

## Risk Factors and Comorbidities Associated with Complete Edentulism in Individuals Younger than Fifty Years of Age

Tamara M Latif\* and Alexandre R Vieira

Department of Oral Biology, University of Pittsburgh, Pittsburgh, PA, USA

\*Corresponding author: Tamara M Latif, Department of Oral Biology, University of Pittsburgh, Pittsburgh, PA, USA; E-mail: tml56@pitt.edu

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### Abstract

**Objectives:** Edentulism is a debilitating condition with a multifactorial etiology, serving as a terminal marker for oral disease. The aim of this study was to examine the risk factors, as well as associated comorbidities, in an edentulous group younger than fifty years of age at the University of Pittsburgh School of Dental Medicine.

**Methods:** Data from the Dental Registry and DNA Repository (DRDR) at the University of Pittsburgh School of Dental Medicine were analyzed and included 5,392 records. Studied risk factors included smoking, hypertension, diabetes mellitus, HIV+ status, depression/psychiatric illness, number of medications being taken, ethnicity, sex, education, employment, and body mass index (BMI). Of the total records, 100 individuals were included in the study for being completely edentulous and younger than fifty years old.

**Result:** Smoking prevalence was 73% among all 100 individuals. Hypertension, diabetes, and HIV+ prevalence were 26%, 13%, and 5%, respectively. 41% of 68 individuals reported a current or history of depression/psychiatric illness. Of 67 individuals, 55% reported taking three or more medications, 32.8% reported taking five or more, and 22.4% taking seven or more. Of 81 individuals who reported on education, 63% reported "some college" or greater. Of 78 individuals, 29.4% reported a disability, 26.9% reported being unemployed, and the remainder either "part-time" or "full-time" employment. 68% of 44 individuals that reported on BMI had a BMI > 25. 61% of individuals reported being male and 39% reported being female. The 100 individuals included 85 White, 14 Black, and 1 Asian-Indian.

**Conclusion:** Edentulism appears to be associated with smoking, HIV+ status, employment status, being male, and White. Depression and BMI were also associated with edentulism. Education, diabetes, and hypertension did not appear to be statistically significant associated with edentulism.

**Keywords:** Edentulism; Tooth Loss; Risk factors; Systemic-oral health

### Introduction

Edentulism is a debilitating condition serving as the terminal sign of an ongoing oral and systemic disease process [1]. It demonstrates a multifactorial etiology characterized by physical, economic, social, and genetic influences. Tooth loss is attributed to the interaction of systemic and oral health, as well as their interplay with environmental factors [1]. The prevalence of edentulism involves a complex relationship between culture, attitude, access to care, dental behavior, pathogenesis, and socio-demographic factors [1].

Factors contributing to tooth loss include socioeconomic status, education attainment, access to care, and physical and mental health. The effects of tooth loss range from its direct physical consequences, including loss of masticatory function and compromised nutrition intake, to an altered perception of self and diminished overall quality of life. Furthermore, tooth loss has been considered a predictor of longevity as a measure of the summative stresses a person has endured in his or her lifetime [2].

The interplay of systemic and oral health has been heavily studied. The presence of chronic systemic conditions such as uncontrolled diabetes mellitus type 2, hypertension, HIV+ status, smoking, obesity, and poor mental health can individually and collectively be attributed to early tooth loss. Sex and ethnicity have also been proposed as potential risk factors for edentulism. In young individuals, the influence of poor social factors in conjunction with poor systemic health likely play an increasingly important role in the etiology of continued oral disease and ultimately early edentulism [3].

The present study examines the influence of systemic health on early edentulism by comparing prevalence rates of different physical, mental, behavioral, and environmental factors. The examined variables include education and employment status, current and/or history of smoking, diabetes, hypertension, HIV+ status, depression/psychiatric illness, number of medications being taken, BMI, sex, and ethnicity. It has been suggested that individuals with higher education attainment, often related to improved socioeconomic status, are more likely to be aware of the importance of oral health [1]. Furthermore, these individuals are more likely able to afford the expenses of dental care, access and transportation, and the maintenance of a dental home. Education level and socioeconomic status have been significantly related to early onset edentulism [1,4].

A history of smoking has been linked to edentulism through its effects on marginal bone loss and periodontal health, as well as an increased predisposition to tooth decay [5]. Other chronic systemic conditions including uncontrolled diabetes, HIV+ status, and obesity may similarly increase the risk of periodontal disease and decay [6-8]. Risk factors related to periodontal status and decay include xerostomia, alteration of the oral microbiota, and immune function. Periodontal disease and decay serve as major etiologic factors directly related to tooth loss [9].

Poor mental health has also been considered a risk factor for early edentulism. Individuals that reported depression or a psychiatric illness were more likely to present with edentulism [10]. Furthermore, individuals with depression or a psychiatric illness may be more likely to neglect their dental health, resulting in poor oral health consequences such as tooth loss. Additionally, individuals with depression are more likely to present with comorbid conditions and to be taking greater number of medications. Thus, a combination of oral neglect and poor systemic health is attributed to the increased prevalence of tooth loss, especially in younger populations [10].

In the US, the prevalence of edentulism is highest in Native Americans, followed by Blacks, Whites, Asians and showing the lowest prevalence in Hispanics [11]. Male/female sex as a risk factor for edentulism has been disputed in previous studies, with certain studies suggesting that male sex may serve as a risk factor for early tooth loss [11].

There is limited research on edentulism in younger cohorts. Ultimately, early edentulism is a result of the interaction of multiple variables predisposing the individual to poor oral health, periodontal disease, and decay [12,1]. By gaining an understanding of the etiology and risk factors for edentulism, preventative measures can be taken to reduce the prevalence of tooth loss [1]. This study aims to examine the risk factors, as well as associated comorbidities, in an edentulous group younger than fifty years of age.

## Methods

The Dental Registry and DNA Repository (DRDR) at the University of Pittsburgh School of Dental Medicine was analyzed for patients meeting the inclusion criteria. The database includes 5,392 records of patients presenting for treatment at the University of Pittsburgh, School of Dental Medicine. Inclusion criteria included all individuals younger than fifty years of age presenting with complete edentulism. Of the 5,392 available dental records in the database, 381 individuals were completely edentulous. Of the 381 completely edentulous individuals, 100 individuals (26.25%) were included in the study for being younger than fifty years of age. The examined population included 61 males and 39 females, which included 85 Whites, 14 Blacks, and one Asian-Indian.

Education level, employment, smoking, diabetes, hypertension, HIV+ status, depression/psychiatric illness, number of medications being taken, BMI, sex, and ethnicity were investigated as risk factors for edentulism in a population less than fifty years of age. Determination of the prevalence of risk factors was based on patients' self-reported answers during the medical history survey recorded in the electronic health record. Education level was self-reported and recorded as either ">high school graduate" or "did not graduate high school". Patients also reported their employment status, including "disability", "unemployed", "part-time" or "full-time" employment. Patients were asked about current and/or history of smoking in which they reported either "yes" or "no." Patients also responded with "yes" or "no" when asked about the presence of diabetes, hypertension, HIV+ status, and depression/psychiatric illness. Number of medications was determined based on the patient's reported medication list during the initial exam. Sex and ethnicity was also patient self-reported.

Prevalence values of risk factors from the sample of 100 edentulous individuals younger than fifty years of age were determined and compared to the remaining patient records for each variable and to the US national prevalence. Data analysis was performed using the "N-1" Chi-squared test. P-values and 95% confidence intervals for prevalence differences between total patient records and the selected edentulous population were determined. All patient records including data regarding risk factors were included. Records without data regarding risk factors were excluded in the total count.

## Results

Figure 1 presents prevalence values for hypertension, smoking, diabetes, HIV+, >High School graduate, disability, and unemployment. Prevalence differences for hypertension, diabetes, and education greater than a high school certificate were not statistically significant ( $p > 0.05$ ). 73% of the edentulous population younger than 50 years of age reported a current or history of smoking, compared to the DRDR population prevalence of 34% ( $p$ -value: $< 0.0001$ ; 95% CI: 29.11, 47.49). Prevalence of HIV+ status in the edentulous population was 5% compared to the DRDR prevalence of 1.2% ( $p$ -value: 0.0009; 95% CI 0.41, 10.07). 29.4% of 78 individuals reported a disability that prevented them from work, compared to the database's total patient population prevalence of 13% ( $p$ -value: $< 0.0001$ ; 95% CI 6.25, 27.55). Of 78 individuals who chose to report on employment status, 26.9% reported being unemployed compared to the DRDR prevalence of 15% ( $p$ -value: 0.004; 95% CI 2.42, 23.19).

Prevalence differences based on ethnicity and sex are displayed in Figure 2. Sex and ethnicity were also examined as risk factors for edentulism and their prevalence compared to the DRDR population. 85% of the edentulous population younger than 50 years of age reported being White, compared to 71% of the DRDR population ( $p$ -value: 0.004, 95% CI 4.48 and 19.57). Males comprised 61% of the edentulous population, compared to 47.4% of the DRDR patient population ( $p$ -value: 0.007; 95% CI 3.24, 23.29).

Prevalence differences between the edentulous population and the US national prevalence for depression, number of medications being taken, and BMI greater than 25 and greater than 30 are displayed in Figure 3. 41% of 68 individuals reported a current or history of depression/psychiatric illness. Of 67 individuals who reported number of medications taking, 55% reported taking three or more, 32.8% reported taking five or more, and 22.4% taking seven or more.

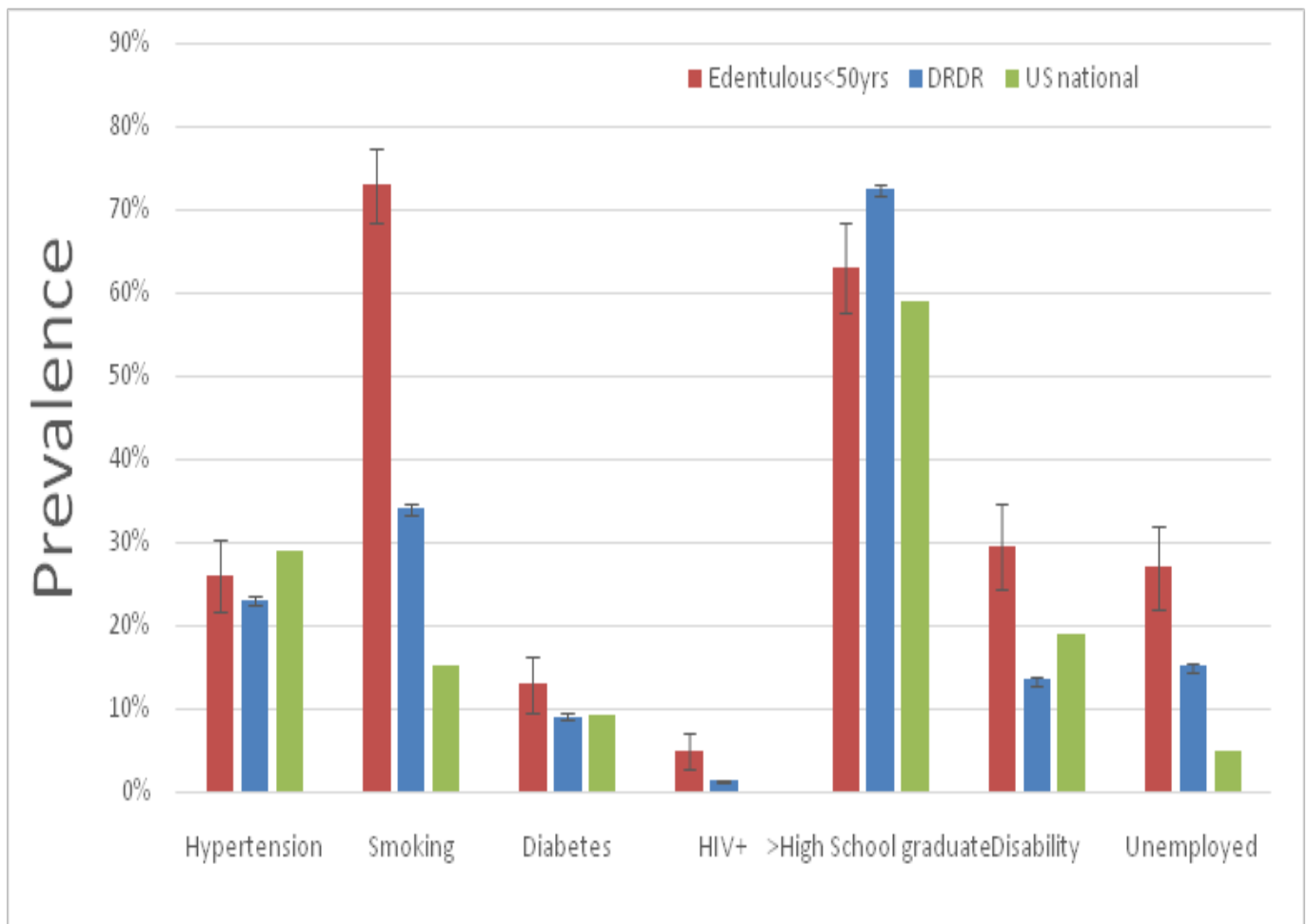


Figure 1: Prevalence of hypertension, smoking, diabetes, HIV+, >High School graduate, disability, and unemployment. Differences in prevalence are noted among the edentulous population younger than 50 years old, the DRDR, and US national values. Standard error bars shown. P-value  $< 0.05$  for smoking, HIV+, disability, and unemployment.

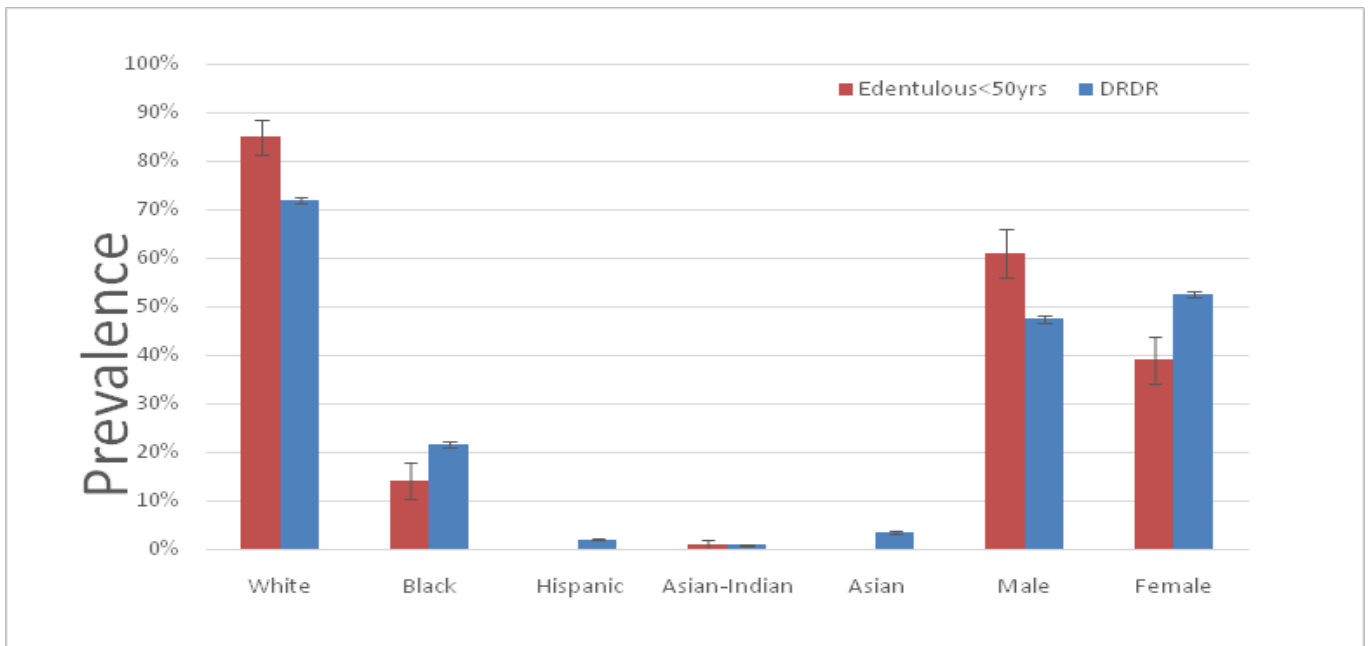


Figure 2: Prevalence differences based on ethnicity and sex. Prevalence values shown for the edentulous population younger than 50 years old and for DRDR records. Standard error bars shown.  $P < 0.05$  for Whites and males.

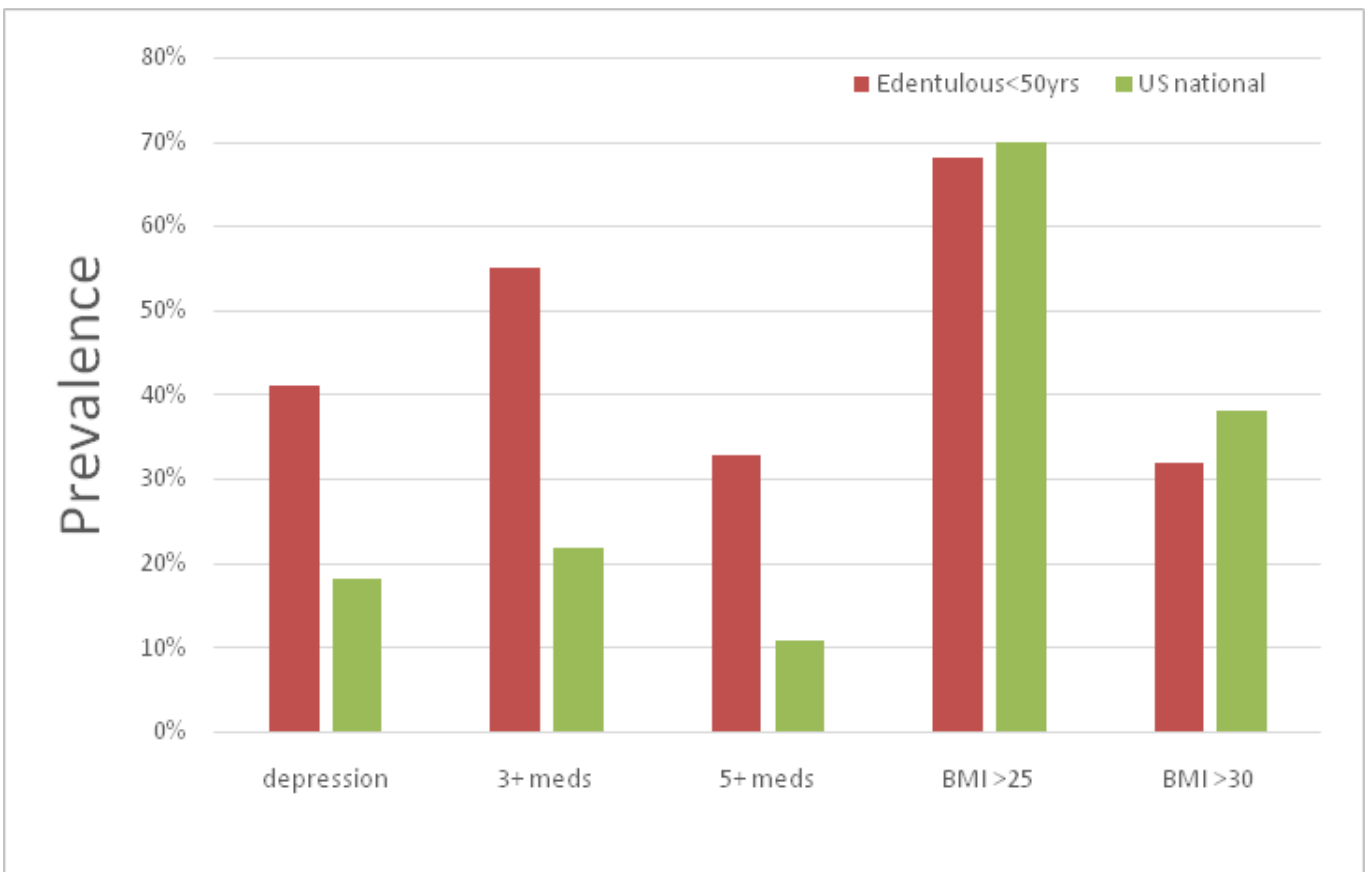


Figure 3: Prevalence of depression, patients taking 3+ and 5+ meds, and patients with BMI greater than 25 and greater than 30. Differences in prevalence shown between the edentulous population younger than 50 years of age and US national values.

## Discussion

Variables that were statistically significant included smoking, HIV+ status, disability and unemployment, being male, and White. Depression and BMI are also suggested as risk factors for early tooth loss. Statistical significance was determined based on prevalence differences amongst the edentulous population younger than 50 years of age and the total school records obtained from the DRDR.

Smoking was associated with early edentulism and can be attributed to changes in the oral flora, immune response, and increased predisposition for oral pathology, periodontal disease, and tooth decay [13]. The effect of smoking on tooth loss has been primarily associated with its link to periodontitis [13,14]. Cigarette and cigar smokers were more likely to have moderate to severe periodontitis and higher prevalence of attachment loss and gingival recession [14]. Additionally, current smokers had a greater number of missing teeth when compared to former smokers and non-smokers [14]. In an effort to prevent tooth loss and minimize the prevalence of edentulism, patient education and smoking cessation measures should be considered.

Unemployment and disability were more prevalent in completely edentulous individuals younger than 50 years of age compared to the total DRDR population. These variables may serve as risk factors since they are directly related to access of care and the ability to afford dental treatment. Individuals that cannot afford dental expenses may be more likely to neglect their oral health and avoid regular dental maintenance. In addition, the distance to dental care facilities has also been considered a significant risk factor for tooth loss [15].

Education level did not appear to be statistically significant associated with edentulism in this study, which has higher levels than the US average of education attainment (p-value=0.06). Thus, higher education itself may be insufficient to prevent early tooth loss. However, it has been suggested that higher education attainment, as well as higher cognitive function, may serve as a protective factor against early tooth loss [16].

Sex was found to be a significant risk factor for edentulism. Certain studies indicate that sex does not play a role in early edentulism while others suggest that being male may increase the risk for edentulism [12]. Males are more likely to engage in poor behavioral habits, such as smoking, as well as participate in more high-risk behaviors that may lead to early tooth loss [12]. Also, males may be more likely to demonstrate poor oral hygiene, be less concerned with esthetics, and be less likely to seek dental care [12].

Like sex, obesity has been debated in the literature as a risk factor for edentulism. Singh et al. did not observe an association between general obesity and tooth loss [17]. Nonetheless, a positive relationship between BMI and complete or partial tooth loss has been suggested [18]. Assessment of the relationship was also based on whether or not individuals were rehabilitated with an oral prosthesis. Individuals with high BMI may be more likely to suffer from dental decay and eventual tooth loss due to dietary behaviors and concomitant disease.

Likewise, edentulism has been considered as a risk factor for obesity, suggesting that the individuals may choose softer diets and more processed foods leading to higher BMI [19].

Depression and poor mental health have been considered as risk factors for early edentulism. Individuals are more likely to neglect their oral health as well as present with additional comorbidities that impact their overall health [20]. Patients with depression are more likely to suffer from cardiovascular disease, diabetes, chronic lung disease, and cancer [20]. Also, patients often take an increased number of medications that predispose them to xerostomia, increasing the likelihood for dental decay and eventual tooth loss [20].

Contrary to what was expected, diabetes was not statistically significant associated with early edentulism in this study. Like smoking, diabetes is a known risk factor for periodontal disease [18]. Approximately one-third of diabetics suffer from severe periodontitis [18]. Indeed, individuals with uncontrolled diabetes presented with greater numbers of missing teeth or were more likely to be edentulous compared to those without diabetes [21-23]. Specifically, individuals with impaired glycemic status had a higher mean number of missing teeth and to suffer from advanced periodontal disease than individuals with normal glucose tolerance [23]. Our data show a clear trend for being edentulous early and having diabetes. A larger population size would be necessary in a future study to confirm the association between uncontrolled diabetes and edentulism.

Our study suggests that being White may serve as a risk factor for early edentulism. This is likely a geographic effect and a reflection of the population that lives in the area and is treated in our school.

Limitations of the study include the small population size that may prevent generalization of the findings to the total population. Future studies should include a larger population size, as well as focus on the etiology of edentulism. It has been suggested that in individuals older than 65 years of age, the main etiologic factor of edentulism is periodontal disease. In young individuals, dental decay and chronic systemic conditions may play an increasingly important role in the etiology of early tooth loss. Furthermore, future studies should also investigate the genetic influences that may predispose an individual to early tooth loss. Once these risk factors are determined, proper preventative measures can be taken to minimize or delay early edentulism. Our data supports our overarching hypothesis that oral health is dramatically impacted by overall health status and good oral health is much more the result of good overall health than the other way around.

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