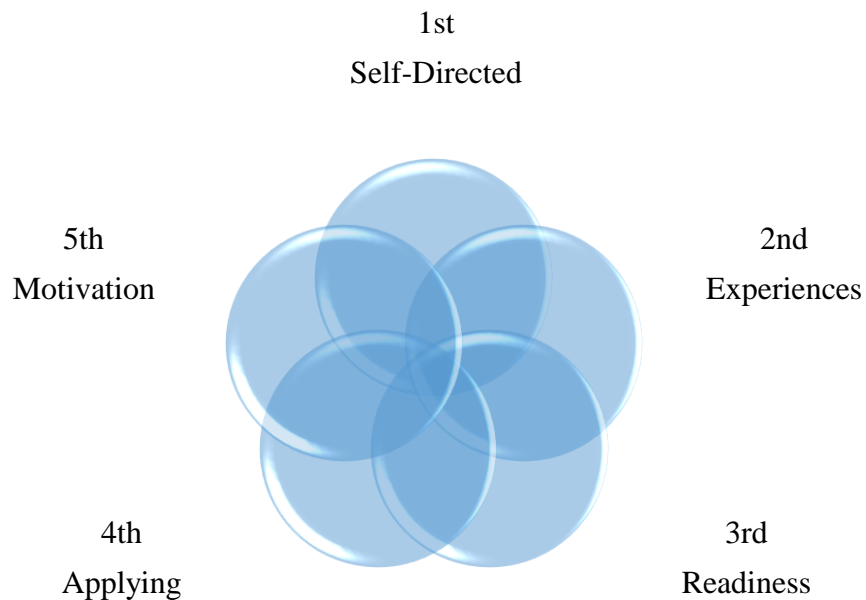
with a variety of patients. The DH program provides the curriculum, course development, and clinical education. Clinical education is based on exposing DH students to supervised practice on patients with a range of disease to assure they are competent. The student must decide how they use this knowledge and how they build their clinical skills.

With education and access to patients with periodontal disease, it is essential DH students be attentive. Being able to visualize tooth and root anatomy assists dental hygienists to scale subgingivally. Scaling or mechanical debridement involves using a mechanical dental instrument to remove biofilm and calcified deposits from the crown and root of the teeth (Takei & Carranza, 2015). If the DH student does not successfully remove subgingival plaque and/or calculus the soft tissue and bone may have increased risk of attachment loss. With increased clinical attachment loss, the periodontal sulcus can increase and deepen thus making subgingival access even more difficult (Takei & Carranza, 2015). Educating DH students on the effects of gingivitis and periodontitis, along with how to prevent it, ultimately benefits the public. Although education is vital, education alone is not enough, it is imperative DH students are able to apply their education and skills.

When DH students gain knowledge and increase the skills needed to help patients improve their oral health, they may also help themselves by increasing their self-efficacy (Bandura 1977). Self-efficacy helps DH students gain the confidence that may assist them into giving more effort to produce positive outcomes. Clinical learning situations that produce affirming effects rather than negative responses help build up the DH students' belief in themselves and their abilities. A DE gives the student the opportunity

to improve the visualization of the anatomy below the gingiva, which may help produce positive outcomes while performing periodontal debridement and consequently may help increase self-efficacy.

**Educational methodology.** There are many different approaches to educating adult learners, in order to achieve specific objectives. According to Knowles (1980), pedagogy theory is transferring facts and adults want more than the typical pedagogy model of lectures, readings, tests and quizzes as a way to learn. Most adults want hands on to increase their learning experience. Another theory is andragogy, which focuses on the learner instead of the educator (Knowles, Holton III, & Swanson, 2015). Andragogy has five basic principles based on the learner (see figure 6). The first principle is based on self-concept and being self-directed. Second includes experiences the learner had previously. Third, the learner needs to be aware of themselves and their qualities. Fourth, orientation of applying gained knowledge. Last, how eager and motivated the person is to learn (Knowles, Holton III, & Swanson, 2015). According to Knowles (1985), with andragogy students are taking control of their own learning and learner involvement is crucial. Critical thinking is an andragogy approach to learning that promotes students thinking and analyzing by themselves.



*Figure 6.* Andragogy principles of learning (Knowles, Holton III, & Swanson, 2015).

A crucial part of DH students' education stems from critical thinking. Facione (2016) defines critical thinking as a judgement that arises through reason. According to CODA (2018) Standard 2-21 and 2-23, dental hygienists need to have skills in self-assessment, decision making, problem solving, and critical thinking. Critical thinking is used with comprehensive patient care; being able to use active learning and problem solving while working with patients. A study by Veeraiyan and Sekhar (2013), determined critical appraisal exercises significantly improved dental students ( $N = 42$ ) tooth preparation skills and improved their self-efficacy. One group ( $n = 19$ ) was taught critical appraisal (CA) exercises where they evaluated previously prepared teeth and then discussed the evaluation answers. Whereas, the control (C) group ( $n = 23$ ) were not given CA exercises. The CA group's overall test scores were significantly higher, ( $p < 0.05$ ), than C group. The CA group also had a significant improvement in their self-

efficacy ( $p = 0.006$ ). A comparable study by Dehghani, Jafarisani, Pakmehr, and Malekzadeh (2011) included university students ( $N = 216$ ), girls ( $n = 150$ ) and boys ( $n = 66$ ) who completed General Self-Efficacy Scale and the California Critical Thinking Skills Test. The study obtained a significant correlation between students' self-efficacy and critical thinking ( $r = 0.21, p < 0.001$ ). When DH programs focus on learner-based education, the DH student is in charge of their own learning experiences. Andragogy learning encourages critical thinking (Bandura, 1977). By combining both together in the learning process, DH students may increase their self-efficacy and perceive their performance as more successful.

Additionally, there are three main sensory learning styles: visual, auditory, and kinesthetic (Lujan & DiCarlo, 2006). Dental hygiene students can learn in conceptually repetitious ways. Some learn best from one sensory style, whereas others may learn with a variety of them. Studies have shown that students prefer to learn with multiple modes of styles. The study by Lujan and DiCarlo (2006) included medical students ( $N = 166$ ) and sought to determine what mode of learning the medical students preferred. It was determined only 36.1% preferred single mode and 63.8% preferred to learn with multiple modes. Of the students that preferred a single mode of learning, 5.4% preferred visual, 4.8% preferred auditory, 7.8% preferred reading and writing, and 18.1% preferred kinesthetic. Whereas the students who preferred multiple modes, 24.5% preferred two modes, 32.1% preferred three modes, and 43.4% preferred four modes. Likewise, a study by Asiry (2016) included dental students ( $N = 269$ ), which aimed to determine the preferred learning style of the participants. The visual, aural, read/write, and kinesthetic (VARK) questionnaire was administered and concluded 58.4% of the participants

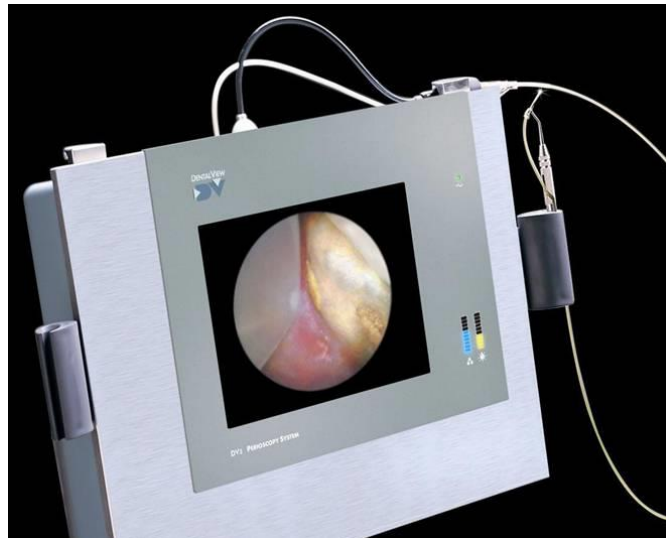
preferred multiple learning preferences. There are multiple modes of learning styles and methods used in DH programs and helps those who learn best with this method (Lujan & DiCarlo, 2006).

Dental hygiene students use dual sensory learning styles while performing periodontal debridement with a DE. First, is kinesthetic or tactile learning of feeling for calculus, discerning it from rough root surfaces and or anatomical root structures and removing the calculus. Second, is visual where the DH student can see these things. Combining these learning styles may help the DH student to improve skills needed for the DH profession. Consequently, knowing what modes of learning students prefer, educators are able to help students get quality education. Furthermore, the DE is used to help educate students in an active learner-based method of teaching, which integrates the student in the learning process.

### **Dental Endoscope**

When the DH student is treating periodontal disease, the main objective is to remove all biofilm and calculus from the crown and roots of the teeth, referred to as debridement. In DH programs, many different methods are utilized when teaching debridement. The educators teach DH students to debride from above and beneath the tissue using: mechanical instruments, ultrasonic instruments, and some programs teach the use of DE (Wilkins, 2017). The DE has innovative video, as shown in Figure 7, with lit magnification enabling the DH student to subgingivally view the problem source (Perioscopy Incorporated, 2017). With the increase in magnification, a DH student can see on the monitor what is underneath the tissue along with what is causing the inflammation and bone loss. The DH student is then able to use both hand and ultrasonic

instruments in conjunction with the DE . This allows the DH student to visually scale the roots of calculus and/or biofilm underneath the gingival tissue.



*Figure 7.* Dental endoscope video monitor. This image illustrates the view of the tooth and tissue the clinician sees with the DE (Perioscopy Incorporated, 2017).

The DE is an instrument that produces a magnification ranging from 24X-48X (Archana, 2014) and is used during non-surgical periodontal debridement. The DE assists in detection and removal of calculus and biofilm. The magnification provides visualization under the gingival tissue and due to the small size, it is only slightly invasive. The optical camera is placed into the periodontal sulcus for magnified root surface visualization. With the DE, the subgingival visualization is improved (Archana, 2014). According to Takei and Carranza (2015), there are many advantages to using a DE: increased view to detect subgingival deposits, guide DH student to remove deposits, help examine for cavities, failing restorations, and subgingival root fractures.

With the DE, the tissue is deflected away from the tooth with the sheathed 0.99-millimeter fiberoptic that captures the images of the sulcus and sends them to the video

monitor. The glass fiber-optic cable captures an area of approximately 3 millimeters (Partido, Jones, English, Nguyen & Jacks, 2014). The intent of using the DE is to increase visualization in areas of bone loss to aid in removal of calculus or other deposits. Blue, Lenton, Lunos, Poppe, and Osborn (2013) stated during periodontal debridement, the DE aids the DH student to visualize the whole tooth, including the roots, which assists in determining the cause of chronic periodontal disease.

What can deter some DH schools from including DE in their program could be the expensive cost to purchase or lease the equipment. The cost of a new DE is around \$13,000-20,000 (DentMedSales, 2017). A new fiber-optic cable for the system costs approximately \$1,400 and the single use optical fiber sheath, which costs approximately \$50 each (Slim, 2011).

Besides the expensive cost of a DE, it is also difficult to master. It takes both hands: non-dominant hand for the scope and dominant for instruments, along with both feet: one for the water on the DE and the other to change illumination and/or ultrasonic instrument (Perioscopy Incorporated, 2017). Despite the barriers to using a DE, including the cost, the use of the DE is beneficial in educating DH students on the skills needed to remove subgingival deposits and crucial for the patient's periodontal health. The use of bright fiber-optic DE, aids the student in finding the source of the inflammation and bone loss (Harrel & Wilson, 2014). Then the dental hygienist will have the opportunity to gain the technical debriding skills needed to remove the problem source. With increased technical debriding skills, the DH student may increase their self-efficacy (Bandura, 1977; Benadom & Potter, 2011).



### **Self-Efficacy**

Self- efficacy is essential in DH education. Dental hygienists are expected to self-direct, think critically, self-assess, and problem solve (CODA, 2018). Likewise, self-efficacy is one's positive attitude towards their ability to succeed (Bandura, 1977), which has two important aspects. First, it is not about someone's ability to do a job at hand; it is the persons' belief that they complete a task. Second, a person's self-efficacy guides them to set goals that challenge their performance (Bandura, 1977). Self-efficacy provides the ability to overcome stressful and taxing situations (Bandura, 1997). In DH education, students are held at a high standard since they are working with patients (CODA, 2018). New DH students start out with no technical skills in periodontal debridement, which may decrease the students' self-efficacy about their ability to perform treatment on patients. When a DH student improves their periodontal debridement skills, it may create positive beliefs in their ability to provide effective treatment. According to Bandura (1977), people can control the way they view situations and the more self-efficacy they have the better they will be at conquering hard tasks and improving their skills. The more positive outcomes the student has in their daily skills, the more the students' attitude may improve. A positive attitude may improve their self-efficacy about their ability to do the job at hand (Bandura, 1997).

Using the DE helps DH students visualize where subgingival calculus is and an improved chance to remove the calculus (Takei & Carranza, 2015). With every positive situation where the DH student can see they removed the problem source; their self-efficacy has a greater chance to increase. According to Bandura (1997), this is prevalent incentive, whereas self-efficacy is motivated by frequent positive benefits. The more a

DH student dwells on their accomplishment, the more self-efficacy should improve. The same may be true if a DH student dwells on fears and failures, there may be a decrease in self-efficacy (Bandura, 1997). With improved self-efficacy, the student may gain confidence and know they can remove plaque and calculus. Removal of subgingival debris may lead to an improvement in the patient's oral and systemic health (CDC, 2015; Takei & Carranza, 2015).

The DE is relatable to medical endoscopes. Medical endoscopes have been shown to help improve self-efficacy in study participants. A study by Westfelt et al. (2013) included participants ( $N = 21$ ) that were endoscopy nurses ( $n = 11$ ) and endoscopists ( $n = 10$ ). This study sought to determine whether training on endoscopy simulators would help increase participants' self-efficacy on their ability to perform colonoscopy, gastroscopy or endoscopy. The study determined training with the colonoscope increased the participants' self-efficacy overall from 26.0 to 30.0 with significance ( $p = 0.0003$ ). Another study by Benadom & Potter (2011) included graduate student communication disorder clinicians ( $N = 17$ ) and sought to determine if the use of transnasal endoscope (TE) helped improve self-efficacy. Students were randomly assigned to use a TE on either human patient simulator or non-lifelike simulator for training. After training on simulators, they performed two TE on two different volunteer patients and then took a Likert scale nine question self-assessment survey. The survey evaluated the graduate students' self-efficacy and competence, along with a Likert scale seven question survey taken by the volunteers to evaluate the students' skills. On the clinician survey, there were 15 out of 17 who reported having greater self-efficacy after performing the second TE and increased their overall time ( $p = 0.05$ ). These studies used

a medical endoscope to train the students on the medical procedure and had increased self-efficacy with their participants.

Endoscope use during simulation is common in the medical field to determine self-efficacy in studies. In a pilot study by Holdsworth, Skinner, and Delany (2016), simulation was used to determine if simulated learning environments (SLE) affect educators' self-efficacy in their clinical student supervision skills. The study included clinical educators ( $N = 17$ ) in SLE group ( $n = 10$ ) and standard education (StED) group ( $n = 7$ ). The SLE group received two 3-hour workshops involving simulated clinical teaching scenarios and facilitated debriefing afterwards. The StED group received two learning modules online. The participants completed a questionnaire to measure their self-efficacy. The SLE group had significant improvement in three self-efficacy domains compared to the StED group: (1) talking to students ( $p = 0.01$ ), (2) adapting teaching styles ( $p = 0.02$ ), and (3) identifying future practice strategies ( $p = 0.02$ ).

Students with high self-efficacy have been shown to have a higher level of academic performance. A study by Goulao (2014) sought to examine if self-efficacy and academic achievement were related in first year undergraduate students ( $N = 63$ ) of different discipline. Results from the participant questionnaire showed a significant relationship between self-efficacy and academic achievement ( $r=0.286$ , at 0.05 level). Likewise, a study by Meral, Colak, & Zereyak, (2012) included sophomore university students ( $N = 82$ ) also determined self-efficacy had a positive influence on academic achievement ( $p > .05$ ).

**Summary**

Periodontal disease varies from person to person depending on their home care, genetic factors, immune system, and environmental factors (Takei & Carranza, 2015). Nonetheless, the disease process generally begins with gingivitis. With education, DH students gain the needed information and skills to be able to help treat patients with any classification of periodontal disease. Dental hygiene students can use the DE in a multi-mode learning experience including critical thinking and andragogy theories of learning. The DE gives the DH student an advantage of seeing what lies beneath the subgingival tissue. With this advantage and experience, DH students may increase their self-efficacy, which may help them in the future as DH professionals.

The current literature supports using a DE to improve the view of the subgingival surfaces, but there is a gap in the literature that shows how dental hygienists feel about using a DE and whether it helps increase their self-efficacy. The goal of this study was to present results on how dental hygienists perceived the DE affected their skills, instrument choices, self-efficacy, and whether multiple uses with a DE affected their skills and self-efficacy.

## **Methodology**

### **Research Method or Design**

This study used mixed-method design utilizing a nonexperimental convenience sample. Mixed-method design takes advantage of the strengths from both quantitative and qualitative research (Bryman, 2012). It also creates confident findings by bringing the qualitative and quantitative designs together, to enhance the technique in measuring corresponding data (Bryman, 2012). This study was conducted in the form of a survey designed by the PI (Appendix A). Qualitative methods offered an effective way to determine dental hygienists' perspective on improved instrumentation skills and self-efficacy as a result of periodontal debridement with DE. Quantitative methods were utilized to establish participants' survey response frequencies.

### **Procedures**

**Human subject's protection/Informed consent.** Approval from Eastern Washington University (EWU) Institutional Review Board (IRB) was obtained prior to implementing this study. Methods were used to ensure participants privacy and anonymity through an email with a blind carbon copy via SurveyMonkey. The survey link was also attached to the EWU DH Facebook® account, which directed participants to SurveyMonkey®. Participants had no known risk with this study and participation was voluntary. Participants could withdraw at any time throughout the study with no consequences to them. Consent (Appendix B) was implied by the participants

completing the survey. Data was stored on the PI's personal password-protected computer.

### **Sample Source, Plan, and Size, Description of setting**

*Sample Source.* Alumni from the Bachelor of Science in Dental Hygiene (BSDH) program from 2007 to 2013 were recruited. Only those with DE experience were eligible for the study since during those years the DE was an elective course. From 2014 to 2018 the DE was a required learning experience, therefore all BSDH alumni were recruited to participate in the study. Also, all current Master of Science in Dental Hygiene (MSDH) students and alumni were recruited since the DE was required as part of their clinical learning experience.

*Plan.* The PI recruited participants by having EWU Alumni Association email BSDH alumni and MSDH current students and alumni. This population sample was chosen for pragmatic purposes including a) all participants have at least one DE experience with a patient, b) the participants were easily accessible, and c) convenient for the PI.

*Size.* EWU Alumni Association sent out emails to the eligible sample size ( $N = 246$ ) including all current EWU MSDH ( $n = 17$ ) students, all EWU BSDH ( $n = 210$ ) alumni, and all MSDH ( $n = 19$ ) alumni. All 246 participants have had at least one experience using a DE on a patient.

*Description of the Setting.* For pragmatic purposes, the study was conducted at the Dental Hygiene Department at EWU Spokane Campus in Spokane, Washington as it utilizes DE in the curricula. This nonprobability convenience sample study included EWU BSDH alumni and MSDH current students and alumni who have used the DE.

Nonprobability sampling is used often when the sample is conveniently available to researchers and opens the door for further studies (Bryman, 2012).

**Variables.** The independent variable is the DE. The dependent variables are the DH students' self-efficacy, length of practice, and perceptions of subgingival scaling skills.

**Instruments.** Quantitative data was collected using seven demographic questions, two binary questions, 12 5-point Likert scale items ranging from (1) "strongly agree" to (5) "strongly disagree." Qualitative data was obtained through five open-ended questions. The 12 5-point Likert scale items were compiled based on Bandura (1997) Self-Efficacy Theory. Demographic data determined which EWU program the dental hygienist is currently enrolled in or alumni of and if they are a MSDH current student or alumni. Also, the demographic data included number of years the dental hygienist has practiced, type of practice they work in, and hours they work per week.

The PI used summary statistics, which included measures of central tendency, along with *t*-test and Pearson Correlation Test to compare relationships between the variables, and thematic analysis to analyze Likert-scale responses. Descriptive statistics were used to analyze survey open-ended responses. The statistical significance of this study was set at  $p < 0.05$ .

**Equipment.** SurveyMonkey® was used to distribute the survey and collect responses. The data was then entered into SPSS® software, that organized the data and transferred the file into Microsoft Excel® where it was analyzed.

**Steps to implementation.** In the first phase, approval was obtained from EWU IRB. During the second phase, the PI requested EWU Alumni Association to email

survey link to all EWU BSDH alumni 2007 to 2018 and MSDH students and alumni from 2014 to 2018.

In the third phase, a link to SurveyMonkey® was emailed to all potential participants and a link to the survey was posted on EWU DH Facebook® page. In this phase, participants were informed of the purpose of the survey and how they were selected for the study. Since there was not enough response to the emails in three weeks, the PI requested EWU Alumni Association to send out another email in the fourth phase.

The fifth phase was collecting, evaluating and analyzing the data. The PI offered to send study results to all the participants once the study was completed. Thematic research methods were used to describe survey responses to open-ended questions. Thematic analysis is used to break down qualitative data into categorical themes to synthesize (Bryman, 2012).

### **Summary**

This study focused on EWU BSDH alumni and MSDH current students and alumni educated and experienced with the DE during at least one patientcare. This study was emailed through EWU Alumni Association and a link to the survey was posted on EWU DH Facebook® page. Data was self-reported from the survey to determine how dental hygienists perceived the DE affected their skills and self-efficacy. The PI used descriptive statistics, *t*-test, and thematic analysis to analyze the data received, along with the Pearson Correlation Test to determine if there was a correlation between the dental hygienists' self-efficacy and the number of times they have used the DE. Also, the Pearson Correlation Test determined if the BSDH alumni felt they had greater self-efficacy by education with a DE in the BSDH program. Thematic analysis was used to



categorize common themes found in participants responses to the open-ended questions.

The PI offered to provide the results of this study to the participants.

## Results

### Description of Sample

This study was a self-reported mixed research study. The PI recruited EWU BSDH alumni and current and alumni MSDH students who utilized the DE at least once during patient care. The total population recruited included all current EWU MSDH students, all EWU BSDH alumni (2007-2018), and all MSDH alumni (2014-2018). A total of 51 participants completed the survey, but only ( $N = 35$ ) actually used the DE at least once during patient care.

The survey demographics identified respondents 52.9% ( $n = 18$ ) attended EWU BSDH, 23.5% ( $n = 8$ ) attended EWU MSDH, and 23.5% ( $n = 8$ ) attended both BSDH and MSDH programs. Out of the respondents, 29.4% ( $n = 10$ ) have been practicing DH 6-10 years and 26.5% ( $n = 9$ ) 11+ years. There was statistical significance with length of practicing influencing participants proficiency in overall periodontal debridement skills ( $p < .0004$ ). The majority respondents 82.4% ( $n = 28$ ) work in a general practice. Whereas, only 2.9% ( $n = 1$ ) works in a periodontal practice (see Table 2).

Table 2

*Dental Endoscope Survey Demographic Data*

| Demographic Characteristics |                                  | (N = 34) | Percent |
|-----------------------------|----------------------------------|----------|---------|
| EWU DH Program Attended     | BSDH                             | 18       | 52.9%   |
|                             | MSDH                             | 8        | 2.4%    |
|                             | Both                             | 8        | 2.4%    |
| How Long Practicing         | If MSDH, Attended EWU DH Program | 9        | 26.5%   |
|                             | 0-2 years                        | 10       | 29.4%   |
|                             | 3-5 years                        | 5        | 14.7%   |
|                             | 6-10 years                       | 10       | 29.4%   |
|                             | 11+ years                        | 9        | 26.5%   |
| Practice Type               | General                          | 28       | 82.4%   |
|                             | Periodontal                      | 1        | 2.9%    |
|                             | Other                            | 2        | 5.9%    |
|                             | Both General and Periodontal     | 1        | 2/9%    |
|                             | Both General and Other           | 2        | 5.9%    |
| Hours Worked per Week       | 0-10 hours                       | 3        | 8.8%    |
|                             | 11-20 hours                      | 5        | 14.7%   |
|                             | 21-30 hours                      | 8        | 2.4%    |
|                             | 31-40+ hours                     | 18       | 52.9%   |

**Statistical Analysis**

Quantitative and qualitative data was collected using a survey with seven demographic questions, two binary questions, 12 5-point Likert scale items, and five open-ended prompts. Responses were manually entered into SPSS® software, transferred into Microsoft Excel® by the PI and stored on the PI's personal password protected computer. A statistician from EWU was recruited to assist with data analysis.

Quantitative analysis was used to compute number of responses for demographic, binary, and Likert scale questions. Participants were asked about their DE use on two demographic and one binary question, as shown on Table 3. All participants (N = 34) answered no to question, "Do you currently use a DE in practice?"

Table 3

*Participants' DE usage*

| DE Usage                        | Number<br>( <i>N</i> = 34) | Percent |
|---------------------------------|----------------------------|---------|
| Used DE on at least one patient | 34                         | 100%    |
| Multiple uses with DE           |                            |         |
| No                              | 24                         | 70.6%   |
| Yes                             | 10                         | 29.4%   |
| If yes, 2 patients              | 6                          | 17.6%   |
| number of 3 patients            | 3                          | 8.8%    |
| patients 4 patients             | 1                          | 2.9%    |
| 5+patients                      | 0                          | 0%      |

This study sought out to answer the following research questions:

1. Did dental hygienists perceive that the use of the DE altered their perception on periodontal disease?
2. Did the use of a DE affect how dental hygienists thought about their subgingival instrumentation skills?
3. Did the use of a DE increase the dental hygienists' self-efficacy towards their periodontal debridement skills?
4. Did dental hygienists' self-efficacy improve with multiple uses of the DE?

The survey Likert-type questions collected data to obtain participants thoughts and perception of DE usage and how it affected dental hygienists' self-efficacy toward their debridement skills. Primary findings were 55.9% (*n* = 19) participants strongly agreed DE improved their ability to detect calculus and 29.4% (*n* = 10) agreed with statement. Only 5.9% (*n* = 3) felt the DE did not help with calculus detection. There was no statistical significance with multiple DE uses.

Relating participants' self-efficacy with their overall skills, 35.4% ( $n = 12$ ) strongly agree and 61.8% ( $n = 21$ ) agreed they are proficient. Only 2.9% ( $n = 1$ ) neither agree nor disagree about their proficiency, as shown in Figure 8. There was a positive correlation between clinical debridement proficiency and multiple uses with DE,  $r = .26$  and statistical significance was  $p < 0.002$ .

### Q13 I believe that I am proficient in overall clinical debridement skills

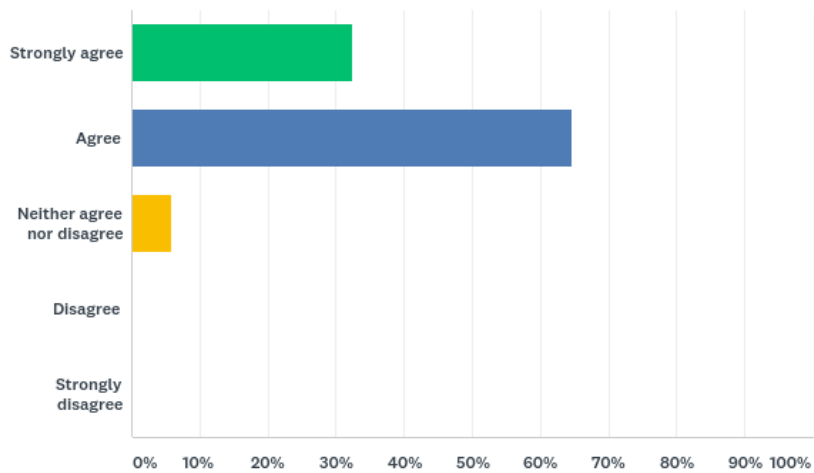


Figure 8. Participant Response to Self-Efficacy Survey Question 13.

The results indicate respondents felt skilled to remove any calculus they could see. There were 64.7% ( $n = 22$ ) participants who strongly agreed with their ability to remove visible calculus, 29.4% ( $n = 10$ ) agreed, only 2.9% ( $n = 1$ ) neither agreed nor disagreed and 2.9% ( $n = 1$ ) disagreed (see figure 9).

### Q14 If I can see calculus, I have the skills to remove it

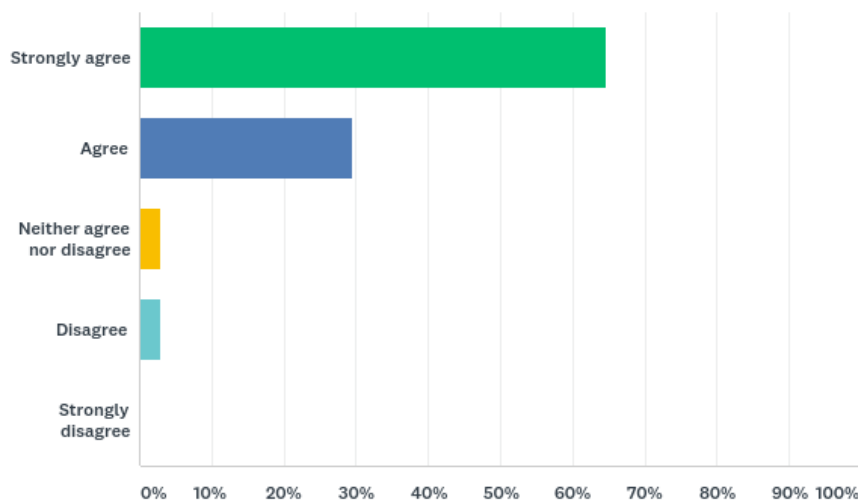


Figure 9. Participant Response to Self-Efficacy Survey Question 14.

A low number of participants 14.7% ( $n = 5$ ) felt skillful using a DE. Of the participants ( $N = 34$ ), 41.2% ( $n = 14$ ) disagreed and 44.1% ( $n = 15$ ) neither agreed nor disagreed they were proficient with DE use. A majority 70.6% ( $n = 24$ ) participants had only one experience using DE. With 44.1% ( $n = 15$ ) answering neither agree nor disagree with their skills using a DE. Only 2.9% ( $n = 1$ ) strongly agreed they were skilled using DE and had only one DE experience. There were 11.8% participants ( $n = 4$ ) who agreed they were skillful using DE and only 25% ( $n = 1$ ) of those participants had more than one experience with the DE. There was no statistical significance in how participants felt using DE once compared with multiple DE uses.

There were differences in the participants' self-efficacy on removing debris, especially supragingival compared to subgingival. Majority of participants 94.1% ( $n = 32$ ) felt proficient supragingival compared to subgingival 82.4% ( $n = 28$ ) without DE. However, a greater number of participants 53.0% ( $n = 18$ ) felt more proficient subgingival with DE compared to supragingival 50.0% ( $n = 17$ ), as shown on Table 4.

Table 4

*Participants' Self-efficacy on Removing Debris*

| Answer                        | Proficient removing<br>Supragingival Debris |            | Proficient removing<br>Subgingival Debris |            |
|-------------------------------|---|------------|---|------------|
|                               | Without DE                                  | With DE    | Without DE                                | With DE    |
| Strongly Agree                | 20 (58.8%)                                  | 6 (17.6%)  | 7 (20.6%)                                 | 9 (26.5%)  |
| Agree                         | 12 (35.3%)                                  | 11 (32.4%) | 21 (58.8%)                                | 9 (26.5%)  |
| Neither Agree nor<br>Disagree | 1 (2.9%)                                    | 11 (32.4%) | 3 (8.8%)                                  | 10 (29.4%) |
| Disagree                      | 1 (2.9%)                                    | 5 (14.7%)  | 3 (8.8%)                                  | 3 (8.8%)   |
| Strongly Disagree             | 0 (0%)                                      | 2 (5.88%)  | 0 (0%)                                    | 3 (8.8%)   |

Thematic coding was used for qualitative analysis to identify common themes and key words to open-ended questions. The first time participants used a DE 47.1% ( $n = 16$ ) found it difficult to use, as shown on Table 5, but most found it amazing and surprising. A participant stated, "I was shocked at how difficult removing biofilm was. Prior to using the DE, I assumed the ultrasonic effectively removed sub gingival biofilm. The DE proved that wrong. It was an amazing experience."

Table 5

*Summary of Survey Open-ended Question Thoughts on DE*

| Thematic response                                      | Number<br>( $N = 34$ ) | Percent |
|--|------------------------|---------|
| The first time you used a DE, what were your thoughts? |                        |         |
| Amazed   | 17                     | (50.0%) |
| Surprised  | 6                      | (17.6%) |
| Difficult to use                                       | 16                     | (47.1%) |
| Interesting  | 3                      | (8.8%)  |
| Time consuming   | 4                      | (11.8%) |
| Confused   | 3                      | (8.8%)  |
| Loved it   | 6                      | (17.6%) |
| Other  | 3                      | (8.8%)  |
| Able to see to remove                                  | 8                      | (23.5%) |
| Improves ability/proficiency                           | 9                      | (26.5%) |
| Other  | 4                      | (11.8%) |

Most respondents 50.0% ( $n = 17$ ) thought the DE increased their subgingival vision that allowed them to detect calculus, biofilm, and root anatomy 47.1% ( $n = 16$ ). There were 29.4% ( $n = 10$ ) who thought DE improved skills, technique, ability, and effectiveness, see Table 6.

Table 6

*Summary of Survey Open-ended Question DE to Detect*

| Thematic response   | Number<br>( $N = 34$ ) | Percent |
|---|------------------------|---------|
| Do you think the DE affects your ability to detect subgingival calculus? Please explain |                        |         |
| Yes   | 27                     | (79.4%) |
| No  | 2                      | (5.88%) |
| Null  | 5                      | (14.7%) |
| Can see subgingival   | 17                     | (50.0%) |
| Beneficial to detect calculus/biofilm   | 16                     | (47.1%) |
| Able to see along with tactile  | 6                      | (17.6%) |
| Able to see calculus removed  | 4                      | (11.8%) |
| Improves abilities and effectiveness  | 7                      | (20.6%) |
| Improves skills and techniques  | 3                      | (8.8%)  |
| Other   | 9                      | (26.5%) |

Participants stated the DE helped detect calculus 29.4% ( $n = 10$ ) and improved their ability and proficiency at removing subgingival deposits 26.5% ( $n = 9$ ), see Table 7. Overall, participants thought the DE affected their ability to detect calculus and affected their debriding skills in a positive way.



Table 7

*Summary of Survey Open-ended Question DE Affects Skills*

| Thematic response  | Number<br>(N = 34) | Percent |
|--|--------------------|---------|
| Do you think the DE affects your skills at removing subgingival deposits? Please explain |                    |         |
| Yes  | 25                 | (73.5%) |
| No   | 5                  | (14.7%) |
| Null   | 4                  | (11.8%) |
| Need practice/it hinders   | 4                  | (11.8%) |
| Can see subgingival  | 6                  | (17.6%) |
| Helps detect calculus  | 10                 | (29.4%) |
| Helps with effective instrumentation   | 3                  | (8.8%)  |
| Able to adjust and learn   | 4                  | (11.8%) |
| Able to see along with tactile   | 2                  | (5.88%) |
| Able to see to remove  | 8                  | (23.5%) |
| Improves ability/proficiency   | 9                  | (26.5%) |
| Other  | 4                  | (11.8%) |

A common theme found among the participants responses 35.3% ( $n = 12$ ) thought the DE helped modify participants perspective on periodontal disease by making it so subgingival view was increased. The majority of participants 70.6% ( $n = 24$ ) stated their perspective was modified. While 2.9% ( $n = 1$ ) stated they were not sure if it modified their perspective (see Table 8). One participant stated their perspective was modified “because not only do I have the theory behind periodontal disease, I also have a live visual for better understanding and diagnosis.” Few participants 5.8% ( $n = 2$ ) answered they needed more experience with DE and 11.8% ( $n = 4$ ) stated the DE hindered their skills.

Table 8

*Summary of Survey Open-ended Question DE Modify Perspective*

| Thematic response   | Number<br>( <i>N</i> = 34) | Percent |
|---|----------------------------|---------|
| Do you feel that the use of the DE has modified your view on periodontal disease? |                            |         |
| Yes   | 24                         | (70.6%) |
| No  | 2                          | (5.88%) |
| Not sure  | 1                          | (2.9%)  |
| Null  | 7                          | (20.6%) |
| Able to see subgingivally   | 12                         | (35.3%) |
| Able to see debris to remove  | 5                          | (14.7%) |
| Better under-standing of disease  | 3                          | (8.8%)  |
| Binds importance of treatment   | 6                          | (17.6%) |
| Eye opening to see diseased pocket  | 5                          | (14.7%) |
| Show complex sub-gingival disease   | 4                          | (11.8%) |
| Show difficulty to remove calculus  | 6                          | (17.6%) |
| Need more experience  | 2                          | (5.88%) |
| See proof of how hard it is to remove biofilm and calculus                        | 4                          | (11.8%) |
| Other   | 6                          | (17.6%) |

There were some modifications on how the participants viewed periodontal disease after using DE. Some 8.8% ( $n = 3$ ) recognized how damaging the disease is and 29.4% ( $n = 10$ ) how important it is for dental hygienists to have the skills and proficiency to remove all supragingival and subgingival debris. There was statistical significance with multiple use of DE influencing participants view of periodontal disease ( $r = -0.371$  and  $p < .003$ ).

## Discussion

### Summary of Major Findings

This research found by including DE in DH education, the clinicians had an altered perspective of periodontal disease. The participants understood the need for precise instrumentation and removing all nidus of disease. One of the most significant findings was the increased self-efficacy with the use of DE. Multiple DE use correlated to increased self-efficacy (see Figure 10).

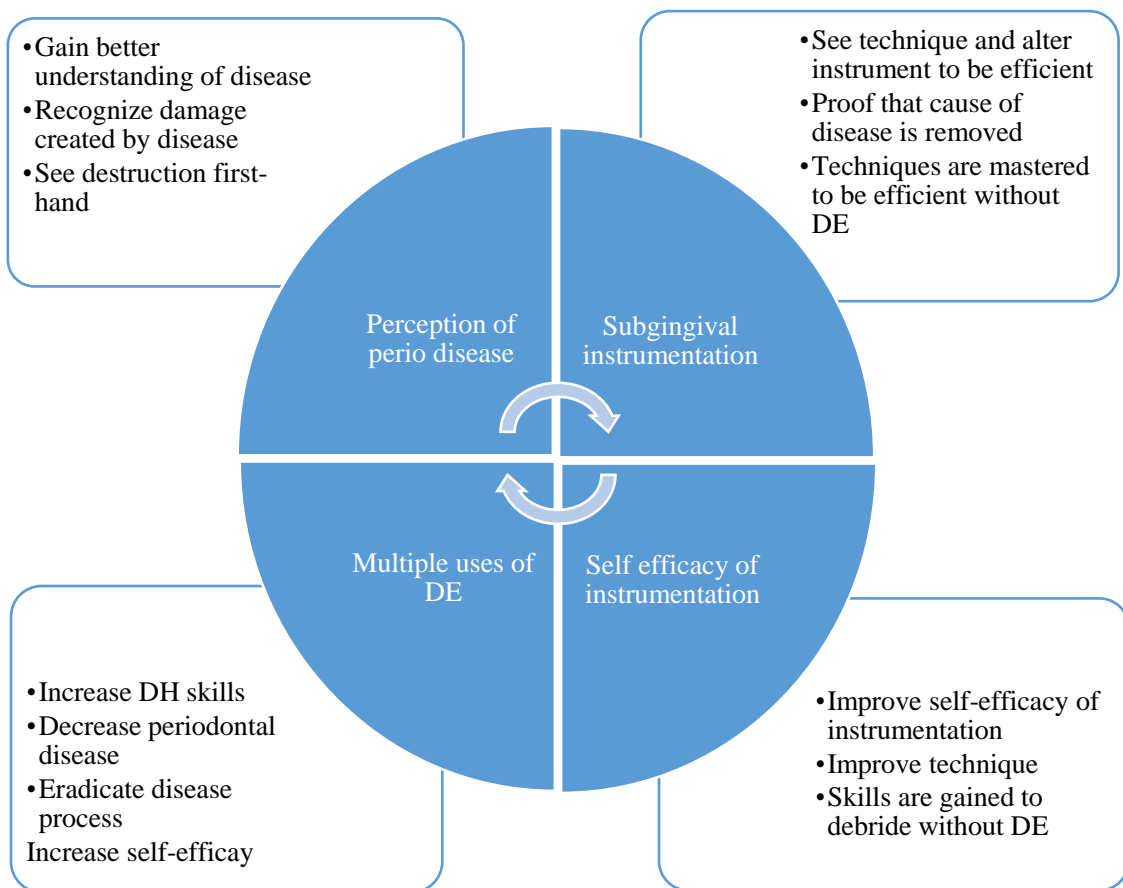


Figure 10. Summary of Research Questions Findings.

## Discussion

**Did dental hygienists perceive that the use of the DE altered their perception on periodontal disease?** Dental hygiene programs use different tools to give dental hygienists the best education possible. Harrel and Wilson (2014) state the DE allows the dental hygienist to visually see the placement of their instrument, adapt to difficult tooth morphology and see the removal of damaging subgingival calculus and biofilm. Data from open-ended questions revealed using a DE gave dental hygienists a different perspective of periodontal disease. Due to the use of the DE, dental hygienists were able to visually see calculus and other debris under the tissue. Hence, they were able to see the extent of periodontal disease and the destruction it caused, which gave them a greater understanding of the disease; this demonstrated competence as delineated by the CODA (2018) requirements. One common theme was stated, “You will have a better chance of stabilizing periodontal disease if you can remove supra and sub gingival deposits and biofilm. Using the DE has made me more aware of how much biofilm and deposits I may be leaving behind, when I have thought I did a thorough job. How much of my patient's persistent periodontal disease is related to my maintenance procedures?” Another commented, “It is amazing how a minute piece of calculus can increase a devastating disease. It is so important for us dental hygienists to do the best job possible and the DE helps improve that opportunity.”

Dental hygienists treat patients with periodontal disease in both general and periodontal practices. Therefore, it is critical a dental hygienist graduates with the knowledge and understanding of how periodontal disease affects their patients, along with the skills to treat the disease. The DE gives a different view subgingivally to where

the clinician gains comprehension on what is happening with the disease under the tissue. With the ability to see subgingivally, participants were able to see the destruction periodontal disease has on tissue and bone support. As one participant said, “I was shocked at how difficult removing biofilm was. Prior to using the DE, I assumed the ultrasonic effectively removed sub gingival biofilm. The DE proved that wrong. It was an amazing experience.” These findings further support the impact of periodontal disease in conjunction with the need to understand and treat the disease (Ferreira et al., 2017).

This study shows how pivotal the DE is in dental hygienists’ education and how it enhances the knowledge of periodontal disease. These results proved the assumption on how DE would alter the participants periodontal disease cognizance. Having a DE as part of the DH experience could be vital in education and may assist in increasing skills needed for the DH profession. Periodontal disease can be a difficult and complex subject. The DE can help individuals who have a propensity towards visual learning to connect didactic education with the clinical skills needed to treat periodontal disease. With new technologies emerging every year, the DE assists in improving treatment outcomes for periodontal patients. The DE provides dental providers with an advanced visual perspective subgingivally that may allow for better patient outcomes with less invasive treatment.

**Did the use of a DE affect how dental hygienists thought about their subgingival instrumentation skills?** Responses from the study indicate the use of DE increased dental hygienists’ debridement skills with the visual acuity along with increased tactile sensitivity. The dental hygiene instrument was able to be adjusted to the angle of the root and placement to remove calculus. With the DE, calculus can be

distinguished from root anatomy, root fractures, restoration, and abnormalities (Blue et al., 2013; Takei & Carranza, 2015). A participant stated “It [DE] improves it [ability to detect calculus] because there are anatomical discrepancies that could be mistaken for calculus. For instance, enamel pearls.”

The present findings are consistent with conclusions from Westfelt et al. (2013) that indicated the use of medical endoscope increased instrumentation skills. One participant noted “DE allowed me to see and improve my instrumentation strokes, they were too long and sweeping prior to DE use, and I now spend more time subgingival to not only remove hard deposits but soft biofilm.” Increasing dental hygienists’ skills will aid in their daily clinical treatment of patients with periodontitis. The DE allows the dental hygienist to learn to visualize root anatomy and placement of instruments for future patient care (Harrel & Wilson, 2014).

The DE increased the awareness of how plaque and calculus relates to periodontitis. One participant noted “We know that as severity of periodontal disease/bone loss increases, our ability to remove 100% of subgingival calculus with traditional instruments decreases. The ability to visualize subgingival calculus increases our ability to remove it.” The clinicians felt if they were able to see the calculus, they were able to remove it. This in turn would relate to better outcomes of patient care in the DH practice and would make them more employable due to higher skills. Scaling with the DE embeds the vision of anatomy and debris so that with closed scaling, blind, the hygienist can visualize what they tactically feel. This technology and non-surgical treatment option, shows the DH practitioner and educator how periodontally involved

patients have better treatment outcomes. By visualizing and removing the calculus, the results can be dramatic in decreasing the pocket depth and ceasing the signs of disease.

Teaching dental hygienists about periodontal disease, how to treat disease, and using the DE helps reiterate orientation of applying gained knowledge (Knowles, Holton III, & Swanson, 2015). Critical thinking is an important part of DH education. Research by Veeraiyan and Sekhar (2013) determined critical appraisal exercises helped improve the participants' skills, which related to this study. Through critical thinking skills, dental hygienists are able to take learned knowledge and apply it to their instrumentation skills. Research by Dehghani, Jafarisani, Pakmehr, and Malekzadeh (2011) relates to this study with findings correlating critical thinking aids in improved self-efficacy.

**Did the use of a DE increase the dental hygienists' self-efficacy towards their periodontal debridement skills?** Self-efficacy is increased by gaining knowledge, confidence, and skills needed to be successful (Bandura, 1977). When participants of this study used DE during debridement, they were able to watch their instruments, adapt to root structure, and see the calculus be removed (Takei & Carranza, 2015). Increased self-efficacy was associated with the visualization of participants instrumentation and calculus removal. Noted by a participant, "with proficiency, my ability to detect subgingival calculus would improve. A combination of years of understanding root morphology blindly and then having a tool that gives me vision under the gum line would drastically improve calculus detection and efficiency of removal."

The results from the study show there was an increase in dental hygienists' self-efficacy due to use of DE during DH education. The findings relate to Benadom and Potter (2011) and Westfelt et al. (2013) where using medical endoscope helped increase

the participants' self-efficacy by allowing them to visualize their technique and placement of instruments. Bandura (1977) relates technology, such as the DE, may help increase self-efficacy because it can assistance in perfecting dental hygienists' debriding skills. With the DE, the dental hygienist has direct vision of the periodontal pocket, which may help work through a challenging debridement, thus increasing self-efficacy. With an in increased self-efficacy, the level of critical thinking may rise, which could change the quality of the dental profession.

One unanticipated finding from the study was a large number of participants ( $n=10$ ) dental hygienists and dental hygiene students did not feel proficient at removing calculus if they saw it with the DE. This potentially could relate to the fact that 85.2% ( $n=29$ ) did not feel they were efficiently skillful at using the DE. This could translate into the clinician focusing more on the technology rather than debridement skills. This finding can help faculty focus on providing more experiences with the DE. There was a correlation with multiple uses of the DE and increased instrument proficiency ( $r = .26, p < 0.002$ ). Increasing the training to multiple periodontal debridement with DE ,could potentially assist dental hygienists with increased self-efficacy and help them feel more proficient at utilizing the DE.

The participants overall felt proficient in their clinical debridement skills and agreed they had the skills to help arrest the disease process. By including the DE in education, students are challenged with thinking and analyzing, which can aid in self-efficacy. Using critical thinking can help dental hygienists face clinical challenges with greater ease and benefit their patient. A barrier to using the DE in educational settings is the cost of the equipment.



**Did dental hygienists' self-efficacy improve with multiple use of the DE?**

These study results agree with the research from Benadom and Potter (2011), which showed that self-efficacy improved, especially with multiple uses with DE. The more a person successfully completes and masters a task, the greater the self-efficacy (Bandura, 1977). Therefore, with every repeated successful DE experience, dental hygienists' self-efficacy improved. Task mastery has the greatest effect and influential power on self-efficacy (Bandura, 1977). A participant with multiple DE uses states "[DE affects skills because] you are able to see how effective your strokes are and adjust as needed and learn that muscle memory." Another participant with multiple DE use noted "[DE affects skills because] it improved my ability to removed deposits and my ability to assess my debridement."

Although there is a gap in current literature showing DE helps increase dental hygienists' self-efficacy, there are studies that confirmed medical endoscopes increased medical students' and doctors' self-efficacy (Bendom & Potter, 2011; Westfelt et al., 2013). Every DH program may benefit from having a DE in their education. Providing DH students with multiple experiences debriding with a DE has a roadblock of finding time in the curricula. Dental hygiene curricula is at least two full years of comprehensive, complex, and extensive academics (CODA, 2018). The results of this study showed increase in self-efficacy with multiple uses, therefore adding more time on curriculum for additional training and utilizing DE may increase dental hygienists' self-efficacy and debridement skills. Those DH programs not having a DE might need to find funding via grants to purchase the equipment. Nonetheless, this study showed how important the DE was to the participants' improved self-efficacy and debridement skills.

For those dental practitioners who have not had an opportunity to utilize a DE, they can be encouraged to attend a clinical continuing education class that advances their experience and knowledge with this technology.

### **Limitations**

This study was not without limitations. Data was collected from a small sample size, which was limited to EWU DH degree programs. This convenient sample study included EWU BSDH alumni and MSDH alumni and students with DE debridement on at least one patient experience. There were less than optimal qualified survey responses 13.8% ( $N= 34$ ). Low response could be due to survey link being emailed out to alumni and students' EWU email, which may no longer be active. Having the survey completed during a dental hygiene course may increase response rate. According to Wahlberg and Poom (2015), nonresponse bias can be reduced by incentives. In a study including students, the survey could be encouraged during class, hence might increase response rate. Also, by offering a drawing for a gift card might provide an incentive and increase response rate. Further study with a larger population size including other DH programs could yield a larger sample size and survey responses.

The survey question relating DE modifying participants view of periodontal disease might have received different responses had it been worded differently. Some participants thought the question was asking about the vision of periodontal disease and answered with how they were able to see subgingivally, able to see debris to remove, and show difficulty to remove calculus. If the question had been stated "Do you think the DE modified your perception of periodontal disease?" it might have received more applicable responses.

**Recommendations/Suggestions for Future Research**

Further research adds to these findings to determine if dental hygienist' self-efficacy is improved by using a DE during their DH education. Having a control group would make the study more effective. Also, having a pretest survey before participants use the DE and a posttest after using the DE would impact self-efficacy findings by providing a comparison. As stated in the limitations, a larger population size should be considered to yield a larger response sample. Even though having a low response rate does not mean the study is less valid (Wahlberg & Poom, 2015). Also, by including dental hygienists who have not used the DE would compare their self-efficacy to those who have used DE.

### **Conclusions**

The results of this study display the effectiveness and benefits of including DE as part of DH education. Giving students the opportunity to use DE during debridement on multiple patients could increase the students' clinical skills and improve self-efficacy. By using DE in DH programs, students are given the opportunity to directly visualize subgingival signs, causes, and destruction from having periodontitis. This study indicates the DE alters the way dental hygienists view diseased pockets especially with multiple use. With the DE, dental hygienists are visually able to see the complexity of periodontal disease.

During periodontal debridement, vision is limited to what clinically can be seen supragingival. Giving students improved opportunity to see the angle and placement of their instruments subgingivally may increase chances of removing damaging debris. With every positive clinical experience where the dental hygienist sees the removal of the debris it will produce improved self-efficacy.

This study provides the beginning research on DE increasing dental hygienists' self-efficacy and provides an important opportunity for further research. Having self-efficacy with debridement skills creates a profession that is beneficial to possibly arrest and reverse periodontal disease to improve the oral health of the general public.

### References

- Agrali, O.B. & Kuru, B.E. (2015). Periodontal treatment in a generalized severe chronic periodontitis patient: A case report with 7-year follow-up. [Image]. *European Journal of Dentistry*, 9(2), 288-292. doi: 10.4103/1305-7456.156844.
- American Academy of Periodontology. (2015). American Academy of Periodontology Task Force Report on the update to the 1999 classification of periodontal diseases and conditions. *Journal of Periodontology*, 86(7), 835-838. doi: 10.1902/jop.2015.157001
- American Academy of Periodontology. (2017). Periodontal disease fact sheet. *Perio.org*. Retrieved from <https://www.perio.org/newsroom/periodontal-disease-fact-sheet>
- American Dental Association [ADA]. (2017). Mouth healthy. *ADA*. Retrieved from <http://www.mouthhealthy.org>
- American Dental Association [ADA]. (2018). State licensure for US dentists. *ADA*. Retrieved from <https://www.ada.org/en/education-careers/licensure/state-dental-licensure-for-us-dentists>
- Archana, V. (2014). Calculus detection technologies: Where do we stand now? *Journal of Medicine and Life*, 7(Spec Iss 2), 18-23.
- Armitage, G.C. (2015). Development of a classification system for periodontal diseases and conditions. *Journal of Periodontology Online*, 4(1), 1-6. doi:10.1902/annals.1999.4.1.1
- Asiry, M.A. (2016). Learning styles of dental students. *The Saudi Journal for Dental Research*, 7(1), 13-17. doi.org/10.1016/j.sjdr.2015.02.002
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W.H. Freeman and Company.
- Baron, S. (Ed.). (1996). *Medical microbiology* (4th ed.). [online version]. Galveston, TX: The University of Texas Medical Branch at Galveston. Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK8259/>

- Benadom, E.M. & Potter, N.L. (2011). The Use of simulation in training graduate students to perform transnasal endoscopy. *Dysphagia*, 26(4) 352-360. doi:10.1007/s00455-010-9316-y
- Bryman, A. (2012). *Social Research Methods* (4<sup>rd</sup> ed.). Oxford, NY: Oxford University Press.
- Centers for Disease Control Prevention. 2015. Oral health basics. *U.S. Department of Health & Human Services*. Retrieved from <https://www.cdc.gov/oralhealth/basics/index.html>
- Commission on Dental Accreditation. (2018). Accreditation standards for dental hygiene education Programs. *American Dental Association*. Retrieved from [http://www.ada.org/~media/CODA/Files/dental\\_hygiene\\_standards.pdf?la=en](http://www.ada.org/~media/CODA/Files/dental_hygiene_standards.pdf?la=en)
- Dehghani, Jafarisani, Pakmehr, and Malekzadeh (2011). Relationship between students' critical thinking and self-efficacy beliefs in Ferdowsi University of Mashhad, Iran. *Procedia Social and Behavioral Sciences*, 15(2011), 2952–2955. doi.org/10.1016/j.sbspro.2011.04.221.
- DentMedSales. (2017). Dental view DV2 perioscopy system- equipment. DentMedSales. Retrieved from <http://www.dentmedsales.com/products.php?product=DENTAL-VIEW-DV2-PERIOSCOPY-SYSTEM-%252d-EQUIPMENT>
- Facione, P.A. & Gittens, C. A. (2016). *Think critically* (3<sup>rd</sup> ed.). New York, NY: Pearson Education.
- Ferreira, M.C., Dias-Pereira, A.C., Branco-de-Almeida, L.S., Martins, C.C., and Paiva, S.M. (2017). Impact of periodontal disease on quality of life: A systematic review. *Journal of Periodontal Research*, 52(4), 651-665. doi.org/10.1111/jre.12436
- Georg, M.D., Preshaw, P.M., Donley, T.G., & Preshaw, P.M. (2014). *Ultrasonic Periodontal Debridement*. Ames, IA: Wiley. Retrieved from <http://ebookcentral.proquest.com.ezproxy.library.ewu.edu>.
- Gold Bamboo. (2017) Gingivitis related keywords & suggestions. *Gold Bamboo*. [Image]. Retrieved from <http://www.goldbamboo.com/pictures-t1364.html>
- Goulao, M.F. (2014). The relationship between self-efficacy and academic achievement in adults' learners. *Athens Journal of Education*, 1(3), 237-246.
- Harrel, S.K. & Wilson, T.G. (2014). *Minimally invasive periodontal therapy: Clinal techniques and visualization technology*. Retrieved from <http://ebookcentral.proquest.com>

- Holdsworth, C., Skinner, E.H., and Delany, C.M. (2016). Using simulation pedagogy to teach clinical education skills: A randomized trial. *Physiotherapy Theory and Practice*, 32(4), 284–295. doi.org/10.3109/09593985.2016.1139645.
- Kazeko, L.A. & Tarasenko, O.A. (2016). Deposits on the teeth. *Belarusian State Medical University*. Retrieved from <http://rep.bsmu.by/bitstream/handle/BSMU/9313/368046-%D0%B8%D0%BD-%D0%B1%D1%80..Image.Marked.pdf?sequence=1&isAllowed=y>
- Knowles, M.S. (1980). *The modern practice of adult education: from pedagogy to andragogy*. Wilton, CT: Association Press.
- Knowles, M.S. (1985). *Andragogy in action: Applying modern principles of adult learning*. San Francisco, CA: Jossey-Bass.
- Knowles, M.S., Holton III, E.F., & Swanson, R.A. (2015). *The adult learner: The definitive classic in adult education and human resource development* (8<sup>th</sup> ed.). New York, NY: Routledge.
- Kwan, J. (2008). Perioscopy: Getting started. *YouTube*. [video]. Retrieved from <https://www.youtube.com/watch?v=L-FDGaM7190>
- Loesche, W.J. (1996). *Microbiology of dental decay and periodontal disease*. Baron, S. (Ed.). *Medical microbiology*. (chapter 99). Galveston, TX: The University of Texas Medical Branch at Galveston. Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK8259/>
- Lujan, H.L. & DiCarlo, S. E. (2006). *First-year students prefer multiple learning styles*, 30(1). 13-16. doi.org/10.1152/advan.00045.2005
- Merriam-Webster Dictionary. (2018). Endoscope. *Merriam-Webster, Incorporated*. Retrieved from <https://www.merriam-webster.com/dictionary/endoscope>
- Meral, M., Colak, E., & Zereyak, E. (2012). The relationship between self-efficacy and academic performance. *Procedia-Social and Behavioral Sciences*, 46(2012), 1143 – 1146. doi: 10.1016/j.sbspro.2012.05.264
- Moghadam, S.A., Abdollahi, Z., Fakour, S.R., Moghaddam, A.A., Kiany, F. & Damani, N. (2015). The relationship between periodontal disease and public health: A population-based study. *Global Journal of Health Science*, 8(7), 110-115. doi:10.5539/gjhs.v8n7p110
- Mohan, R., Jain, S., & Rai, R. (2014). A review: Dental endoscope: A boon to dentistry. *Journal of Dental Herald*, 1(4), 18-20.

- Newman, T. & Carranza, K. (2015). *Carranza's clinical periodontology* (12<sup>th</sup> ed.). St. Louis, MO: Elsevier Saunders.
- Partido, B. B., Jones, A. A., English, D. L., Nguyen, C. A., & Jacks, M. E. (2014). Calculus detection calibration among dental hygiene faculty members utilizing dental endoscopy: A pilot study. *Journal of Dental Education*, 79(2), 124-132.
- Perioscopy Incorporated. (2017). Frequently asked questions. *Perioscopy Incorporated*. Retrieved from <http://www.perioscopyinc.com/perioscopy-technology.php>
- Poppe, K. & Blue, C. (2014). Subjective pain perception during calculus detection with use of a periodontal endoscope. *Journal of Dental Hygiene* 88(2), 114-123. Retrieved from <http://web.b.ebscohost.com.ezproxy.library.ewu.edu/ehost/pdfviewer/pdfviewer?vid=4&sid=56b5625c-af05-41cd-b5fd-362e4648db67%40sessionmgr103>
- Preshaw, P.M. (2015). Detection and diagnosis of periodontal conditions amenable to prevention. *Biological Medicine Central*. 15(suppl. 1), 1-11. Retrieved from <http://bmcoralhealth.biomedcentral.com/articles/10.1186/1472-6831-15-S1-S5>
- ProProfs. (n.d). The junction of the cementum and the enamel. *ProProfs*. [Image]. Retrieved from <https://www.proprofs.com/flashcards/story.php?title=dental-anatomy-unit-1-2>
- Slim. (2011). Perioscopy and ultrasonic efficiency. *RDH Magazine*. Retrieved from <http://www.rdhmag.com/articles/print/volume-31/issue-4/columns/perioscopy-and-ultrasonic-efficiency.html>
- Turner, A.M., Prihoda, T.J., English, D.K., Chismark, A., & Jacks, M.E. (2016). Millennial dental hygiene students' learning preferences compared to non-millennial faculty members' teaching methods: A national study. *Journal of Dental Education* 80(9), 1082-1090.
- Veeraiyan, D.N. & Sekhar, P. (2013). Critical appraisal-based learning in a dental college in India: A randomized control study. *Journal of Dental Education* 77(8), 1079-1085.
- WA.Gov. (2018). RCW 18.29.050. Washington State Legislature. *WA.Gov*. Received from <http://app.leg.wa.gov/rcw/default.aspx?cite=18.29.050>
- Wahlberg, A.E. & Poom, L. (2015). An empirical test of nonresponse bias in internet surveys. *Basic and Applied Social Psychology*, 37(6), 336-347, doi.org/10.1080/01973533.2015.1111212



- Westfelt, P., Hedman, L., Lindkvist, M.A., Enochsson, L., Fellander-Tsai, L., & Schmidt, P.T. (2013). Training nonanesthetist administration of propofol for gastrointestinal endoscopy in scenario-based full-scale hybrid simulation – a pilot study. *Scandinavian Journal of Gastroenterology* 48(11), 1354-8. doi: 10.3109/00365521.2013.836753.
- Wilkins, E.M. (2017). *Clinical practice of the dental hygienist*, (12<sup>th</sup> ed.). Philadelphia, PA: Wolters Kluwer.
- Winning, L. & Linden, G.J. (2015). Periodontitis and systemic disease. [Image]. *British Dental Association*. 2(15163), 7-10. doi:10.1038/bdjteam.2015.163
- Yamamoto, S. L. (Ed.). (2011). *Periodontal disease: symptoms, treatment and prevention*. Retrieved from <http://ebookcentral.proquest.com.ezproxy.library.ewu.edu>
- Zarandi, A., Mostafapoor, Y, & Kashefimehr, A. (2016). Comparing effectiveness of two scaling methods: Hand and ultrasonic instruments in patients with periodontitis disease. *International Journal of Dental Sciences and Research*, 4(4), 76-78. doi: 10.12691/ijdsr-4-4-4.

**Appendix A**

**Survey Questionnaire**

| Dental Endoscope (DE) Usage  |  |
|--|--|
| <b>Demographic Information: Please check the boxes that are most appropriate response</b>  |  |
| 1. Eastern Washington University (EWU) Dental Hygiene Program attended<br><input type="checkbox"/> Bachelor of Science in Dental Hygiene (BSDH)<br><input type="checkbox"/> Master of Science in Dental Hygiene (MSDH)<br>If MSDH, did you attend EWU BSDH for the hygiene program? <input type="checkbox"/> Yes <input type="checkbox"/> No |  |
| 2. How long have you been practicing?<br><input type="checkbox"/> 0-2 years <input type="checkbox"/> 3-5 years <input type="checkbox"/> 6-10 years <input type="checkbox"/> 11+ years  |  |
| 3. Practice type <input type="checkbox"/> general <input type="checkbox"/> periodontal <input type="checkbox"/> other  |  |
| 4. Hours worked weekly <input type="checkbox"/> 0-10 <input type="checkbox"/> 11- 20 <input type="checkbox"/> 21-30 <input type="checkbox"/> 31-40+  |  |
| <b>Survey Questions</b>  |  |
| Please answer the following questions  |  |
| 5. Have you used a DE to perform periodontal debridement on a patient?   | <input type="checkbox"/> Yes <input type="checkbox"/> No   |
| 6. Do you currently use a DE in your practice?   | <input type="checkbox"/> Yes <input type="checkbox"/> No   |
| 7. Have you had multiple experiences using DE to perform periodontal debridement on patients?  | <input type="checkbox"/> Yes <input type="checkbox"/> No   |
| If yes, how many patients?   | <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5+ |
| Please answer the following  |  |
| <b>8. The first time you used a DE, what were your thoughts?</b>   |  |
| Please Select the number that best represents how you feel   |  |
| 1 = Strongly agree, 2 = Agree, 3 = Neither agree nor disagree, 4 = Disagree, 5 = Strongly disagree   |  |
| 9. The DE helps improve the ability to detect calculus   | 1   2   3   4   5  |
| 10. The DE helps improve the ability to determine root anatomy.  | 1   2   3   4   5  |
| 11. I believe that I am proficient in overall clinical debridement skills.   | 1   2   3   4   5  |
| 12. If I can see calculus, I have the skills to remove it.   | 1   2   3   4   5  |
| 13. I consider myself educated on DE usage.  | 1   2   3   4   5  |

|  |   |   |   |   |   |
|--|---|---|---|---|---|
| 14. I feel that I am skillful using a DE.  | 1 | 2 | 3 | 4 | 5 |
| 15. I feel proficient removing supragingival debris without a DE.                                    | 1 | 2 | 3 | 4 | 5 |
| 16. I feel proficient removing supragingival debris with a DE.                                       | 1 | 2 | 3 | 4 | 5 |
| 17. I feel proficient removing subgingival debris without a DE.                                      | 1 | 2 | 3 | 4 | 5 |
| 18. I feel proficient removing subgingival debris with a DE.   | 1 | 2 | 3 | 4 | 5 |
| 19. Subgingival vision is improved using a DE.   | 1 | 2 | 3 | 4 | 5 |
| 20. Instrumentation skills are improved each time I use a DE.  | 1 | 2 | 3 | 4 | 5 |
| <b>Please answer the following</b>   |   |   |   |   |   |
| 21. Do you think the DE affects your ability to detect subgingival calculus? Please explain          |   |   |   |   |   |
| 22. Do you think the DE affects your skills at removing subgingival deposits? Please explain         |   |   |   |   |   |
| 23. How would you feel if you were asked to use a DE on a patient right now? Please explain          |   |   |   |   |   |
| 24. Do you feel that the use of the DE has modified your view on periodontal disease? Please explain |   |   |   |   |   |

## **Appendix B**

### **Participant Consent Letter**

My name is Sandra Walker, I am the Principal Investigator and currently enrolled as a student in Master of Science in Dental Hygiene at Eastern Washington University. I would like to invite you to participate in my study titled *Endoscope Use to Improve Students' Periodontal Debridement Skills and Self-Efficacy*. This study is intended to satisfy my thesis requirement for my masters' degree.

You are being asked to participate in this study because you are an Eastern Washington University Dental Hygiene alumni and/or student who potentially utilized the dental endoscope in your education. The aim of this study is to determine if the dental endoscope affects debridement skills and self-efficacy of dental hygienists. Participation is voluntary and you may discontinue the survey at any time. There are no known risks associated with this survey. By clicking on the survey, you consent to be part of the research.

As a participant you will complete a brief survey that is estimated to take 10-15 minutes. The data collected from this study will be kept confidential and only the research principal investigator (student) and a statistician will have access to the information. The identity of all participants will remain anonymous, your information is not linked to any personal identification. Study results will be made available to all participants upon request at Sjwalker65@eagle.ewu.edu. If you have any questions about the research study please contact Professor Lisa Bilich RDH, MSED, the Responsible

Project Investigator, at [lbilich@ewu.edu](mailto:lbilich@ewu.edu) or (509)828-1295. If you have any concerns about your rights as a participant in this research or any complaints you wish to make you may contact Ruth Galm, Human Protections Administrator, at [rgalm@ewu.edu](mailto:rgalm@ewu.edu) or (509)359-6567.

Sincerely,

Sandra Walker RDH, BSDH, MSDH (C)

[Sjwalker65@eagle.ewu.edu](mailto:Sjwalker65@eagle.ewu.edu), (509)969-9693

## Curriculum Vitae

### Sandra J Walker RDH, AAS, BSDH, MSDH(c)

sjwalker65@eagles.ewu.edu • sjwalker65@msn.com

Yakima, WA 98908

509-969-9693 (cell)

#### Licensure

|              |                             |
|--------------|-----------------------------|
| 2004-Present | Registered Dental Hygienist |
| 1991-2005    | Cosmetologist               |

#### Graduate

|                      |  |
|----------------------|--|
| 2016-Present MSDH(c) | Eastern Washington University (EWU)<br>Spokane, WA |
|----------------------|--|

#### Undergraduate

|                  |   |
|------------------|---|
| 2014-2016 BSDH   | EWU<br>Spokane, WA  |
| 1999-2004 AAS DH | Weston D. Brown Dental Hygiene Clinic<br>Yakima Valley Community College (YVCC)<br>Yakima, WA |

#### Course Work

|      |                                  |   |
|------|----------------------------------|---|
| 2016 | Advanced Dental Hygiene Practice | EWU Cheney, WA<br>Completion in Dec. 2016 |
|------|----------------------------------|---|

#### Scholarly Activities

|      |  |   |
|------|--|---|
| 2014 | Research Paper Non-Clinical<br>Down syndrome with gingivitis:<br>Power it away | Whether power toothbrushes<br>help control gingivitis in<br>individuals with Down<br>Syndrome |
|------|--|---|

#### Academic/Teaching Experience

|      |   |  |
|------|---|--|
| 2016 | YVCC Dental Hygiene<br>EWU Teaching Practicum | Proper usage and techniques<br>of using topical anesthetic |
|------|---|--|

|      |                                       |   |
|------|---------------------------------------|---|
| 2004 | Highgate Nursing Home<br>Yakima, WA   | Taught nursing home staff<br>proper oral hygiene for<br>elderly residents |
| 2003 | St. Joseph School<br>Yakima, WA       | Taught proper oral hygiene<br>to elementary school students               |
| 2003 | Pace Alternative School<br>Wapato, WA | Taught pregnant women<br>proper oral care for their<br>baby's teeth       |

**Work experience**

|              |  |  |
|--------------|--|--|
| 2018-Present | Dr. Victor Immell<br>Yakima, WA                  | Traditional hygienist                  |
| 2005-2018    | Creekside Dental<br>Yakima, WA                   | Hygienist with 1-2 days<br>restorative |
| 2004-2005    | Dr. Ryan Kezele<br>Yakima, WA                    | Hygienist and ordered<br>supplies      |
| 1992-2004    | Sandie's hair etc.<br>Puyallup, WA<br>Yakima, WA | Owner/Operator<br>Cosmetologist        |

**Certification**

|              |           |
|--------------|-----------|
| 2002-Present | First Aid |
| 2002-Present | BLS/CPR   |

**Professional Associations**

|              |   |
|--------------|---|
| 2015-Present | American Dental Education Association   |
| 2015-Present | American Dental Hygienists' Association |
| 2002-2004    | American Dental Hygienists' Association |

**Honors and Awards**

|           |                  |         |
|-----------|------------------|---------|
| 2014-2016 | Summa Cum Laude  | EWU     |
| 2003-2004 | Dean's List      | YVCC DH |
| 2001      | President's List | YVCC    |
| 1999-2001 | Dean's List      | YVCC    |
| 1999      | President's List | YVCC    |

**Community service**

|           |                      |  |
|-----------|----------------------|--|
| 2015-2016 | Harman Senior Center | Saturday breakfast volunteer                     |
| 2011      | YVCC Dental Hygiene  | Sealant Day RDH volunteer<br>Placed sealants and |

|            |   |  |
|------------|---|--|
| 2008-2011  | Yakima Gospel Mission<br>Yakima, WA       | coordinated patients<br>Served dinners to homeless families with Trinity Family Fellowship |
| 2005-2009  | West Valley School District<br>Yakima, WA | Classroom volunteer, helped my children's teachers   |
| 2005, 2008 | YVCC Dental Hygiene                       | Sealant Day RDH Volunteer<br>Placed sealants and coordinated patients                      |
| 2005       | Yakima Soccer Association                 | Coached soccer youth 8   |
| 2003       | Team Yakima Volley Ball                   | Coached volleyball youth 14  |
| 2002-2004  | Jane's House<br>Yakima, WA                | Daycare volunteer  |
| 2002-2004  | Highgate Nursing Home<br>Yakima, WA       | Provided oral hygiene care for an elderly resident   |
| 1998-2005  | Highland School District<br>Coviche, WA   | Classroom volunteer, helped my children's teachers   |
| 1990-1998  | Puyallup School District<br>Puyallup, WA  | Classroom volunteer, helped my children's teachers   |

### References

Dennis Smith -Pastor  
Yakima, WA  
(509) 952-0371

Pastordennis@trinityyakima.com

Sarah Vijarro-RDH  
Yakima, WA  
(509) 952-4283

S-renee@hotmail.com

Stephen (Steve) Busby-Teacher  
Sunnyside, WA  
(509) 961-4596

Stephensc15@charter.net