Variation in Treatment Decisions Among AAP-Certified Specialists in Periodontology

A Thesis

Presented in Partial Fulfillment of the Requirements for the Degree Master of Science in the Graduate School of The Ohio State University

By

Rachana Hegde BDS

Graduate Program in Dentistry

The Ohio State University

2014

Thesis Committee:

Dr. Angelo Mariotti, Chair

Dr. Arthur Hefti, member

Dr. Eric Seiber, member

Copyright by

Rachana Ashok Hegde

2014

#### Abstract

**Objective:** There are no peer-reviewed studies assessing the treatment decisions of U.S. periodontists. Periodontal specialists were presented clinical scenarios to investigate treatment decisions for periodontal diseases.

<u>Material & Method:</u> A questionnaire and clinical record were mailed to all educationally-certified periodontists in 4 U.S. states (N=297). The clinical record provided medical information, probing depths, attachment levels, furcation involvements, clinical photographs, and radiographs of patients with various types of periodontitis. Participants were asked to indicate their most likely and second most likely treatment choices from a list of treatment options. Data were tabulated, reviewed for possible errors, and analyzed statistically. The OSU-IRB reviewed and approved the study.

**<u>Results:</u>** 103 periodontists (34.68 %) returned the questionnaire. The sample was not different statistically (P=0.284) from the population regarding gender distribution. However, very experienced periodontists (>20 years) were over represented among responders (P=0.007). In regard to the most common primary treatment options selected by periodontists for each of the four clinical vignettes, agreement amongst periodontists ranged from 45.5% to 67.3%. For the secondary treatment options, agreement ranged from 26.7% to 41.6% for the four clinical vignettes. Treatments most commonly selected by the periodontists included osseous surgery and regenerative surgery.

**Conclusions:** Although there was no consensus of treatment for any of the standardized case scenarios, regenerative procedures and osseous resective surgery were often the treatments of choice. These decisions of dental-care may have important implications for patient management.

# Dedication

Dedicated to my wonderful husband, Aaditya and my loving parents

## Acknowledgements

I wish to thank my advisor, Dr. Angelo Mariotti, for his support and encouragement in preparation of this thesis.

I would also like to thank Drs. Frank Beck his help with the statistical analysis and Mrs.

Deborah Hooper for her support during the preparation of this manuscript.

## Vita

2005: B.D.S., Dr. D Y Patil Dental College and Hospital, Navi Mumbai, India 2011 to present: Graduate Teaching Associate, Division of Periodontology, College of Dentistry, The Ohio State University

> **Fields of Study** Major Field: Dentistry

# **Table of Contents**

Abstractii
Objective: ii
Material & Method: ii
Results:ii
Conclusions:iii
Dedication iv
Acknowledgementsv
Vitavi
Fields of Study vi
List of Tables ix
List of Figures
Chapter 1: Introduction
The Problem1
Best Available Evidence/ Evidence Based Practice
Clinical Decision Making6
Unwarranted Variation (Geographic Variation)8
Chapter 2: Materials and Methods12
Primary Null Hypothesis12
IRB Approval12
Pilot Study12
Clinical Vignettes12
Sampling Methods14
Data Management and Analysis15
Chapter 3: Results
Demographic characteristics of periodontal practices16
Treatment options for clinical scenarios16

Chapter 4: Discussion	23
Appendix A: Tables	34
Appendix B: Figures	45
Appendix C: Cover letter	62
Appendix D: Survey Questionnaire Case # 1	63
Appendix E: Survey Questionnaire Case # 2	65
Appendix F: Survey Questionnaire Case # 3	67
Appendix G: Survey Questionnaire Case # 4	69
Appendix H: Periodontist Information Sheet	71
References	72

## List of Tables

Table 1: Sample and population demographics
Table 2: "Other" treatment options selected by periodontists for patients with generalized severe chronic periodontitis (case #1)
Table 3: "Other" treatment options selected by periodontists for patients with localized aggressive periodontitis (case #2)
Table 4:"Other" treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class III mobility and Hamp III furcation involvement of a mandibular molar (case #3)
Table 5: "Other" category treatment option for patients with generalized moderate and

# **List of Figures**

Figure 1: Primary treatment options selected by responders for patients with generalized severe chronic periodontitis (case #1)
Figure 2: Secondary treatment options selected by periodontists for patients with generalized severe chronic periodontitis (case #1)
Figure 3: Primary treatment options selected by periodontists for patients with localized aggressive periodontitis (case #2)
Figure 4: Secondary treatment options selected by periodontists for patients with localized aggressive periodontitis (case #2)
Figure 5: Primary treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class III mobility and Hamp III furcation involvement of mandibular molar (case #3)
Figure 6: Secondary treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class III mobility and Hamp III furcation involvement of mandibular molar (case #3)
Figure 7: Primary treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class 1 mobility and Hamp II furcation involvement of mandibular molar (case #4)
Figure 8: Secondary treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class 1 mobility and Hamp II furcation involvement of mandibular molar (case #4)60

#### **Chapter 1: Introduction**

## **The Problem**

The World Health Organization (WHO) stated that the United States of America (U.S.) spent more on health care as percentage of its gross domestic product (GDP; 17.2%), than any other nation in the year 2011.<sup>1</sup> Furthermore, in the U.S. people spent a significant dollar amount on health care (\$8,608 per person) when compared to other countries.

Despite the amount of resources used for health care, Berk et al in 1994 reported that lack of dental care accounts for the highest amount of unmet health care need in the US population<sup>2</sup>. About 22.5% of the population who experienced dental problems did not seek formal treatment<sup>3</sup>. Among the people who received emergency dental treatment, gingival and periodontal diseases accounted for 31.8% and 10.5% of dental related Emergency Department (ED) claims, respectively. <sup>4</sup>

Periodontal disease is an infectious disease that is associated with inflammation of soft and hard tissues around the teeth. It is characterized by pocket formation, bleeding, and attachment loss that may ultimately lead to tooth loss if left untreated. Periodontal disease is a leading cause of tooth loss in older individuals according to the National Institute of Dental and Craniofacial Research (NIDCR)<sup>5</sup>.

Recent results obtained from the National Health and Nutritional Examination Survey (NHANES III) showed that approximately 47% of adults aged  $\geq$ 30 years (65 million people) have periodontitis, the most frequently observed form of periodontal disease. Mild, moderate and severe forms of periodontitis were diagnosed in 8.7%, 30.0%, and 8.5% of the population, respectively. The prevalence of periodontitis is increasing with age; adults older than 65 years have periodontitis at rates of 5.9%, 53.0%, and 11.2% for mild, moderate, and severe forms, respectively.<sup>6</sup>

Treatment of periodontitis ranges from economical non-surgical therapy to complex surgical procedures, using expensive biologic regenerative agents. Efficient and cost effective treatment becomes imperative in the climate of increasing demands for health care needs and limited resources. Despite the fact that the U.S. spends more per capita on health care than other countries, concerns about the quality of care in terms of predictability of treatment plan and outcome, and lack of uniformity are on the rise.<sup>7</sup> In 1998, the National Roundtable on Health Care Quality reported serious quality problems throughout the American health care system.<sup>8</sup> Practicing evidence-based healthcare has been postulated by professional and health care organizations, with the aim of delivering the most effective treatment for a given disease/condition.

### **Best Available Evidence/ Evidence Based Practice**

Evidence based medicine (EBM) is defined as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients."<sup>9</sup> EBM evolved from the need to bridge the gap between research and practice. Having evolved from clinical epidemiology and critical thinking, its practice involves integrating individual clinical expertise with the best available external clinical evidence from systematic reviews.<sup>10</sup> The five steps involved in the practice of EBM involve generating a question, systematic retrieval of the best available evidence, critical appraisal of the evidence, application of the results in clinical practice, and periodic evaluation of these results. The process is life-long, self-directed learning of clinically important information about diagnosis, prognosis, therapy, and other clinical and health care issues.<sup>8</sup>

Similarly, evidence based dentistry (EBD) was first introduced by Gordon Guyatt and the EBM Working Group at McMaster University in Ontario, Canada, in the 1990s. According to the American Dental Association (ADA), EBD is an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient's oral and medical condition and history, with the dentist's clinical expertise and the patient's treatment needs and preferences.<sup>11</sup> Similar to its medical counterpart, the practice of EBD requires lifelong learning of research findings and assimilation of the knowledge in clinical practice as per the guidelines put forward by the American Dental Education Association (ADEA).

The resources available for the practice of EBD are numerous. Some of the better known resources include:

(1) Organizations: Association of State and Territorial Dental Directors: Guidelines, Recommendations and Evidence-based Practices Resource Links Centre for Evidence-Based Dentistry; Cochrane Collaboration; Evidence-Based Practice Centers - Agency for Healthcare Research and Quality Evidence-Based Medicine Resource Center; The Forsyth Institute (Cambridge, MA); International Centre for Evidence-Based Oral Health - UCL Eastman Dental Institute, (London, UK); Oxford Centre for Evidence-Based Medicine; University of York NHS Centre for Reviews and Dissemination: Database of Abstracts of Reviews of Effects (DARE); and NIDCR Dental Practice-Based Research Networks (PBRNs).

(2) Journals: Bandolier; Evidence-Based Dentistry; Evidence-Based Medicine Online; Journal of the ADA; and Journal of Evidence-Based Dental Practice.

(3) Critical Appraisal and Evidence Analysis: Appraisal Tools - Critical Appraisal Skills Programme (Public Health Resource Unit, UK); AMSTAR (Assessment of Multiple Systematic Reviews); Grading of Recommendations, Assessment, Development and Evaluation (GRADE) - Working Group Publications; PRISMA Statement; CONSORT Statement (Consolidated Standards of Reporting Trials); CATs (Critically Appraised Topics - University of Texas Health Science Center, San Antonio); Critical Appraisal Tools (Centre for Evidence-Based Medicine, UK); Critical Analysis Tools (SUNY Downstate); Critical Appraisal Tools (International Center for Allied health Evidence); Meta-analysis of Observational Studies in Epidemiology (MOOSE): A Proposal for Reporting and Evidence-Based Medicine Toolkit (University of Alberta).

4

(4) Systematic Reviews: Cochrane Oral Health Group; PubMed systematic review search page; Agency for Healthcare Research and Quality (AHRQ) Evidence-based Practice Center (EPC) Reports.

(5) Clinical Recommendations: ADA Evidence-Based Clinical Recommendations,
National Guideline Clearinghouse; National Institute for Health and Clinical Excellence
(NICE); NHS Evidence; CDC Division of Oral Health; Scottish Intercollegiate
Guidelines Network; and Agency for Healthcare Research and Quality (AHRQ).

However, limitations of these guidelines have also been noted in the literature. Critics of the practice guidelines and flowcharts in clinical practice were concerned that the guidelines use a nomothetic approach, i.e., one size fits all. It is possible that the results of the evidence may not be relevant for all treatment situations, and it may not involve the co-morbidities and other conditions accompanying the disease being treated.<sup>12</sup> Historically, certain populations (e.g., racial minorities) have been underresearched and thus the randomized controlled trials (RCT) restrict generalizing.<sup>13</sup> In addition, RCTs are expensive to conduct, and are subject to various forms of bias (Reference).<sup>14</sup> There is also a lag between RCT execution and publication of the results, as well as when conclusions are translated into practice guidelines.<sup>15</sup> Besides, all treatment protocols may not be effective routinely. Considering that, operator skill, patient preference, values and expectations and insurance claims are a few of the factors that limit the results achieved in clinical practice. EBD applies research information (evidence) to clinical practice, emphasizing the importance of the use of quantitative (as well as qualitative) evidence in the "art" of clinical decision making.<sup>16</sup> However, EBD represents only one part of the triad involved in clinical decision making.

## **Clinical Decision Making**

Decision-making can be regarded as the cognitive process resulting in the selection of a belief or a course of action among several alternative possibilities.<sup>17</sup> Decision making in general is the study of identifying and choosing alternatives based on the values and preferences of the decision maker. It implies that the decision maker considered all the possible alternatives and chose an alternative that s/he thought was the best based on their goals, desires and values. How human beings make decisions has been researched from several perspectives.<sup>18</sup> These perspectives include: (1) Psychological: individual decisions have been examined in the context of the individual's set of needs, preferences and values; (2) Cognitive: the decision-making process regarded as a continuous process integrated in the interaction with the environment; and (3) Normative: the analysis of individual decisions is concerned with the logic of decision-making and rationality.

Logical decision-making is an important part of all science-based professions, where specialists apply their knowledge in a given area to make informed decisions. Clinical decision-making often involves a diagnosis and the selection of appropriate treatment.

Clinical decision-making is a complex process involving multiple variables. Frequently, it is thought to be an art rather than a science. Best available research, practitioner characteristics, as well as patient values, characteristics and circumstances have been considered the most important contributing factors. Studies amongst physiotherapists and nurses have found that factors attributable to the clinician, such as confidence, self-efficacy, emotions, frames of reference, and degree of expertise, have influenced decision making most profoundly.<sup>19</sup>

Biases have also been reported in the decision-making process.<sup>20</sup> Biases may include selective search for evidence (i.e., confirmation bias), cognitive inertia (i.e., unwillingness to change existing thought patterns in the face of new circumstances), selective perception (i.e., prejudice), wishful thinking, choice-supportive bias (i.e., occurs when people distort their memories of chosen and rejected options to make the available options seem more attractive), recency (i.e., people tend to place more attention on more recent information and either ignore or forget more distant information), repetition bias (i.e., a willingness to believe what one has been told most often and by the greatest number of different sources), anchoring and adjustment (i.e., decisions are unduly influenced by initial information that shapes our view of subsequent information).

## **Unwarranted Variation (Geographic Variation)**

First termed by Wennberg forty years ago, unwarranted variation refers to differences in health care that cannot be explained by illness, medical need, or the dictates of evidence-based medicine (include reference).<sup>20</sup> Wennberg and his colleagues at the Dartmouth Center for Evaluative Clinical Sciences documented these variations in how healthcare is practiced around the country. They found through analysis of Medicare data that per-capita spending is almost 2.5 times greater in Miami than in Minneapolis, even after adjusting for age, sex, and race differences. Variations in clinical practice have been well documented in the medical literature. In a series of articles spanning from 1987 to 1994, Wennberg and colleagues investigated the rates of elective surgery and reported that the overall rate of surgery was nearly identical between residents of New Haven and Boston, yet the rates for individual procedures varied remarkably, even though the populations were similar demographically.<sup>21</sup> Small area variation was demonstrated in the treatment of cardiac patients in the United States.<sup>22,23</sup>

Characteristics of health care providers and hospitals explain in part the geographic variations in guideline-based care for elderly patients with heart failure. In contrast, a recent study conducted in the United Kingdom found no strong association between practice characteristics of the primary care physicians and operation rates for coronary artery bypass grafting, angioplasty, cataract surgery, and hip replacement.<sup>24</sup> Among insured adults in the U.S., use of chiropractic care was higher in rural than in urban areas in Washington state.<sup>25</sup> Geographic differences have also been reported by

Welch and colleagues. They noticed higher resource utilization by attending physicians in hospitals in Florida compared to Oregon across all specialties and all types of service.<sup>26</sup>

Variation in clinical practice among physicians is an important determinant of expenditure for primary care services. Variation in expenditure for specific procedures has been attributed to physician-specific effects (49-61%). In contrast, patient characteristics, such as age and gender, accounted for 1%, only.<sup>27</sup> A physician's style of practice tended to be stable, which was demonstrated by the fact that physicians who relocated their practice location and changed their patient population completely did not change their practice style after moving.<sup>21</sup> This suggested that practice style reflected an underlying behavior in how medicine was practiced. The findings were in agreement with another study that reported about 40% of variation in health care needs was explained by variation in clinical practice among physicians.<sup>28</sup>

Preliminary studies in dentistry have been undertaken to examine the role of the dentist, practice, and patient factors in the provision of dental services.<sup>29</sup> Variations may be related to the dentist (e.g., practice beliefs, clinical decision making, decision to intervene, dentist-patient interaction), practice characteristics (e.g., size and patient throughput of practice, practice age, geographic location), and the patient (e.g., age, gender, non-emergency visits, dental insurance, and socioeconomic status). Patient factors have been studied by Manski and colleagues who reported that when controlling for private dental insurance coverage, there were no rural- or urban-specific associations.<sup>30</sup>

9

Unwarranted variation of health care has been defined as care inconsistent with a patient's preference or unrelated to a patient's underlying illness. It is further subcategorized as effective, preference-sensitive, and supply sensitive.<sup>31</sup> Much of periodontal therapy is considered to be "preference-sensitive". Required interventions permit the choice between at least two treatment modalities with different risks and benefits. For instance, a tooth can be maintained long term with periodontal surgery and routine maintenance therapy or, it can be extracted and replaced with a dental implant and appropriate superstructure. The provider's recommendations and the treatment costs ultimately will determine the course of treatment.

A project conducted at The Ohio State University, Division of Periodontology, used insurance claims to study variations in the procedures performed by periodontists in five states. Claims collected from 2000-2009 by Delta Dental of Ohio, Michigan, Indiana, New Mexico, and Tennessee, were examined to analyze periodontists' practice patterns. Differences in the selection frequency of periodontal procedures were present across the states. Overall, osseous surgery was the most frequently claimed surgical procedure. However, claims related to regenerative procedures (e.g., bone grafts, biologics, GTR) showed the greatest increase over time. Similarly, claims related to extractions and dental implant placements increased over time. Differences in the procedures were observed when the characteristics of periodontal providers were considered.

Health care databases are particularly useful as a surveillance system because they are population-based, readily available, and relatively complete.<sup>32</sup> However, one of the

likely limitations of such studies is that population disease patterns can differ from area to area, leading to practice variation.

The goal of the present study was to evaluate differences amongst periodontists in treatment options rendered to patients who presented with the same periodontal condition.

#### **Chapter 2: Materials and Methods**

#### **Primary Null Hypothesis**

There is no difference among AAP-certified periodontists in their treatment recommendation for a clearly defined case of periodontal disease. The hypothesis was tested using the data obtained from a survey that was mailed to all practicing, registered periodontists in Ohio, Michigan, Indiana, and West Virginia.

## **IRB** Approval

The study protocol was reviewed and approved by the Institutional Review Board (IRB) of The Ohio State University (IRB #: 2013E0333).

#### **Pilot Study**

A pilot study was conducted using four 3rd year residents in the Advanced Dental Specialty Program in Periodontics at the College of Dentistry, The Ohio State University, to determine the time required to complete the clinical vignettes as well as of any difficulties encountered in completing the treatment plan questionnaire. It was noted that two of the clinical vignettes were difficult to understand and they were removed. The average time to complete the remaining four clinical vignettes was less than 30 minutes.

#### **Clinical Vignettes**

The four clinical vignettes included in the study were: (Appendices D-G)

**Case #1**- A 57 year old Caucasian female diagnosed with generalized severe chronic periodontitis, and horizontal bone loss. (Appendix D)

**Case # 2-** A 30-year old Asian female diagnosed with localized aggressive periodontitis, and vertical bone loss on the mesial surface of a maxillary molar. (Appendix E)

**Case # 3-** A 45-year old Caucasian male diagnosed with generalized moderate and localized severe chronic periodontitis, with Miller class III mobility and Hamp III furcation involvement on buccal and lingual aspect of a mandibular molar (Appendix F)

**Case # 4**- A 33-year old African American female diagnosed with generalized moderate and localized severe chronic periodontitis. She exhibited Miller class I mobility and a Hamp II furcation on the buccal aspect of the mandibular molar. (Appendix G).

The vignettes presented 4 specific cases of periodontal disease. Information provided with each case included demographics (age, race, ethnicity, gender, and chief complaint), medical history, a selection of important clinical information following initial therapy (probing depth, tooth mobility, furcation involvement), clinical photos, radiographs, and the periodontal diagnosis. Eight treatment options were offered for each case. Option content varied from case to case and included frequently used periodontal procedures. Each case included options that were more or less likely to reflect the currently "best available evidence". The participating periodontists were asked to rank the treatment options on the provided case treatment plan sheet. Rankings should be made according to the periodontist's personal preference and indicate their first and second choices.

## **Sampling Methods**

The population of periodontists (N=297) that was surveyed included all certified periodontists practicing in Ohio, Michigan, Indiana, and West Virginia. Names and addresses were obtained from the membership directory of the American Academy of Periodontology (AAP).

The periodontists that were identified by name and address received the same information packet by mail. It included a brief study description (Appendix C), a copy of the periodontist's information sheet (Appendix H), and the four clinical vignettes of standardized case scenarios including treatment options (Appendices D-G). A return paid envelope was also provided in the packet. A reminder telephone call was made to all the participants half distance to the submission deadline.

On receipt at the Division of Periodontology, the packets were de-identified. Then, a person entered the data into an Excel worksheet. Before data were used for analysis, the entered information was verified by another individual for accuracy. Then, the original Excel worksheet was locked. Subsequent construction of data sets was done using copies of the master worksheet.

#### **Data Management and Analysis**

Using the provider's practice location (zip codes), a regional analysis was performed by comparing urban and rural areas. Using ZIP codes, counties were classified according to the 2006 Rural-Urban Commuting Area Codes (RUCA; WWAMI Rural Health Research).<sup>33</sup> The 10 RUCA codes (three metropolitan and seven nonmetropolitan) were based on: a) 2000 Census work commuting information, and b) Census Bureau defined urbanized areas (cities of 50,000 and greater population) and urban clusters (cities/towns with population size 2,500 to 49,999). These categories were aggregated into one metropolitan (urban, ZIP codes containing cities of 50,000 or larger) and one rural category (population <50,000) to allow for an exploration of regional variation. Other demographic information included gender (female / male), years of practice information (0 to 10 years, 11 to 20 years, 21 to 30 years, and >30 years), and practice location (Ohio, Michigan, Indiana, West Virginia, other). Demographics were tabulated and subjected to standard statistical procedures for rates and proportions (Fleiss et al 2003).

The Case data were analyzed to calculate the frequency of the primary and secondary treatment options selected by the periodontists. Each clinical scenario was treated independently. 95% confidence intervals (<sub>CI95%</sub>) of the percentage of positive responses for each of the options were calculated using PROC FREQ in statistical analysis software (SAS).<sup>34</sup>

#### **Chapter 3: Results**

103 surveys were returned, corresponding to a 34.6% response rate. Two surveys were returned without any demographic information and were excluded from the analyses.

#### **Demographic characteristics of periodontal practices**

Demographic characteristics of the population and the associated sample are found in Table 1. The majority of the respondents were males (80.2%). Gender distribution of the sample was not different statistically from the population (p=0.76). 10.9% of the respondents had a practice experience of 0-10 years and 18.8% had an experience of 11-20 years. Very experienced periodontists (>20 years) were over represented among responders (P=0.01). 97% of the survey responders were located in urban areas. Because of the small size (n=3) of the rural data set, urban and rural data were pooled in subsequent analyses.

#### **Treatment options for clinical scenarios**

In the first clinical scenario, a 57-year old Caucasian female was diagnosed with generalized severe chronic periodontitis. The patient exhibited radiographic evidence of generalized horizontal bone loss (Appendix D). In this standardized clinical scenario of horizontal bone loss, 48.5% or the respondents decided that osseous surgery was the primary treatment option (Figure 1). The second most common primary treatment option reported was regenerative surgery, which accounted for 15.8% of periodontists (Figure 1). The third most common primary treatment choice was the "other", which accounted for 12.8% of periodontists (Figure 1). Of the choices in the "other" category, the majority (85.7% of other; 11.8% of total) of periodontists preferred laser assisted new attachment procedure (LANAP) as their primary treatment (Table 2). Of the remaining treatment choices, open flap and debridement (OFD), re-instrumentation of teeth by scaling and root planing (SRP), monitoring the patient without further treatment followed by maintenance therapy, and extraction of the tooth with implant placement accounted for 9.9%, 8.9%, 2.9%, 0.9% of primary treatment selections, respectively (Figure 1). The remaining choices in the "other" category included perioscopy assisted SRP (0.1% of other; 0.01% of total), and pulp testing (0.1% of other; 0.01% of total) (Table 2).

In the same clinical scenario, the most common secondary treatment of choice was OFD (28.7%) (Figure 2). The second most common secondary treatment options reported were osseous surgery (24.8%) (Figure 2) and regenerative surgery (24.8%) (Figure 2). Monitoring the patient without further treatment followed by maintenance therapy was the next most common secondary treatment which accounted for 9.9% of the periodontists (Figure 2). Of the remaining treatment choices, re-instrumentation of teeth by SRP, "other" treatment, and extraction of the tooth with implant placement accounted for 3.9%, 2.9% and 1.9%, respectively, of secondary treatment selections (Figure 2). Of the choices in the "other" category, 50% (0.01% of total) of the periodontists preferred LANAP as their primary treatment (Table 2) and the other 50% (0.01% of total) preferred DNA probe and administration of systemic antibiotic (Table 2).

In the second clinical scenario, a 30-year old Asian female was diagnosed with localized aggressive periodontitis. The patient exhibited radiographic evidence of vertical bone loss on the mesial surface of a maxillary molar (Appendix E). Over two-third of the periodontists (67.3 %) agreed that regenerative surgery was the primary treatment option (Figure 3). The second most common primary treatment option reported was the "other" treatment, which accounted for 9.9 % of periodontists (Figure 3). Of the choices in the "other" category, the majority (41.6% of other; 4.9% of total) of periodontists preferred LANAP as their primary treatment (Table 3). The third most common primary treatment choice was re-instrumenting the teeth for SRP (8.9%) (Figure 3). Of the remaining treatment choices, OFD and osseous surgery accounted for 6.9% and 4.9% respectively of primary treatment selections (Figure 3). The remaining choices in the "other" category included DNA probe and administration of systemic antibiotic (25 % of other; 0.03% of total) (Table 3), occlusal adjustment (16.6% of other; 0.02% of total) (Table 3), perioscopy assisted SRP (8.3% of other; 0.01% of total) (Table 3) and pulp testing (8.3% of other; 0.01% of total) (Table 3).

In the same clinical scenario of vertical bone loss on a maxillary molar, 41.5% periodontists reported osseous surgery as the secondary treatment option (Figure 4). The second most common secondary treatment option reported was OFD which accounted for 26.7% (Figure 4). The third most common secondary treatment choice was the

regenerative surgery which accounted for 17.8 % of periodontists (Figure 4). Of the remaining treatment choices, the "other" treatment, extraction of the tooth with implant placement and monitoring the patient with no further active treatment followed by maintenance therapy accounted for 5.9%, 3.9% and 2.9%,of the secondary treatment selections, respectively (Figure 4). Of the choices in the "other" category, 50% (5.9% of total) of periodontists preferred LANAP as their primary treatment (Table 3). Local delivery of antibiotic (33.3% of other; 0.02% of total) (Table 3) and DNA probe and administering systemic antibiotic (16.6% of other; 0.01% of total) (Table 3) were the other "other" treatment choices.

In the third clinical scenario, a 45-year old Caucasian male was diagnosed with generalized moderate and localized severe chronic periodontitis. The patient also exhibited Miller class III mobility and Hamp III furcation involvement on buccal and lingual aspect of the mandibular first molar (Appendix F). Two-third of the periodontists (66.3 %) agreed that extracting the mandibular first molar and inserting an implant (immediate or delayed) was the primary treatment option (Figure 5). The second most common primary treatment options reported were "other" treatment (Figure 5) and regenerative surgery. Both options were selected by 7.9% of responders (Figure 5). Of the choices in the "other" category, the majority (50% of other; 5.9% of total) of periodontists preferred LANAP as their primary treatment (Table 4). The third most common primary treatment option was osseous surgery, which accounted for 6.9% of the periodontists (Figure 5). Of the remaining treatment choices, OFD, re-instrumenting the

teeth for SRP, and re-instrumenting the teeth for SRP with concomitant use of a local antibiotic delivery accounted for 3.9%, 3.9% and 2.9% of primary treatment selections, respectively (Figure 5). The remaining choices in the "other" category included pulp testing (16.6% of other; 0.02% of total) (Table 4), occlusal adjustment (16.66% of other; 0.02% of total), apically positioned flap (8.33% of other; 0.01% of total) (Table 4) and DNA probe and administration of systemic antibiotic (8.33% of other; 0.01% of total) (Table 4).

In the same clinical scenario, 26.7% reported that osseous surgery was the most common secondary treatment option (Figure 6). The second most common secondary treatment options reported were OFD and regenerative, which accounted for 26.7% of periodontists each (Figure 6). The third most common primary treatment choice was extracting the mandibular first molar and inserting an implant (immediate or delayed) which accounted for 11.8% of periodontists (Figure 6). Of the remaining treatment choices, monitoring the patient with no further active treatment followed by maintenance therapy, the "other" treatment, and re-instrumenting the teeth for SRP accounted for 10.8%, 9.9% and 5.9% of the secondary treatment selections, respectively (Figure 4). Of the choices in the "other" category, 50% (0.04% of total) of periodontists preferred extracting the mandibular first molar only (Table 4) and 37.5% preferred LANAP as their primary treatment (Table 4). Apically positioned flap procedure (12.5% of other; 0.01% of total) (Table 4) was selected also among "other" secondary treatment options.

The fourth clinical scenario showed a 33-year old African American female who was diagnosed with generalized moderate and localized severe chronic periodontitis. The patient also exhibited a Miller class I mobility and a Hamp class II furcation on the buccal aspect of the mandibular molar (Appendix G). In this standardized clinical scenario of Hamp II furcation involvement of a mandibular molar, less than half of the periodontists (45.5%) agreed that regenerative surgery was the primary treatment option (Figure 7). The second most common primary treatment option reported was the "other" treatment, which accounted for 24.7% of periodontists (Figure 7). Of the choices in the "other" category, the majority (64% of other; 15.8% of total) of periodontists preferred occlusal adjustment as their primary treatment (Table 5). The "other" treatment choices included LANAP (24% of other; 0.06% of total) (Table 5), DNA probe and administration of systemic antibiotics (8% of other; 0.02% of total) (Table 5) and pulp testing (4% of other; 0.01% of total) (Table 5). The third most common primary treatment choice was osseous surgery, which accounted for 9.9% of periodontists (Figure 7). Of the remaining treatment choices, re-instrumentation of teeth by scaling and root planning with local antibiotic delivery, open flap and debridement and re-instrumenting the teeth for SRP accounted for 8.9%, 5.9% and 4.9%, respectively, of primary treatment selections (Figure 7).

In the same clinical scenario, 35.6% periodontists reported osseous surgery was the most common secondary treatment option (Figure 8). The second most common secondary treatment option reported was OFD (20.9%) (Figure 8). The third most common primary treatment choice was regenerative surgery which accounted for 12.8% of periodontists (Figure 8). Of the remaining treatment choices, re-instrumenting the teeth for SRP with simultaneous local delivery of antibiotic, monitoring the patient with no further active treatment followed by maintenance therapy, the "other" treatment, and accounted for 7.9%, 6.9% and 5.9% of the secondary treatment selections, respectively (Figure 8). Of the choices in the "other" category, 80% (0.04% of total) of periodontists preferred occlusal adjustment (Table 5) and 20% (0.01% of total) preferred LANAP as their secondary treatment (Table 5).

#### **Chapter 4: Discussion**

There was no consensus amongst the periodontists on the primary treatment choice in the standardized clinical scenario of chronic periodontitis with horizontal bone loss. The most common primary treatment of choice was osseous surgery (48.5%) followed by regenerative surgery (15.8%) and the "other" category (12.8%). Amongst the periodontists who preferred the "other" category, 11.8% of the periodontists preferred LANAP as their primary treatment.

Olsen et al. (1985)<sup>35</sup>, Becker et al. (1988)<sup>36</sup> and Kaldahl et al. (1988)<sup>37</sup> reported long term follow up studies comparing SRP, osseous surgery and Modified Widman flap and concluded that all therapies reduced probing depth, however, osseous surgery was most effective in reducing probing depth. The sites that were treated with osseous surgery were also reported to have more stable and reduced probe depths (PD) over the long term. Smith and colleagues evaluated the effectiveness of osseous surgery and open flap curettage on twelve patients with moderate periodontitis using a split-mouth design.<sup>38</sup> They reported that the pocket reduction achieved by osseous recontouring was maintained over 6 months while pockets tended to recur after open flap curettage. Osseous surgery resulted in a net loss of attachment of 1.4 mm and open flap curettage resulted in an attachment gain of 0.9 mm. The authors concluded that either procedure could achieve periodontal health. Ramfjord and co-workers evaluated the effects of Modified Widman flap, curettage and pocket elimination surgeries in patients with moderate to severe chronic periodontitis over 8 years. They concluded that pocket reduction was greater for Modified Widman flap and pocket elimination therapy as compared to gingival curettage. Attachment gain in moderately deep pockets (4-6mm) was significantly greater for Modified Widman flap and gingival curettage than for pocket elimination surgery.<sup>39</sup>

Regenerative surgery is a broad description of treatment modalities that include several surgical techniques (i.e., membranes, bone grafts, and biological materials). There is agreement in the periodontal literature that use of bone grafts should be limited to intra-bony periodontal defects.<sup>40</sup> Only limited evidence is available for using other regenerative agents in the treatment of horizontal bone defects. The application of enamel matrix derivative (EMD) as a regenerative material was compared to open flap debridement in patients with horizontal bone loss in posterior teeth.<sup>41</sup> After 1 year, the EMD treated defects showed greater PD reduction, greater clinical attachment level gain (CAL), and smaller amounts of gingival recession (GR) than the group receiving open flap debridement. Bone level changes did not significantly differ between the two groups. Differences in PD, CAL and GR between treatments were statistically significant (p<0.001), but the benefit's clinical relevance remained questionable.

The amount of evidence in support of LANAP is extremely limited. Only one prospective clinical study, with nine months of follow-up in eight patients with advanced periodontitis, reported that the PD was reduced from  $4.62 \pm 2.29$  mm to  $3.14 \pm 1.48$  mm

and from  $6.50 \pm 2.07$  mm to  $3.92 \pm 1.54$  mm.<sup>42</sup> The paper did not specify the nature of periodontal defects found in these patients. It also did not compare the effects of LANAP to any other surgical or non-surgical periodontal therapy.

Currently, osseous surgery and open flap debridement are the only evidencesupported options for treatment of horizontal defects in chronic periodontitis patients. They were also the most commonly selected primary and secondary treatment options in the survey. However, there was no unanimity in this clinical decision. Less than half the periodontists in this study opted for osseous surgery as primary treatment and only 9.9% of the periodontists preferred OFD as their primary treatment choice. There is extremely weak evidence for the use of biological materials as a regenerative material in the treatment of patients exhibiting horizontal bone loss in posterior teeth (include reference). There is no evidence in current literature to support the use of LANAP over any other surgical and non-surgical periodontal therapy.

Two-third of the surveyed periodontists (67.33%) preferred regenerative surgery as a primary treatment for a patient with localized aggressive periodontitis with vertical bone loss on a maxillary first molar (case #2). The second most common primary treatment option reported was the "other" treatment (9.9%).

Two systematic reviews evaluated the effectiveness of periodontal regeneration with the use of bone grafts over open flap debridement alone. Reynolds and colleagues concluded that bone replacement grafts provided demonstrable clinical improvements in
periodontal osseous defects compared to surgical debridement alone.<sup>43</sup> Autogenous bone treatment resulted in statistically significant greater CAL gain (weighted mean difference: 0.72 mm, SD ±1.82) and bone fill (weighted mean difference: 1.62 mm, SD ±1.53) for autogenous bone compared to open flap debridement alone. In the review performed by Trombelli and colleagues, autogenous bone grafts were compared to OFD.<sup>44</sup> The results indicated a greater CAL gain for grafted group (CAL gain: 3.2 mm, SD  $\pm 0.5$ ) compared with controls (CAL gain: 2.0 mm, SD  $\pm 0.8$ ). The difference in CAL gain between groups (1.20 mm, SE  $\pm 0.39$ ) was not statistically significant. Murphy and colleagues<sup>30</sup> evaluated the effect of guided tissue regeneration (GTR) over surgical debridement alone. The difference in CAL gain between the test barrier collagen, polymeric and ePTFE membrane and OFD was 0.95±0.47mm, 0.92±0.18mm and 1.61±0.25mm respectively.<sup>45</sup> In a systematic review analyzing the effectiveness of enamel matrix derivative over placebo and GTR, Esposito and co-workers noted 0.9mm of additional pocket depth reduction over placebo and GTR.<sup>46</sup> Another Cochrane review, by Needleman and coworkers, compared the efficacy of GTR over open flap debridement (OFD).<sup>47</sup> It found that the PD reduction was greater for GTR than OFD (1.21 mm; CI<sub>95%</sub>: 0.53 mm to 1.88 mm ) or GTR and bone substitutes, (1.24 mm; CI<sub>95%</sub>: 0.89 mm to 1.59 mm ). However, there was also substantial unexplained heterogeneity among the results of the GTR studies that were included in the analysis. This suggests a limited predictability of the clinical outcome in practice.

Overall, there is evidence to suggest that regenerative surgery yields favorable results in the treatment of intra-bony periodontal defects as compared to open flap debridement alone. However, in the present survey, only two-third of the periodontists preferred regeneration as the primary treatment of choice. There is no scientific evidence to suggest that LANAP will result in resolution of the intra-bony defect. Osseous resective surgery was the primary treatment of choice for 7% of the periodontists. While osseous surgery will result in elimination of the pocket depth, it will also result in loss of attachment.<sup>33 34 35 36 37</sup> Osseous surgery should be avoided for treating localized aggressive periodontitis with an infrabony defect.

In the third clinical scenario of generalized moderate and localized severe chronic periodontitis with Miller class III mobility and Hamp III furcation of a mandibular first molar, two-third of the responders (66.3 %) decided that extracting the mandibular first molar and inserting an implant (immediate or delayed) was the primary treatment option.

McGuire and Nunn proposed a classification in which a tooth was defined "hopeless" if it had a mobility of Miller class III and a Hamp III furcation.<sup>48</sup> According to these authors, the treatment for such hopeless teeth should be extraction. However, teeth with severe loss of periodontal support can be retained within a strict program of periodontal therapy and supportive periodontal care.<sup>49,50</sup> The results from the repeated examinations demonstrated that treatment of advanced forms of periodontal disease resulted in clinically healthy periodontal conditions and that this state of "periodontal health" could be maintained in most patients and sites over a period of 14 years. In this survey, however, no responder recommended monitoring the patient using supportive maintenance therapy.

In the 4<sup>th</sup> clinical scenario, less than one in two practitioners (45.5%) preferred regeneration of a Hamp Class II buccal furcation defect on a mandibular molar in a patient with generalized moderate and localized severe chronic periodontitis. Also, 15.8% of the responders recommended occlusal adjustment as their primary treatment of choice with no other active surgical therapy.

Kinaia and colleagues conducted a meta-analysis investigating the effectiveness of GTR and OFD on class II molar furcations.<sup>51</sup> They reported that the use of resorbable membranes showed significant improvement in vertical probing reduction  $(0.73 \pm 0.16 \text{ mm}; [CI_{95\%}: 0.42 \text{ mm}, 1.05 \text{ mm}])$ , attachment gain  $(0.88 \pm 0.16 \text{ mm}; [CI_{95\%}: 0.55 \text{ mm}, 1.20 \text{ mm}])$ , horizontal bone fill  $(0.98 \pm 0.12 \text{ mm}; [CI_{95\%}: 0.74 \text{ mm}, 1.21 \text{ mm}])$ , and vertical bone fill  $(0.78 \pm 0.19 \text{ mm}; [CI_{95\%}: 0.42 \text{ mm}, 1.15 \text{ mm}])$  over OFD. Similarly, Bowers and co-workers reported that complete closure was achievable in 50% of molars with class II furcation involvement.<sup>52</sup> Also, 15 out of 22 (68%) of all residual defects were reduced to class I and only seven (8%) failed to improve. They concluded that successful clinical resolution of class II furcations in a molar is attainable. There is no evidence currently to suggest that occlusal adjustment alone can resolve an intra-bony defect.

This survey showed substantial variation in the treatment decisions for similar periodontal problems amongst 101 responders. These results are consistent with results published in the medical literature.<sup>19</sup> However, most of the studies documented in the medical literature used health care database and insurance claims for the evaluation of practice variation. A limitation of using a database to evaluate a clinician's practice pattern is the great variability of the clinical expression of one and the same diagnostic entity (code); hence affecting the number of procedures (variation in practice patterns) the clinician in that area would perform. The advantage of using standardized patient clinical vignettes is that any variation in practice patterns cannot be attributed to differences in disease patterns or patient preference.

Clinical decision-making is both a result and constituent of clinical reasoning. Given its important role in health care practice, it is important to identify and understand the factors that positively or negatively influence clinical decision-making. Health care professionals are required to make decisions with multiple factors (e.g., diagnosis, clinical co-morbidities, treatment plan) in consideration. In almost all clinical situations, clinical decision-making is a dynamic process that requires using diverse knowledge base including an increasing body of evidence-based literature, with multiple individuals involved. The quality of health care is hence dependent on these factors that influence clinical decision-making. Any errors in clinical decision-making can have potential adverse effects on patient management and treatment outcome. In the present survey, the clinical vignettes provided were presentations of simple cases with disease patterns limited to the periodontium. They were devoid of many factors that may affect clinical decision-making, i.e., the patients had no medical co-morbidities and had no treatment preferences. The costs of treatment and third party payments/ insurance claims were also not of concern to the periodontists in this survey. In this ideal scenario, the periodontists were free to choose the most appropriate treatment plan based on their clinical and scientific expertise. However, more than one-third of the responders did not select the treatment plans with the strongest scientific evidence.

The most common treatment options selected in this study were osseous and regenerative surgery. Another frequently selected treatment option was LANAP, a periodontal regenerative procedure that uses a variable free-running pulsed neodymium: yttrium-aluminum-garnet (Nd:YAG at 1064 nm wavelength) dental laser. It is believed that LANAP can achieve new attachment to the root surface in the absence of a long junctional epithelium. The current AAP statement quotes, "The Academy is not aware of any randomized blinded controlled longitudinal clinical trials, cohort or longitudinal studies, or case-controlled studies indicating that 'laser excisional new attachment procedure (or Laser ENAP)' or 'laser curettage' offers any advantageous clinical result not achieved by traditional periodontal therapy. Moreover, published studies suggest that use of lasers for ENAP procedures and/or gingival curettage could render root surfaces and adjacent alveolar bone incompatible with normal cell attachment and healing." In the present study, it was also observed that the responders who preferred LANAP as their

primary treatment of choice for one of the clinical vignettes presented, selected LANAP as their primary treatment of choice for all the cases presented, independent of the different periodontal conditions. It is of interest to note that untested therapies are used to manage periodontal diseases.

One of the other factors that affect the quality of health care is the relation between cost and outcome. It is assessed using the cost-effectiveness analysis, a method in which the total costs of a particular therapy are compared with its benefit or effectiveness. Researchers who perform cost-effectiveness analyses compare two or more therapies aimed at the same medical condition and determine which of these therapies can be judged "better" in terms of the positive and negative consequences associated with them. For example, the regenerative surgeries done in periodontics can be attempted using various techniques and materials. The studies presented in the scientific literature currently show clinical efficacy for all these techniques. The range of clinical attachment gained by these various techniques and materials varies largely but averages 1.2 mm generally. It will be important to note the most "cost-effective" treatment if the clinical outcomes achieved with all of these materials and techniques are comparable. Periodontitis is a major health concern, but there are no systematic reviews that evaluate the cost-effectiveness of the periodontal therapies. One of the limitations in evaluating cost-effectiveness is that, unlike in medicine, periodontology lacks well-defined and distinct outcomes.<sup>53</sup> Evaluation of cost-effectiveness is also limited by the ability to get national mean costs of all the procedures. However, it would not be unrealistic to expect

that the costs of treatments might have affected the clinical decision making in this survey. In principle, the clinical practice guidelines promulgated by specialty societies should help clinicians with their treatment decisions and should be based on carefully structured comparative effectiveness research. The current American Academy of Periodontology position paper on guidelines for periodontal therapy sets forth the clinical objective and scope of periodontal therapy, without getting in to the details of each surgical treatment modality for a specific periodontal disease.<sup>54</sup>

This survey was subject to several limitations. One of the limitations was sample size. All practicing periodontists in four states received an invitation to participate, but only one third responded. In order to increase the response rate, a reminder telephone call was made to all the periodontists. This survey had a response rate of 34.6%. Although there is no scientifically proven minimally acceptable response rate, a response rate of 60 % is generally considered acceptable.<sup>55</sup> As a result of the low response rate, the study did not have sufficient power to evaluate if the variations in practice patterns were attributable to any variables associated with the periodontist. Another limitation was how the periodontal practioners using a voluntary questionnaire, only captures those who are willing to respond, creating a potential bias. Finally, the demographics of the sample available in this thesis were different from the sampled population. In this cohort, periodontists who had 0-10years of experience were under represented and periodontists over 20 years of experience were over represented in the surveyed sample.

In conclusion, periodontists exhibited substantial variation in primary and secondary choices for treatment of a standardized case scenario. These decisions made by periodontists may not exactly replicate the evidence reported in scientific literature, even in the absence of patient preferences. These decisions in dental-care provision may have important implications in patient management. Further investigation will be needed to ascertain if these clinical decisions are based on any other variables attributable to the periodontist. **Appendix A: Tables** 

**Table 1:** Sample and population demographics.

	Sample n (%)	Population N (%)	p value
Gender			
Male	81 (80.2)	234 (78.8)	
Female	20 (19.8)	63 (21.2)	0.76
Years of experience			
0 to 10	11 (10.9)	67 (22.6)	0.01
11 to 20	19 (18.8)	61 (20.5)	0.71
>21	71 (70.3)	169 (56.9)	0.01
<b>RUCA Code</b>			
Rural	3 (2.9)	NA	
Urban	98 (97)	NA	NA

Table 1

**Table 2:** "Other" treatment options selected by periodontists for patients with generalized severe chronic periodontitis (case #1).

Primary "Other" Treatment Options				
Procedure	Frequency			
Laser Assisted New Attachment Procedure				
(LANAP)	12			
Perioscopy assisted SRP	1			
Pulp Testing	1			
Secondary "Other" Treatment Options				
Laser Assisted New Attachment Procedure				
(LANAP)	1			
DNA Probing and systemic Antibiotic	1			

Table 2

**Table 3:** "Other" treatment options selected by periodontists for patients with localized aggressive periodontitis (case #2).

Primary "Other" Treatment Options				
Procedure	Frequency			
Laser Assisted New Attachment Procedure (LANAP)	5			
Perioscopy assisted SRP	1			
DNA Probe and systemic Antibiotic	3			
Pulp Testing	1			
Occlusal Adjustment	2			
Secondary "Other" Treatment Options				
¥				
Laser Assisted New Attachment Procedure (LANAP)	3			
Local delivery of Antibiotic	2			
DNA Probing and systemic Antibiotic	1			

Table 3

**Table 4:**"Other" treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class III mobility and Hamp III furcation involvement of a mandibular molar (case #3).

Primary "Other" Treatment Options				
Procedure	Frequency			
Laser Assisted New Attachment Procedure				
(LANAP)	6			
Apically positioned flap	1			
DNA Probe and systemic Antibiotic	1			
Pulp Testing	2			
Occlusal Adjustment	2			
Secondary "Other" Treatment Options				
Laser Assisted New Attachment Procedure (LANAP)	3			
Apically positioned flap	1			
Extraction only	4			

Table 4

**Table 5:** "Other" category treatment option for patients with generalized moderate and localized severe chronic periodontitis with Miller Class 1 mobility and Hamp II furcation involvement of a mandibular molar (case #3).

Primary "Other" Treatment Options				
Procedure	Frequency			
(LANAP)	6			
Occlusal Adjustment	16			
DNA Probe and systemic Antibiotic	2			
Pulp Testing	1			
Secondary "Other" Treatment Options				
Laser Assisted New Attachment Procedure (LANAP)	1			
Occlusal Adjustment	4			

Table 5

**Appendix B: Figures** 

**Figure 1:** Primary treatment options selected by responders for patients with generalized severe chronic periodontitis (case #1).

The frequency distributions of 103 periodontists were recorded for various treatment options. The treatment options for the clinical vignette included: 1) re-instrumentation by scaling and root planing; 2) monitoring the patient without further treatment and placing patient on 3 month periodontal maintenance schedule; 3) providing osseous surgery; 4) providing open flap and debridement surgery; 5) providing regenerative surgery; 6) extracting maxillary first molar and inserting either an immediate or delayed implant; 7) root canal therapy and root resection for maxillary first molar; or 8) some other preferred treatment. Data are expressed as the percentage of responders selecting a treatment option +/- the CI<sub>95%</sub>.



Figure 1

**Figure 2:** Secondary treatment options selected by periodontists for patients with generalized severe chronic periodontitis (case #1).

The frequency distributions of 103 periodontists were recorded for various treatment options. The treatment options for the clinical vignette included: 1) re-instrumentation by scaling and root planing; 2) monitoring the patient without further treatment and placing patient on 3 month periodontal maintenance schedule; 3) providing osseous surgery; 4) providing open flap and debridement surgery; 5) providing regenerative surgery; 6) extracting maxillary first molar and inserting either an immediate or delayed implant; 7) root canal therapy and root resection for maxillary first molar; or 8) some other preferred treatment. Data are expressed as the percentage of periodontists selecting a treatment option +/- the 95% CI.



Figure 2

**Figure 3:** Primary treatment options selected by periodontists for patients with localized aggressive periodontitis (case #2).

The frequency distributions of 103 periodontists were recorded for various treatment options. The treatment options for the clinical vignette included: 1) re-instrumentation by scaling and root planing; 2) monitoring the patient without further treatment and placing patient on 3 month periodontal maintenance schedule; 3) providing osseous surgery; 4) providing open flap and debridement surgery; 5) providing regenerative surgery; 6) extracting maxillary first molar and inserting either an immediate or delayed implant; 7) root canal therapy and root resection for maxillary first molar; or 8) some other preferred treatment. Data are expressed as the percentage of periodontists selecting a treatment option +/- the 95% CI.



Figure 3

**Figure 4:** Secondary treatment options selected by periodontists for patients with localized aggressive periodontitis (case #2).

The frequency distributions of 103 periodontists were recorded for various treatment options. The treatment options for the clinical vignette included: 1) re-instrumentation by scaling and root planing; 2) monitoring the patient without further treatment and placing patient on 3 month periodontal maintenance schedule; 3) providing osseous surgery; 4) providing open flap and debridement surgery; 5) providing regenerative surgery; 6) extracting maxillary first molar and inserting either an immediate or delayed implant; 7) root canal therapy and root resection for maxillary first molar; or 8) some other preferred treatment. Data are expressed as the percentage of periodontists selecting a treatment option +/- the 95% CI.



Figure 4

**Figure 5:** Primary treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class III mobility and Hamp III furcation involvement of mandibular molar (case #3).

The frequency distributions of 103 periodontists were recorded for various treatment options. The treatment options for the clinical vignette included: 1) monitoring the patient without further treatment and placing patient on 3 month periodontal maintenance schedule; 2) re-instrumentation by scaling and root planning with local antibiotic delivery; 3) re-instrumentation by scaling and root planning; 4) providing osseous surgery; 5) providing open flap and debridement surgery; 6) providing regenerative surgery; 7) extracting mandibular first molar and inserting either an immediate or delayed implant; 8) root canal therapy and root resection for mandibular first molar; or 9) some other preferred treatment. Data are expressed as the percentage of periodontists selecting a treatment option +/- the 95% CI.



Figure 5

**Figure 6:** Secondary treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class III mobility and Hamp III furcation involvement of mandibular molar (case #3).

The frequency distributions of 103 periodontists were recorded for various treatment options. The treatment options for the clinical vignette included: 1) monitoring the patient without further treatment and placing patient on 3 month periodontal maintenance schedule; 2) re-instrumentation by scaling and root planning with local antibiotic delivery; 3) re-instrumentation by scaling and root planning; 4) providing osseous surgery; 5) providing open flap and debridement surgery; 6) providing regenerative surgery; 7) extracting mandibular first molar and inserting either an immediate or delayed implant; 8) root canal therapy and root resection for mandibular first molar; or 9) some other preferred treatment. Data are expressed as the percentage of periodontists selecting a treatment option +/- the 95% CI.



Figure 6

**Figure 7:** Primary treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class 1 mobility and Hamp II furcation involvement of mandibular molar (case #4).

The frequency distributions of 103 periodontists were recorded for various treatment options. The treatment options for the clinical vignette included: 1) re-instrumentation by scaling and root planning; 2) re-instrumentation by scaling and root planning with local antibiotic delivery; 3) monitoring the patient without further treatment and placing patient on 3 month periodontal maintenance schedule; 4) providing osseous surgery; 5) providing open flap and debridement surgery; 6) providing regenerative surgery; 7) extracting mandibular first molar and inserting either an immediate or delayed implant; 8) root canal therapy and root resection for mandibular first molar; or 9) some other preferred treatment. Data are expressed as the percentage of periodontists selecting a treatment option +/- the 95% CI.



Figure 7

**Figure 8:** Secondary treatment options selected by periodontists for patients with generalized moderate and localized severe chronic periodontitis with Miller class 1 mobility and Hamp II furcation involvement of mandibular molar (case #4).

The frequency distributions of 103 periodontists were recorded for various treatment options. The treatment options for the clinical vignette included: 1) re-instrumentation by scaling and root planning; 2) re-instrumentation by scaling and root planning with local antibiotic delivery; 3) monitoring the patient without further treatment and placing patient on 3 month periodontal maintenance schedule; 4) providing osseous surgery; 5) providing open flap and debridement surgery; 6) providing regenerative surgery; 7) extracting mandibular first molar and inserting either an immediate or delayed implant; 8) root canal therapy and root resection for mandibular first molar; or 9) some other preferred treatment. Data are expressed as the percentage of periodontists selecting a treatment option +/- the 95% CI.



Figure 8
#### **Appendix C: Cover letter**



DIVISION OF PERIODONTOLOGY

College of Dentistry 4129 Postle Hall 305 West 12th Avenue Columbus, OH 43210

Phone (614) 292-0371 Fax (614) 292-4612

Dear Colleague:

We are conducting a research study to examine practice patterns of periodontists in the prevention and/or treatment of periodontitis by evaluating general characteristics of the periodontal practicing community.

In this packet you will find an information sheet asking about you and your practice and a questionnaire that includes 4 different clinical cases that we would like you to treatment plan. For each case, you have clinical parameters (e.g., probing depths, furcations, mobilities) as well as clinical photographs and radiographs.

Using these clinical data, please select a treatment that is included with each case on the subsequent page. The Treatment Plan sheet will contain various options as well as an opportunity for you to add a treatment that may not be listed. We would like you to select what you feel are the <u>2</u> most appropriate treatment plans for each case and to rank them as either 1 (have the highest priority in your treatment decision) or 2 (have the 2<sup>nd</sup> highest priority in your treatment decision). Please select a treatment plan only for the teeth listed in each case. Cost of treatment should not enter into your decision for the treatment plans. Completion of the information sheet and the 4 treatment plans should take approximately 20 minutes of your time.

Your name and address will not be on the information form that you return, thus you will not be identified in the database. The zip code of your practice will be collected for the sake of evaluating geographic variation (urban vs. rural). All data will be combined; therefore, **no individual information** will be identified or published.

For questions, concerns, or complaints about this study, please contact:

Dr. Rachana Hegde 4129 Postle Hall 305 West 12<sup>th</sup> Avenue Columbus OH 43210 Telephone: 614-292-0371 Fax: 614-292-4612

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If you choose to participate, please complete the information sheet and the Treatment Planning sheets, and return them in the enclosed, self-addressed, stamped envelope.

Thank you for considering this request.

Sincerely

Dr. Angelo Mariotti Chair, Division of Periodontology The Ohio State University

## Appendix D: Survey Questionnaire Case #1

# Case #1

**Demographic Data** - 57 year old Caucasian female who is a retired nurse presents with the chief complaint that "My dentist referred me for boneloss".

Medical History - Not significant

## Clinical Data Following Initial Therapy (Scaling and Root Planing done)

probing d	epths					
	Tooth	#2	#3	#4	#5	
	Buccal	555	565	4 5 5	555	
	Palatal	555	554	4 5 5	666	
furcations	s (Hamp Cl	assificati	on)			
	Tooth		#3	#4	#5	
Buccal		I	I			
		(2mm)	(2mm)			
	Mesial	-	Ι			
			(2mm)			
	Distal	-	-			

mobility - none

#### Periodontal Diagnosis – Generalized Severe Chronic Periodontitis



**Treatment Plan Sheet for Case** #1- Rank your first (1 = highest priority) and your second (2 =  $2^{nd}$  highest priority) treatment choice from the list.

Treatment	Rank
Re-instrument teeth #2-5(SRP and planing)	
Monitor and place on 3 month periodontal appointment	
Osseous Surgery	
Open Flap and Debridement Surgery	
Regenerative Surgery	
Extract #3 and implant (immediate/delayed) placement	
RCT #3 and Root resection	
Other (please list and rank)	

## Appendix E: Survey Questionnaire Case # 2

# Case #2

**Demographic Data** - 30 year old Asian female presents with the chief complaint, "I have gum disease"

Medical History - Not significant

Clinical Data Following Initial Therapy (Scaling and Root Planing done)

probing depths

Tooth	#12	#13	#14	#15
Buccal	434	434	744	4 3 3
Palatal	4 3 3	334	644	3 2 2

mobility - none

#### Periodontal Diagnosis – Localized Aggressive Periodontitis





Treatment Plan Sheet for Case #2 - Rank your first (1 = highest priority) and your second (2 =  $2^{nd}$  highest priority) treatment choice from the list.

Treatment	Rank
Re-instrument teeth #12-15 (SRP and planing)	
Monitor and place on 3 month periodontal appointment	
Osseous Surgery	
Open Flap and Debridement Surgery	
Regenerative Surgery	
Extract #14 and implant ( immediate/ delayed) placement	
RCT #14 and Root resection	
Other (please list and rank)	

## Appendix F: Survey Questionnaire Case # 3

## Case #3

**Demographic Data** - 45 year old Caucasian male presents with the chief complain have gum disease"

Medical History - Not significant

#### Clinical Data Following Initial Therapy (Scaling and Root Planing done)

probing depths

Tooth	#18	#19	#20	#21
Buccal	2 3 5	687	543	4 3 3
Palatal	3 3 5	676	544	3 2 2

furcations (Hamp Classification)

Tooth	#18	#19	#20	#21
Buccal	-	III	-	-
Lingual	-	III	-	-

mobility (Miller) - Class 3 mobility for #19

# Periodontal Diagnosis- Generalized Moderate and Localized Severe Chronic Periodontitis





Treatment Plan Sheet for Case #3 - Rank your first (1 = highest priority) and your second (2 =  $2^{nd}$  highest priority) treatment choice from the list.

Treatment	Rank
Monitor and place on 3 month periodontal appointment only	
Re-instrument teeth #18-21 with local delivery	
Re-instrument teeth #18-21(SRP and planing)	
Osseous Surgery	
Open Flap and Debridement Surgery	
Regenerative Surgery	
Extract #19 and implant ( immediate/ delayed) placement	
RCT #19 and Root resection	
Other (please list and rank)	

## Appendix G: Survey Questionnaire Case #4

## Case #4

**Demographic Data** – 33 year old African American female presents with the chief complaint, "my teeth are mobile"

Medical History - Not significant

#### Clinical Data Following Initial Therapy (Scaling and Root Planing done)

probing depths

Tooth	#18	#19	#20	#21
Buccal	345	666	4 1 3	4 1 4
Palatal	3 3 3	434	322	3 2 2

#### furcations (Hamp Classification)

Tooth	#18	#19	#20	#21
Buccal	-	II	-	-
Lingual	-	-	-	-

mobility (Miller) - Class 1 mobility for #19

Periodontal Diagnosis – Generalized moderate and localized severe Chronic Periodontitis





Treatment Plan Sheet for Case #4 - Rank your first (1 = highest priority) and your second (2 = 2<sup>nd</sup> highest priority) treatment choice from the list.

Treatment	Rank
Re-instrument teeth #18-21(SRP and planing)	
Re-instrument teeth #18-21 with local delivery	
Monitor and place on 3 month periodontal appointment only	
Osseous Surgery	
Open Flap and Debridement Surgery	
Regenerative Surgery	
Extract #19 and implant ( immediate/ delayed) placement	
RCT #19 and Root resection	
Other (please list and rank)	

**Appendix H: Periodontist Information Sheet** 

# Information Sheet

Please provide the following information:

Gender- 🗆 Male 🗆 Female

Location of your practice 
Urban 
Rural OR Zipcode of practice-\_

No. of years in practice in years-\_\_\_\_\_

Periodontal Program -\_\_\_\_

### References

<sup>3</sup> Cohen LA, Manski RJ. Visits to non-dentist health care providers for dental problems. Fam Med. 2006 Sep;38(8):556-64.

<sup>4</sup> Cohen LA, Manski RJ. Visits to non-dentist health care providers for dental problems. Fam Med 2006;38(8):556-64

<sup>5</sup> https://www.nidcr.nih.gov/DataStatistics/ByPopulation/Seniors/

<sup>6</sup> Eke PI, Dye BA, Wei L, Thornton-Evans GO, Genco RJ; CDC Periodontal Disease Surveillance workgroup: James Beck (University of North Carolina, Chapel Hill,USA), Gordon Douglass (Past President, American Academy of Periodontology), Roy Page (University of Washin. Prevalence of periodontitis in adults in the United States: 2009 and 2010. J Dent Res. 2012 Oct;91(10):914-20. Epub 2012 Aug 30.

<sup>7</sup> Fischer ES, Wennberg JE. Health care quality, geographic variations, and the challenge of supply-sensitive care. Perspect Biol Med 46:69-79, 2003.

<sup>8</sup> Chassin MR, Galvin RW. The urgent need to improve health care quality. Institute of medicine national roundtable on health care quality. JAMA 280:1000-5, 1998.

<sup>9</sup> Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS (January 1996). "Evidence based medicine: what it is and what it isn't".*BMJ* **312** (7023)

<sup>10</sup> David L. Sackett, Evidence-based medicine, Seminars in Perinatology, Volume 21, Issue 1, February 1997

<sup>11</sup> <u>http://ebd.ada.org/en/about</u>

<sup>&</sup>lt;sup>1</sup> http://en.wikipedia.org/wiki/Health\_care\_in\_the\_United\_States

<sup>&</sup>lt;sup>2</sup> Berk ML, Schur CL, Cantor JC. Ability to obtain health care: recent estimates from the Robert Wood Johnson Foundation National Access to Care Survey. Health Aff (Millwood) 1995;14(3):139-46.

<sup>12</sup> Upshur RE, VanDenKerkhof EG, Goel V (May 2001). "Meaning and measurement: an inclusive model of evidence in health care". J Eval Clin Pract 7 (2): 91–6 doi:10.1046/j.1365-2753.2001.00279.x.

<sup>13</sup> Cohen LA, Manski RJ. Visits to non-dentist health care providers for dental problems. Fam Med 2006;38(8):556-64

<sup>14</sup> Timmermans S, Mauck A (2005). <u>"The promises and pitfalls of evidence-based medicine"</u>. Health Aff (Millwood) **24** (1): 18–28.

<sup>15</sup> Yitschaky O, Yitschaky M, Zadik Y (May 2011). "Case report on trial: Do you, Doctor, swear to tell the truth, the whole truth and nothing but the truth?" (PDF). J Med Case Reports 5 (1): 179.

<sup>16</sup> Grobbee, D.E.; Hoes, Arno W. (2009). Clinical Epidemiology: Principles, Methods, and Applications for Clinical Research. Jones & Bartlett Learning.

<sup>17</sup> James Reason (1990). Human Error. Ashgate.

<sup>18</sup> Daniel Kahneman, Amos Tversky (2000). Choice, Values, Frames. Cambridge University Press. <u>ISBN 0-521-62172-0</u>

<sup>19</sup> Smith M C L 2006 Clinical decision making in acute care cardiopulmonary physiotherapy. Unpublished doctoral thesis, University of Sydney, Sydney

<sup>20</sup> Blackhart, G. C.; Kline, J. P. (2005). "Individual differences in anterior EEG asymmetry between high and low defensive individuals during a rumination/distraction task". Personality and Individual Differences **39** 

<sup>21</sup> Wennberg JE. Unwarranted variations in healthcare delivery: implications for academic medical centres. Bmj 2002;325(7370):961-4.

<sup>22</sup> Havranek EP, Wolfe P, Masoudi FA, Rathore SS, Krumholz HM, Ordin DL. Provider and hospital characteristics associated with geographic variation in the evaluation and management of elderly patients with heart failure. Arch Intern Med 2004;164(11):1186-91

<sup>23</sup> O'Connor GT, Quinton HB, Traven ND, Ramunno LD, Dodds TA, Marciniak TA, et al. Geographic variation in the treatment of acute myocardial infarction: the Cooperative Cardiovascular Project. JAMA 1999;281(7):627-33.

<sup>25</sup> Lind BK, Diehr PK, Grembowski DE, Lafferty WE. Chiropractic use by urban and rural residents with insurance coverage. J Rural Health 2009;25(3):253-8

<sup>26</sup> Welch HG, Miller ME, Welch WP. Physician profiling. An analysis of inpatient practice patterns in Florida and Oregon. N Engl J Med 1994;330(9):607-12.

<sup>27</sup> Grytten J, Sorensen R. Practice variation and physician-specific effects. J Health Econ 2003;22(3):403-18.

<sup>28</sup> Phelps CE, Mooney, C., Mushlin A.I., Handy, B., Perkins, N. Doctors Have a Style - and They Matter! University of Rochester, New York: Department of Community and Preventive Medicine; 1994.

<sup>29</sup> Brennan DS, Spencer AJ. The role of dentist, practice and patient factors in the provision of dental services. Community Dent Oral Epidemiol 2005;33(3):181-95.

<sup>30</sup> Manski RJ, Macek MD, Moeller JF. Private dental coverage: who has it and how does it influence dental visits and expenditures? J Am Dent Assoc

<sup>31</sup> Wennberg DE, Wennberg JE. Addressing variations: is there hope for the future? Health Aff (Millwood) 2003;Suppl Web Exclusives:W3-614-7.

<sup>32</sup> Potter BK, Manuel D, Speechley KN, Gutmanis IA, Campbell MK, Koval JJ. Is there value in using physician billing claims along with other administrative health care data to document the burden of adolescent injury? An exploratory investigation with comparison to self-reports in Ontario, Canada. BMC Health Serv Res 2005;5(1):15.

<sup>33</sup> WWAMI Rural Health Research Center. Rural-urban commuting area codes (version 2.0); 2006. Available at: http://depts.washington.edu/uwruca/ Accessed March 2010.

<sup>34</sup> Fleiss JL, Levin B, Paik MC. Statistical methods for rates and proportions. 3rd edition 2003, Wiley series in probability and statistics. John Wiley & Sons, Hoboken, NJ

<sup>&</sup>lt;sup>24</sup> Majeed A, Eliahoo J, Bardsley M, Morgan D, Bindman AB. Variation in coronary artery bypass grafting, angioplasty, cataract surgery, and hip replacement rates among primary care groups in London: association with population and practice characteristics. J Public Health Med 2002;24(1):21-6.

<sup>36</sup> Becker W, Becker B, Ochsenbein C, et al. A longitudinal study comparing scaling, osseous surgery and modified Widman procedures. Results after one *year*. J Periodontol 1988;59:351-365.

<sup>37</sup> Kaldahl W, Kalkwarf K, Patil K, Dyer J, Bates R. Evaluation of four modalities of periodontal therapy. Mean probing depth, probing attachment level and recession changes. J Periodontol 1988;59:783-793

<sup>38</sup> Smith D, Ammons W, van Belle G. A longitudinal study of periodontal status comparing osseous recontouring with flap curettage. II. Results after 6 months. J Periodontol 1980;51:367-375.

<sup>39</sup> J. W. Knowles, F. G. Burgett, R. R. Nissle, R. A. Shick, E. C. Morrison and S. P. <u>Ramfjord</u>Results of Periodontal Treatment Related to Pocket Depth and Attachment Level. Eight Years J Periodontol May 1979, Vol. 50, No. 5, Pages 225-233

<sup>40</sup> Cortellini P, Tonetti MS (2000) Focus on intrabony defects: guided tissue regeneration. J Periodontol 22:104–132

<sup>41</sup> Di Tullio M, Femminella B, Pilloni A, Romano L, D'Arcangelo C, De Ninis P,Paolantonio M. Treatment of supra-alveolar-type defects by a simplified papilla preservation technique for access flap surgery with or without enamel matrix proteins. J Periodontol. 2013 Aug;84(8):1100-10.

<sup>42</sup> Nevins M, Kim SW, Camelo M, Martin IS, Kim D, Nevins M. A prospective 9-month human clinical evaluation of Laser-Assisted New Attachment Procedure (LANAP)therapy. Int J Periodontics Restorative Dent. 2014 Jan-Feb;34(1):21-7.

<sup>43</sup> Mark A. Reynolds , Mary Elizabeth Aichelmann-Reidy , Grishondra L. Branch-Mays and John C. Gunsolley The Efficacy of Bone Replacement Grafts in the Treatment of Periodontal Osseous Defects. A Systematic Review Annals of Periodontology Dec 2003, Vol. 8, No. 1, Pages 227-265

<sup>&</sup>lt;sup>35</sup> Olsen C, Ammons W, van Belle G. A longitudinal study comparing apically repositioned flaps, with and without osseous surgery. Int J Periodontics Restorative Dent 1985;5(4):ll-33.

<sup>44</sup> Trombelli L, Heitz-Mayfield LJ, Needleman I, Moles D, Scabbia A. A systematic review of graft materials and biological agents for periodontal intraosseousdefects. J Clin Periodontol. 2002;29 Suppl 3:117-35; discussion 160-2. Review.

<sup>45</sup> Kevin G. Murphy and John C. Gunsolley Guided Tissue Regeneration for the Treatment of Periodontal Intrabony and Furcation Defects. A Systematic Review Annals of Periodontology Dec 2003, Vol. 8, No. 1, Pages 266-302

<sup>46</sup> Esposito M, Grusovin MG, Papanikolaou N, Coulthard P, Worthington HV. Enamel matrix derivative (Emdogain(R)) for periodontal tissue regeneration in intrabony defects. Cochrane Database Syst Rev. 2009 Oct 7;(4):CD003875.

<sup>47</sup> Needleman I, Tucker R, Giedrys-Leeper E, Worthington H. Guided tissue regeneration for periodontal intrabony defects--a Cochrane Systematic Review. Periodontol 2000. 2005;37:106-23. Review.

<sup>48</sup> McGuire, M. K. & Nunn, M. E. (1996a) Prognosis versus actual outcome. II. The effectiveness of clinical parameters in developing an accurate prognosis.J Periodontol 67, 658–665.

<sup>49</sup> Lindhe, J. & Nyman, S. (1984) Long-term maintenance of patients treated for advanced periodontal disease. J Clin Periodontol 11,504–514.

<sup>50</sup> Pretzl, B., Wiedemann, D., Cosgarea, R., Kaltschmitt, J., Kim, T. S., Staehle, H. J. & Eickholz, P. (2009a) Effort and costs of tooth preservation in supportive periodontal treatment in a German population.J Clin Periodontology 36, 669–676

<sup>51</sup> Kinaia BM, Steiger J, Neely AL, Shah M, Bhola M. Treatment of Class II molar furcation involvement: meta-analyses of reentry results. J Periodontol. 2011Mar;82(3):413-28

<sup>52</sup> Gerald M. Bowers, Robert G. Schallhorn, Pamela K. McClain, Grace M. Morrison, Rose Morgan and Dr. Mark A. Reynolds. Factors Influencing the Outcome of Regenerative Therapy in Mandibular Class II Furcations: Part I J Periodontol Sep 2003, Vol. 74, No. 9, Pages 1255-1268

53 Gjermo PE, Grytten J. Cost-effectiveness of various treatment modalities for adult chronic periodontitis. Periodontol 2000. 2009;51:269-75.

<sup>&</sup>lt;sup>54</sup> Position paper: American Academy of Periodontology's guidelines for periodontal therapy. Dent Today. 2002 Aug;21(8):32.

<sup>&</sup>lt;sup>55</sup> Johnson TP, Wislar JS. Response rates and nonresponse errors in surveys. JAMA. 2012 May 2;307(17):1805-6.