

**REVITALIZING THE GUIDELINES FOR INTERPROFESSIONAL CARE
OF PATIENTS WITH TYPE II DIABETES & PERIODONTITIS**

An Undergraduate Research Scholars Thesis

by

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ABSTRACT

Revitalizing the Guidelines for Interprofessional Care of Patients with Type II Diabetes & Periodontitis

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Type II diabetes mellitus (T2DM) is a chronic systemic condition caused by the inability of the body to regulate blood glucose levels. Periodontal disease is a common comorbidity of T2DM caused by an inflammatory reaction to an oral biofilm. This reaction causes gingival inflammation that leads to irreversible deterioration of the alveolar bone, loosening of the teeth, and in severe cases, tooth loss. Patients with T2DM are two to three times more likely to suffer from periodontal disease, and proper treatment of either condition improves the prognosis of the

other. Despite this well-known association, patients seldom receive coordinated medical and dental care. In addition to the need for coordinated care, these patients frequently have limited economic resources. Patients with T2DM have a higher tendency towards falling into the category of lower-income populations with limited resources. Due to majority of the population that have T2DM falling into a lower SES dental care often falls to the back burner. With majority of patients being in this lower SES category there needs to be coordinated care for these patients with the proposed treatment guidelines. People of lower SES typically reside in lower-income neighborhoods with limited access to medical or dental care. Dental Hygienists have recognized limited access to care and have lobbied for law change from indirect access to care to direct access to care in 42 states. This legislative change has improved access to care for underserved populations. However, the quality of patient care for T2DM and PD is still lacking due to the deficit of referrals from the treating physician to dental health care providers for this patient population. Current clinical trials have established that the proper treatment of periodontitis can lower hemoglobin A1c and facilitate the treatment of systemic inflammation. The dental hygienist represents a potential entry point into periodontal care that may be more generally accessible and affordable. The dental hygienist is well positioned to bridge the gap between medical and dental treatment by aiding in managing both diseases to improve care for those afflicted.

DEDICATIONS

To my friends, family, instructors, and peers who supported me throughout the research process.

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NOMENCLATURE

T2DM	Type II Diabetes Mellitus
DM	Diabetes Mellitus
PD	Periodontal Disease
CAL	Clinical Attachment Loss
SES	Socioeconomic Status
SEP	Socioeconomic Profile
DHCP	Dental Health Care Providers
NSPT	Nonsurgical Periodontal Therapy

INTRODUCTION

Type II diabetes mellitus (T2DM) is a chronic systemic condition involving the body's inability to accept glucose into its cells due to the desensitization of insulin receptors on the cell.¹ T2DM is a common health problem worldwide and carries significant comorbidities, including periodontal disease.^{1,2,3} Periodontal disease (PD) is a chronic inflammatory disease initiated by the body's reaction to the bacteria and biofilm around the teeth.⁴ This reaction causes gingival inflammation and ultimately leads to deterioration of the alveolar bone, loosening teeth, and tooth loss in severe cases.^{2,3} Poor glycemic management and insulin resistance render diabetic patients two to three times more likely to suffer periodontitis and its accompanying bone loss than non-diabetic patients.² Despite the well-known link between these two diseases, periodontists are typically not in contact with a patient's treating physician.^{2,3,5,6} Conversely, the physician is often unaware of the patient's periodontal status, even though the proper treatment of periodontitis can lower hemoglobin A1c, a significant index of T2DM, and facilitate the treatment of the systemic disease.^{2,5,6,7,8} The gaps within the current standard of care for treatment management of patients with T2DM and PD have spurred the creation of new and improved inter-professional guidelines between the endocrinologist, primary care provider, the dental hygienist, the dentist, and periodontist.^{7,8} This article will review the current interprofessional guidelines and recommend changes indicated by existing bodies of evidence to discover better solutions to this urgent world health problem.

For this patient population one needs to look at all the significant societal components involved to make a difference in better quality care. The limited economic resources of many people with T2DM remain a significant impairment to quality of and access to care for this

patient population.¹⁰ T2DM is frequently associated with lower-income populations lacking access to medical or dental care and costly periodontal treatment.^{9,10} The dental hygienist represents a potential point of entry into periodontal care that is more generally accessible and affordable to these populations and may lower disease severity.^{9,10}

1. PERIODONTAL DISEASE AND TYPE II DIABETES MELLITUS

Periodontal disease is a chronic disease that develops due to a sustained biochemical inflammatory response to the biofilm around the teeth and underneath the gums.^{11,13} Primarily, this inflammation destroys the alveolar bone, gingiva, cementum, and periodontal ligament, which can cause loosening of the teeth and tooth loss in the most severe cases.^{4,13} The prevalence of this issue is that of the general public 47.2% of adults aged 30 years or older currently have at least some form of periodontal disease.⁵ Periodontal disease can be categorized into two categories, chronic and aggressive. Chronic periodontitis is a slow to moderate disease process with generalized and consistent horizontal bone loss.¹³ Aggressive periodontal disease is a rapid disease process, with losing up to 2mm of alveolar bone within one year. This aggressive periodontal disease consists of typically more localized inconsistent vertical bone loss.⁸ Severe PD is one of the most prevalent chronic diseases that affects nearly 750 million of the general population. With chronic PD the loss of alveolar bone occurs over an extended period, for example 5-15 years. Of those, people that have T2DM and uncontrolled moderate to severe PD experience an increase in poor glycemic control.^{3,4}

Type II diabetes mellitus is a chronic systemic condition involving the body's inability to accept glucose into its cells due to the desensitization of insulin receptors on the cell.^{2,6} According to the National Diabetes Statistics Report, it was estimated in 2022 that more than 130 million adults in the United States have either been diagnosed with diabetes or pre-diabetes.² In addition, the World Health Organization has projected that the public health crisis of diabetes in 2030 will be the seventh leading cause of death.³ These statistics render the morbidity and

mortality of this disease a significant public health crisis. Of those, people that have T2DM and PD experience an increase in poor glycemic control.^{3,4}

2. POSITIVE CORRELATION BETWEEN ORAL AND SYSTEMIC INFLAMMATION

Both T2DM and PD are diseases that can cause chronic inflammatory reactions within the body. Inflammation is an immune reaction of the body that directs the white and red blood cells to the site of damage, and or infection. The white blood cells release biochemical inflammatory compounds to help mediate the location of infection.^{3,4} The severity of T2DM and PD increases due to a sustained chronic inflammatory response. Although the mechanism of action for both diseases differs, there is intra-cellular cross-talk between the two.^{3,4} The constant level of similar inflammatory mediators between these two diseases involve elevation levels of interleukin (IL)-1- β , tumor necrosis factor- α , IL-6, receptor activator of nuclear factor-kappa B ligand/osteoprotegerin ratio, oxidative stress and Toll-like receptor (TLR) 2/4 expression.⁴ With this chronic inflammatory response, there is an increased in the progression of both PD and T2DM. This relationship is thought to occur from the body's sustained inflammatory response and, thus, the release of biochemical mediators to aid in bringing one's body back to a level of homeostasis.^{4,3} The bodies overreaction of the body's immune system to foreign invaders, such as the gram-negative bacteria around the gums and teeth, and homeostatic imbalance of excess glucose in the blood causes the two diseases to exacerbate one another due to shared biochemical inflammatory mediators.^{3,4}

Although the mechanism of action for both diseases differs, there is intra-cellular cross-talk between the two.^{3,4} The similar inflammatory mediators between the two diseases include elevated levels of interleukin (IL)-1- β , tumor necrosis factor- α , IL-6, receptor activator of

nuclear factor-kappa B ligand/osteoprotegerin ratio, and oxidative stress and Toll-like receptor (TLR) 2/4 expression.⁴ When both diseases are in constant sustained biochemical inflammatory responses due to either the gram negative bacteria around the teeth and gums, or elevated levels of blood glucose; can cause the similar intra-cellular mediators that are released to exacerbate one another.^{3,4}

The discovery of a positive correlation between oral and systemic inflammation has led to the conduction of more clinical trials that further explore whether either one of these diseases can cause and increase in similar intra-cellular mediators that are released to exacerbate either one of the two diseases.¹² The Journal of Clinical Periodontology published an article by authors Preshaw and Taylor that concluded within their study that there was a 50-100% increased incidence of T2DM odds associated with patients that have periodontal disease.¹² This information is relevant because when physicians pre-screen their patients for diabetes, they inform the patient of other risk factors that could increase their risk for T2DM.¹² With this information, one could conclude that seeing a DHCP would benefit them by decreasing their risk of developing T2DM.¹²

Besides the data that shows if a person were to suffer from periodontal disease, they could increase their own risk of developing T2DM; there are also studies that have hypothesized that the application of NSPT could show a mean reduction in HbA1c in the treatment group receiving this therapy.¹² The study done by Preshaw and Taylor concluded that within a 6-month period of time, they saw reductions in HbA1c results ranging from 0.22 ± 0.11 .¹² At the same time, control groups that were not receiving the treatment of NSPT showed an increase in HbA1c results ranging from 0.056 ± 0.10 during re-evaluation.¹² These results imply that NSPT improved the glycemic status of these prediabetic patients.¹²

3. TREATMENT OPTIONS

Evidence suggests that non-surgical periodontal treatment noticeably improved glycemic control when administered to patients with T2DM and PD.^{6,11,13,14,15} In a study with T2DM patients that experience poorly controlled blood glucose, a significant reduction of 2.2 points of HbA1c was noticed.⁹ A HbA1c is a blood test that shows the patient's blood sugar over the last couple of months to the physician and patient.¹⁶ This blood test gives the patient and physician information on how well managed the patient's diabetes has been. Normal HbA1c is 5.7%, Pre-diabetics range from 5.7%- 6.4%, and Interestingly, non-diabetic patients range from 6.5% or higher.¹⁶ The correlated blood sugar for a diabetic patient that has a 6.4% HbA1c is equal to a blood glucose of 140mg/dL.¹⁷ A higher HbA1c of 9.5 % is correlated with a blood glucose of 226 mg/dL.¹⁷ In conclusion, the respective changes that we see with multiple clinical trials that have proven to have clinically significant results insinuates that application of the non-surgical periodontal therapy treatment is a feasible solution in aiding in managing this patient population.

The available data suggests and supports the rationale for including nonsurgical periodontal therapy in diabetes treatment and prevention. It should be recognized as a firm goal worth working towards.¹⁹ Interestingly, patients with periodontitis show decreased glycemic control and an elevated risk of developing diabetes mellitus.^{6,13} The participants of such referenced studies affected by diabetes showed a noticeable deterioration of glycemic control associated with periodontitis and a significantly higher prevalence of diabetes-related complications.^{6,11,12,14,15,18} The pathogenic biofilm associated with PD induces sustained chronic systemic inflammation.^{3,4,5,6,13} Thus, this contributes to an accumulating inflammatory burden

which can worsen insulin resistance and impaired glycemic control in patients afflicted with T2DM.^{3,4,5,6,13}

4. GAPS IN THE CURRENT GUIDELINES AFFECTING QUALITY OF CARE

The current standard of care for diabetic patients is management by the endocrinologist and the primary care physician (PCP). The treatment plan for these patients typically includes managing the patient's blood glucose through diet, exercise, medications to aid in insulin resistance, and routine appointments to monitor the patient's HbA1c.^{7,18} Despite the abundant evidence for the relationship between PD and T2DM, medical providers do not consistently refer T2DM patients to the dentist.⁸ There is a lack of oral health knowledge and awareness of the bidirectional link between these two diseases among physicians.⁸

The dental hygienist is a licensed dental professional trained in clinical applications of management for PD. The first process of management for PD involves staging and grading the patient's oral health based on many factors.¹⁹ The staging of PD intends to classify the severity and extent of a patient's disease.¹⁹ This is based on the measurable amount of destroyed and/or damaged tissue because of periodontitis and, if applicable, the implications of specific factors like T2DM can have on the complexity of long-term case management.¹⁹ A baseline is determined by gaining information to create a stage for the periodontal disease using clinical attachment loss (CAL).¹⁹ If CAL is unavailable, radiographic bone loss should be used.¹⁹ Tooth loss due to periodontitis may modify stage definition by moving it to a more severe stage of periodontitis.¹⁹

One or more complex factors may shift the grade (rate of progression of PD) to a higher level; one of these factors is the patient's HbA1c levels.^{19,21} The pathogenic biofilm around the teeth correlated to periodontal disease causes a chronic systemic inflammatory response.⁶ Due to

this inflammation, it has an additive effect on the cumulative inflammatory toll that can worsen insulin resistance and negatively impair the glycemic control in patients with DM.⁶ Evidence shows that proinflammatory cytokines, such as IL-1 β and TNF- α , produced due to a systemic response to a current periodontal infection, are responsible for insulin resistance.⁶ Due to the positive correlation of oral and systemic inflammation mentioned previously, one can conclude why higher levels of HbA1c could shift the grade of the periodontal disease to a faster rate of progression. for the case group after NSPT was 0.22 ± 0.11 , while the control group showed a mean increase in HbA1c value of 0.056 ± 0.10 during re-evaluation, implying that non-surgical periodontal therapy improved the glycemic status in pre-diabetic patients with patients that have chronic periodontal disease.¹³ The mean reduction of 0.22% HbA1c observed in this study cannot be ignored.¹³

After the staging, grading, oral hygiene assessment, oral examination, and radiographs (if needed) are completed, the dental hygienist, dentist, and or periodontist work together and can determine the treatment required outcome for said patient.¹⁹ Treatment varies based on the patient's needs, but if the patient shows evidence of an active disease process for PD, they would benefit from an NSPT.^{13,19} After a NSPT, the patient returns 4-6 weeks to re-evaluate the tissue and assess the patient's oral home care. If the tissue responds well, the patient can continue with 3–4-month periodontal maintenance cleanings to help manage and maintain the PD. Oral health home care instructions along with individually tailored recall intervals are vital to helping prevent the disease from progressing further, especially with complications like T2DM.^{6,13,19,21}

If evidence-based scientific data is one of the paramount tools we use to base our standard of care as clinicians, then having increased referrals to a DHCP could aid in managing these two diseases.⁸ One would assume that there would be an increase in interprofessional

communication between the two respective physicians managing these different diseases.^{3,4,5,7,8,9,13,14,15,18} However the data shows that currently, in managing patients with T2DM, there is a lack of active collaboration between treating physicians such as PCP and endocrinologists and a lack of referrals to their local dental facilities, including dentists, dental hygienists, and periodontists.⁸ Due to the substantial evidence that there is intracellular crosstalk between PD and T2DM because of the chronic systemic inflammation that both these disease causes. The association between these two diseases creates an opportunity for interprofessional care that deserves to be delivered to maintain the best quality treatment for these patients.⁸

5. ECONOMIC FACTORS AFFECTING ACCESS TO CARE

The problem with the guidelines for managing these two diseases conjointly is that the issue is multifaceted, with the need for more referrals to dental health care providers, limited access to care, and limited quality of care. Studies have looked at the interprofessional care or lack of interprofessional care, of patients with T2DM and PD, in hopes of finding ways to improve the quality of care^{1,7,8,18,20} Improving the quality of care for these patients is paramount, however one area that needs to be improved when developing a solution for better managing these patients is the comprehension and consideration of the overall increased risk of T2DM in low socio-economic (SES) groups.^{9,10,20} Patients that fall into this category of lower SES typically have limited resources available to them, including but not limited to access to quality medical and dental care.^{9,10} A disproportionate number of those living in poverty and the working poor reside in geographically isolated areas with the maldistribution of dentists and a limited number of Medicaid providers.⁴ Rural areas often have inadequate public transportation systems, making accessing dentists outside the proximal area very difficult.^{4,6} Compared to metropolitan populations, rural populations have a higher prevalence of caries and tooth loss and a lower degree of private dental insurance combined with limited access to public dental services.^{5,7}

This additional piece of information that the chronic condition of T2DM is commonly associated with individuals of lower socioeconomic status (SES) is an important addition to this puzzle of how to improve the quality of and access to care.^{9,10} Furthermore, a study from Agardh and Allebeck examined three main pillars of the participant's social and economic profile (SEP).

The association with lower SEP was based on three categories. Those with a lower educational level were estimated to have a 41% higher chance of developing T2DM, lower occupation level was 31%, and a lower income level was (40%).¹⁰ These statistics over the different categories of SEP were consistent in high-income countries.¹⁰ A similar study was also done, and their results showed a strong association between low income and low educational attainment with a higher prevalence of T2DM in Korean adults.⁹ Even though these results are of Korean adults the article reference also found that these results are consistent in Western populations such as the U.S.⁹ Paying attention to the social determinants of these individuals is essential for the effective management of T2DM.⁹

Each pillar of this complex public health problem needs to be addressed; otherwise standard of care will continue to be lacking for these patients.⁷ With the morbidity and mortality rate of T2DM, being so high this puts this issue as a sizable public health issue.^{2,3} There is an absence of interprofessional patient care between medical and dental professionals while managing patients with DM.⁷ To best address the issue at hand we need to firstly emphasize the importance of referrals for interprofessional care of this patient population and secondly improve quality of and access to care by implementing an already developed form of preventative and active treatment that is cost efficient.^{9,10,20} This treatment of NSPT and glucose monitoring by Dental Hygienist would be this solution.^{13,14} The dental hygienist is a prevention specialist trained to identify possible oral health complications in relation to the entire body. A disproportionate number of those living in poverty and the working poor reside in geographically isolated areas with maldistribution of dentists and a limited number of Medicaid providers.⁴ Rural areas often have inadequate public transportation systems, making accessing dentists outside the proximal area very difficult.^{4,6} Compared to metropolitan populations, rural

populations have a higher prevalence of caries and tooth loss and a lower degree of private dental insurance combined with limited access to public dental services.^{5,7}

6. THE DENTAL HYGIENIST: ACCESSIBLE CARE PROVIDER

An oral health disparity exists due to the limited access to dental care for low-income and affected rural populations versus people of middle to higher income levels with better access to dental care.²³ The organization Healthy People help to identify public health disparities to help the people of the United States improve their overall well-being and health.²³ According to the report Healthy People 2020, oral health is integral to overall health, and access to dental services is crucial in promoting and maintaining good oral health.²² The path forward must include improvements to interprofessional communication between the dental hygienist, dentist, and periodontist and other treating medical physicians.^{6,7,11,13,14,15,19,20} In previous studies, the suggestion of interprofessional care has only highlighted the dentist and periodontist as the primary care providers for treating periodontal disease.¹ The dental hygienist is likely more accessible than the periodontist and dentist when compared to more rural areas.¹⁸ Due to the substantial number of T2DM patients falling into the category of lower SES, the dental hygienist is the most cost-effective option compared to costly periodontal treatment at a specialist.^{10,18} Receiving cojoined treatment is projected to be a better option for the patient's HbA1c and management of their PD.^{6,7,11,13,14,15,19} With most patients falling into the lower SES category, we must ensure that quality care is accessible.¹⁰ The Introduction of the dental hygienist as the first point of contact would help create a solution with a higher chance of compliance and success in managing the two diseases.¹⁸

Routine dental care is essential to maintain overall health, but access to quality dental care for patients of lower SES is a multifaceted issue in Americas Dental hygienists recognize this health concern and have tried to reach more people in need because it is the patient's right to access dental care.²² Texas is currently a state that allows indirect access to care.²⁷ Indirect access to care limits the ability of the hygienist to work independently.²⁷ When dental hygienists work under an indirect access law, they can perform NSPT only if a dentist has diagnosed the procedure and is always in the facility when treatment is being performed.²⁷ On the other hand, states that allow direct access care allow a dental hygienist the right to initiate treatment based on their assessment of a patient's needs without the specific authorization of a dentist, treat the patient without the presence of a dentist, and maintain a provider-patient relationship.²²

Since 2013 there has been an increase from 36 to 42 states that have changed their laws to allow dental hygienists the legal ability to provide direct access to dental hygiene services.^{25,26,27} Dental hygienists have lobbied for changes in several other states to increase independence and create direct access to dental hygiene services.²⁷ Texas is one of the few states that have not seen legislative change for direct access of care.²⁷ In 1984 Washington State became the first state to legislate a law that allowed dental hygienists to provide dental hygiene treatment without the dentist being at the facility.²² A dental hygienist can be a more accessible option if direct access to care is allowed.²² A middle ground to the practicing regulations for a dental hygiene for practicing under direct access, would be a collaborative practice agreement.²⁶ A collaborative agreement with direct access would allow dental hygienists and dentists to enter a written contract that permits dental hygienists to initiate patient care before the examination of a patient by a dentist.²⁶ Agreements would include criterion that define populations served, the

scope of services provided, reporting treatments completed, referrals to other specialties and emergency protocols.²⁶

Additionally allowing dental hygienists to act independently with direct access of care thus improving access to quality dental care in rural areas, could potentially decrease dental and medical emergencies in states that currently allow indirect access of care for dental hygienists.^{22,26} The University of Minnesota School of Public Health conducted an observational study and concluded that one-year dental visits in medical emergency rooms cost upwards near five million dollars, with public programs reimbursing only 50 percent of out of pocket costs.^{23,24} Patients that fall into a lower SES and or live in rural locations, typically resort to medical emergency rooms when they experience severe oral pain.^{21,29} The dental hygienist could be more accessible in rural areas if the laws were to allow direct access of care to these patients.²² The dental hygienist is a prevention specialist that could help to aid patients by receiving routine dental care, which in turn could help catch early periodontal issues or caries and refer them to a dentist.^{22,24} Access to a dental hygienist in areas of lower income could help prevent patients from resorting to the medical emergency rooms for their oral health concerns.^{22,23} Conversely, preventive dental care could reduce taxpayer dollars that go back to these reimbursements.²⁵

Another issue for patients with limited access to dental care is finding a dentist accepting Medicaid or CHIP.²⁵ Qualifying for Medicaid or CHIP alone is not enough to help reach their dental needs.²⁵ These patients need more DHCP that are registered providers with CHIP and Medicaid.²⁵ These patients need a DHCP to receive consistent dental care that could help prevent and treat active oral disease. The limited access to care for these patients also affects the potential of DHCP can assist in managing conditions like T2DM and PD with NSPT and glucose monitoring at dental appointments.²⁴

7. IMPROVED QUALITY OF CARE WITH BETTER MANAGEMENT OF T2DM AND PD

Blood glucose monitoring is crucial for managing T2DM patients, and it requires the dental facility to be equipped with a glucometer and testing strips.³⁰ These supplies cost money, so there needs to be a way to account for said costs.³⁰ Currently, a dental code allows dental facilities to bill insurance for the glucose monitoring chairside, which can offset the potential costs to dental providers.³⁰ A study was conducted on the feasibility of blood glucose testing in dental practices.²⁸ The dental health care workers that participated in the feasibility study of taking chair side glucose reading in a dental office setting was received well with the post-facto results of 84%.²⁸ These results were significantly larger than the 56 % pre-test results of the willingness of the dental health care workers to taking chairside glucose.²⁸ According to the results, this study reported an average of 2-5 minutes for the dental health care worker to acquire and record the patient's blood glucose chairside with a glucometer.²⁸ These results suggests that dental health care workers found it easy to implement chair side once realizing that the chairside glucose testing easier after the practical application.²⁸

The American Heart Association and American Diabetes Association have both called for updated strategies to advance the detection of diabetes mellitus and pre-diabetes mellitus.²⁸ A recent article from the Healthy People 2020 initiative states that screening for diabetes mellitus as one of the uppermost measures to be implemented in the healthcare system.²³ Additionally due to correlational relationship between T2DM and PD already mentioned, further supports the potential benefit of screening the patient by the DHCP.²⁷ Diabetic screening can help increase the quality of care for these patients by helping catch unmanaged T2DM.²⁷ The screening can

help the DHCP make a fully informed medical history and be able to apply quality care to these patient's by sending medical referrals, thus helping to implement a standard of care for diabetic patients.²⁷

Improving the care of this patient population is the goal by providing chair side glucose testing.²⁷ It is not out of the scope of practice of the dentist or dental hygienist to perform chairside glucose monitoring.³⁰ Even though the dentist and dental hygienists cannot diagnose T2DM, they are required by law to check blood glucose levels before dental treatment if the patient has reported to have T2DM on their medical history.³⁰ Due to the dental hygienist being trained in recognizing changes in the oral cavity in relation to the patient's overall health, and by analyzing the patient medical record on file; they are equipped to make an informed decision on whether or not a chairside blood glucose test would be beneficial for the patient.³² For patients that are unaware of their diabetic or pre-diabetic status, it is within the dentists and dental hygienists scope of practice to check glucose readings if they suspect that their patient may have diabetes.^{30,32} If a dentist or dental hygienist identifies high-risk factors in a patient's medical history and observes hyper or hypoglycemia symptoms, taking a blood glucose chair side is recommended.^{30,32} These risk factors include high BMI, a sedentary lifestyle, and a family history of diabetes.^{33,34} The risk that uncontrolled periodontal disease poses on a patient that is not diabetic or a pre-diabetic patient is high, with the incidence ranging from 30-50% of an increased risk of developing type II diabetes mellitus.¹²

For a diabetic patient, a chairside glucose reading and an updated HbA1c should be acquired before receiving invasive dental treatment.³³ To proceed with dental treatment, green flags include having an HbA1c of less than 8.0 and a blood glucose reading between 70-175 mg/dL.³³ If a patient is unaware that they may have diabetes and warning signs are present

before dental treatment, a dentist can take a chairside glucose reading.³⁰ Implementing this before dental treatment means medical emergencies, such as hyperglycemia or hypoglycemia, can be prevented.³⁰ In addition, patients that are unaware of their diabetic status or are not aware of how well-controlled they are, the patient could gain valuable information and incentives to get treatment through their physician.^{30,31}

To bring back the issue of interprofessional communication, a systematic review was conducted by author Siddiqi et al. and found that there needed to be increased interprofessional patient care connecting medical and dental professionals while managing patients with T2DM.²⁹ The review aimed to investigate the knowledge and understanding of physicians and specialists regarding the two-way relationship between diabetes mellitus and periodontal disease and the physicians probability of them referring their patients for a dental consultation.²⁹ Over 50% of the medical professionals understood oral health and or periodontal disease.²⁹ On the other hand, only one-third of medical professionals were unaware of the interrelation between oral health and diabetes mellitus.²⁹ The study concluded that 30% reported referring their patients for an oral health assessment, was indicative of the lack of education between the oral and systemic link.²⁹ Interprofessional collaborative care is essential in improving quality of care.²⁹ In addition to lack of referrals discovered from this systemic review was the lack of interprofessional collaborative care between medical and dental professionals while managing patients with diabetes mellitus.²⁹ Collaborative care with the Dentist and or Dental hygienist with the treating physicians of patients with T2DM includes referrals and follow up on patients going to their dental care provide.²⁹ The lack of interprofessional collaborative care is an issue in the interprofessional communication among dental and medical professionals, because this impacts the quality of care that this patient population deserves.²⁹ Therefore, to bridge this gap, it is

suggested that a dental hygienist can be incorporated into the comprehensive care of a diabetic patient with periodontitis.³¹

CONCLUSION

In summary, PD is a well-known complication of T2DM, but communication between the dental health care providers and managing physician is commonly insufficient to render effective treatment. This is a critical health problem because inattention to either condition exacerbates the progression. However, guidelines have been proposed to address this gap in the standard of care, due to the lack of interprofessional collaborative care. Nevertheless, the expense of seeing a periodontist often poses a significant barrier to those diabetic patients with limited economic means and access to quality dental care. This study has addressed that barrier by exploring the data to support the role of intervention such as nonsurgical periodontal therapy and periomaintenance dental cleanings by the dental hygienist as an affordable periodontal treatment alternative for patients that have Type II diabetes mellitus and periodontal disease. This study reviewed the current proposed guidelines for the multidisciplinary treatment of T2DM, explored the feasibility of modifying such policies, and offered a role for the dental hygienist as the critical intersection of access to care with aiding in managing both diseases to improve care for those afflicted.

The purpose of having the dental hygienist be the point of contact for initial dental referrals for the periodontal assessment, would be to improve the quality of and access of care for this patient population. The Dental hygienist is a skilled dental professional trained in preventative treatment modalities that include but not limited to non-surgical periodontal therapy, periomaintenance dental cleanings, and performing blood glucose monitoring. These modifications to the current standard of care are a realistic modification of the clinical guidelines

for interprofessional care of patients with T2DM and PD based on the substantial bodies of evidence provided in this thesis.

Some questions that need answering from further research after these guidelines have been revitalized are as follows. How is patient compliance with following up on referrals? How is patient compliance with dental recall appointments? Is the patient compliance better or worse with attending their appointments for their dental and medical providers? Does this patient population understand the link between their oral health and systemic health? Are the patients receptive and motivated to seek interprofessional care after receiving a referral? Are there any other potential roadblocks preventing this patient population from accessing quality dental and medical care? Do medical professionals follow up on the referrals if they are made? What are the current take-home educational materials being used for the patient about oral health at their medical providers? Conversely, what or is there take-home information for patients about how their type II diabetes mellitus affects their oral health at their dental office? What are the outcomes of continued non-surgical periodontal treatment for this patient population extending past six months? Answers to these questions would give insight into the solution of the dental hygienist as the pivotal point of collaboration with the treating physicians to create an improved standard of care for patients with type II diabetes and periodontal disease.

The upcoming actions that need to be taken are to effect change to the laws in the states of indirect care to direct care. This action would increase access to care and open the doors up for primary care physicians to refer to dental hygienists for periodontal assessments, periodontal treatment, and diabetic monitoring. The next step is to establish a standard of care for pre-diabetic, possibly diabetic patients, and T2DM patients, by implementing a T2DM screening with chairside blood glucose monitoring. The screening would give the DHCP information that

would aid in managing this patient population better. The ongoing continuous cycle of interprofessional collaborative care through referrals from the dental health care providers to the patient's primary care physician because either one suspects that a patient may have underlying risk factors that could contribute to acquiring T2DM or PD is essential in properly managing this patient population.

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