**Relation between teeth retention and longevity: A cross-sectional study**

Mohammed Jafer1, 2\*

1 School Of Dental Medicine, Case Western Reserve University, United States of America

2 College of Dentistry, Jazan University, Kingdom of Saudi Arabia

\* Corresponding author:

Mohammed Jafer

College of Dentistry

Jazan University- 45142

Email: dr.mjafer@gmail.com

**Running head:** Effects of Teeth Retention on Longevity

**Keywords:** Teeth retention, Tooth loss, Longevity, Mortality.

**Abstract:**

**Objective:** Systemic health and mortality has been shown to be affected by oral disease in the elderly. The purpose of this study was to examine the effects of teeth retention on longevity.

**Materials and Methods:** 300 randomly chosen patient charts from the Case Western Reserve University, School of Dental Medicine were used to obtain data on age, number of teeth present, gender, race, insurance, smoking, alcohol consumption, type of diabetes and cardiovascular disease. A descriptive test was run to assess the distribution of demographics, systemic health and the number of teeth present. Analytic tests included bivariate and multivariate regression analysis. Pearson’s Correlation test investigated any association between the dependent variable, age and independent variable, number of teeth. Linear Regression investigated any relationship between age and number of teeth adjusting for gender, race/ethnicity, dental insurance coverage, smoking, alcohol, diabetes, and cardiovascular disease.

**Results:** Study sample’s average age was 73.7  6.8 years, with 49.3% Whites and 42.3% African-Americans, and the average number of teeth present was 17.5  9.9. There was a weak negative correlation with the number of teeth and age (r = - 0.23, p < 0.01). The regression model predicted that; for every tooth retained, age was reduced by 0.23 years. The prevalence of cardiovascular disease was 69%, diabetes was 23.8%, Smoking was 7.1%, and Alcohol consumption was 28.3%.

**Conclusion:** Mortality and tooth retention, in the elderly, are both negatively correlated with age. Smoking, in the elderly, also has a negative correlation with age.

**Introduction**

A strong association has been identified between oral health and morbidity/mortality in the elderly, independent of established risk factors for mortality [1]. A positive association between the number of teeth and mortality has been reported in several studies [2-11]. As people age, many lose teeth, resulting in reduced masticatory capacity and food selection, nutritional status, and general health. Evidence is also increasing that oral infections play a role in the pathogenesis of certain systemic diseases, particularly in the elderly [12, 13]. A positive association between periodontitis and systematic diseases such as chronic kidney disease (CKD) and cardiovascular disease (CVD) has been reported [13, 14, 15, 16].

 Several longitudinal studies, with large sample sizes, have indicated that missing teeth has a signiﬁcant effect on longevity after adjusting for the general health variables [2-4]. Being male, edentulousness and age has been reported to increase the risk of mortality in elderly subjects [3]. This was assumed to be related to deterioration in the systemic health of the elderly and was confirmed by Österberg et al. in three different cohorts of elderly [4]. Two longitudinal studies, with large cohorts, by Appollonio and group indicated that in elderly Italian men, well-preserved dentition has been shown to increase longevity and also has significant correlation with mortality [17,18]. Both of these studies utilized a cross-sectional design as a baseline in their studies; it was reported in these studies that individuals with 16 or more teeth exhibited reduced risk for mortality compared with denture wearers or individuals less than 16 teeth. Literature supports the effects of age on oral health. The purpose of this study was to examine the relation between teeth retention and longevity in the elderly people.

**Materials and Methods**

*Ethical issues*

The Institutional Review Board (IRB) at Case Western Reserve University (CWRU) approved the protection of human subjects for this research. Personal signed ethical approval was obtained from each participant who was included in the study.

*Sample selection*

A total of 300 random patient charts from the CWRU, School of Dental Medicine for patients aged 65 and higher were obtained. The present study was a cross-sectional design and the abstracted charts were limited to patients seen during the year 2013. The most recent and updated data on age and teeth retention present were collected from the patient charts. Age was used as a proxy for longevity/outcome.

*Confounders*

The present study controlled for potential confounders; gender, race, insurance status, smoking, alcohol consumption, diabetes, and cardiovascular disease. All variables were dichotomous with present or absent being the two categories: gender, insurance status, tobacco consumption, alcohol consumption, diabetes and cardiovascular disease. Race was the only categorical variable: Caucasian, African-American, Hispanic, Asian, and Other.

*Statistical analysis*

The descriptive phase consisted of measuring the mean number of teeth, mean age and frequency of distribution of other categorical variables. The analytic phase included Pearson’s Correlation that investigated any relationship between teeth retention and longevity. A linear regression model investigated any relationship between teeth retention and longevity, which was adjusted for confounding variables: gender, race, insurance coverage, tobacco consumption, alcohol consumption, diabetes and cardiovascular disease. Alpha was set less than or equal to 0.05 for significance in the analytic tests.

**Results**

Age in the study sample was averaged as 73.7 + 6.8 years, and the average number of teeth present was 17.5 + 9.9. Whites were the highest proportion of ethnic group with 49.3%, followed by 42.3% African-Americans and 8.4% other. The majority of the study subjects had private health insurance (70.3%). The smokers and alcohol consumers accounted for 7.1% and 28.3%, respectively. Almost all of the diabetic patients were suffering from Type II diabetes; 23.8%. A large portion (69%) of the sample cohort had cardiovascular disease.

All study variables had significant correlation to age, except gender. Age had a negative correlation with the number of teeth (r = - 0.23, p < 0.01). The correlation between teeth retention and longevity was similar to Pearson’s Correlation. The number of teeth present was also seen to have correlation with all study variables except gender. (Table 2)

The linear regression model is expressed in Table 2 to demonstrate the relationship between age and the number of teeth present. The number of teeth made the greatest contribution to the model, (t = - 3.27, p < 0.01). Nearly 7% of the variation in age was explained by the predictor variables. Overall, the model significantly predicted the age; and it was seen that for every tooth retained, patient’s age could reduce by 0.23 years.

The ethnic variation of the diseases and their health behavior is recorded in the Table 3. Whites were 1.8 times more likely to have cardiovascular disease compared to others in the sample (OR = 1.79, 95% CI = 1.09 – 2.95).

**Discussion**

A positive association between the number of teeth and mortality has been previously reported [2-11]. However, the finding of the present study is different from previous one, which could be due differences in data collection methods. In the present study, the data on number of teeth was obtained from the patient charts. Whereas in the previous study, the numbers of teeth was self-reported by the study subjects, this might have had the potential for reporting bias and also, the cohort consisted only of highly educated Whites [1]. Furthermore, the previous studies utilized a longitudinal design and larger sample sizes than the present cross-sectional study [2-5, 7, 8, 10, 11].

There was a negative correlation between age and number of teeth, which implies that as a person ages, she/he is losing teeth. This could be due to the accumulation of risk factors such as low income, low education, unhealthy behaviors (smoking and physical activity), chronic conditions (diabetes and obesity) or disabilities, and no dental insurance coverage [19]. In the present study, we adjusted for some of these factors, chronic conditions (diabetes and cardiovascular disease), unhealthy behaviors (smoking and alcohol consumption), and insurance coverage. This study shows that smoking’s negative effects extend from tooth retention, as previously studied, to longevity of life as well.

In the United States, an estimated 83.6 million American adults have 1 or more types of cardiovascular diseases (CVD). Of these, 42.2 million or 50.4% are those of age 60 years or above [20]. In the present study, the percentage having CVD came to 69%, which is above the national average. One of the clearest examples of how poor oral health can aggravate morbidity is illustrated by patients with CVD which is often due to or combined with atherosclerosis and infectious complications [21, 22]. Recent studies have shown periodontitis is associated with coronary heart disease and cerebrovascular disease in the general population [13, 15, 21]. NHANES from 1999-2000 suggested that advanced age and diabetes mellitus, are risk factors for oral health [23].

The proportion of Whites and African-Americans is well-represented in the data. This is important because of the issue of healthcare utilization. The healthcare utilization rate for the elderly decreased from 73.1 percent in 1997 to 69.6 percent in 2010 [24]. It has been documented that there is a disparity with healthcare utilization between Whites and African-Americans. Relative to Whites, Blacks (OR = 0.65) were less likely to have a dental cleaning in the previous 12 months [25]. Since the data is similarly proportioned between these two races, it demonstrates that dental utilization is similar in this sample cohort.

The insurance status in the study sample is similar to that of general population. According the United States Census Bureau for 2010-2011, 1.6% of the uninsured population is 65 years or older [26]. However, the most common form of health insurance for elderly people in the United States is Medicare. In the State of Ohio, Medicare only covers emergency and urgent dental care [27]. Although, the entire present study cohort had some form of health insurance, they may not have had comprehensive dental insurance. This may explain why this sample cohort chose a treatment option for their dental care that is almost half the cost of private treatment options.

The present study may have been limited by the cross-sectional study design that does not consider the variations in teeth retention and/or variations in systemic health status as well as a lack of clinical calibration of dental students although they receive similar didactic education. Differences in dental instructor philosophies, regarding diagnosis and treatment plan may influence the dental students and subsequently impact the collected data. These shortcomings can be overcome by (a) longitudinal study (ies) investigating the relation between age and number of teeth retained. Another possibility would be to compare the number of teeth at one’s when someone is deceased. Furthermore, the study could utilize thoroughly calibrated dental students, or patient examinations and data collection could be done by the principal investigator(s).

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**Appendix:**

Table 1: Demographic, Health Behavior and Systemic Health Status of the Study Sample

|  |  |  |
| --- | --- | --- |
| **Demographics** | **N** | **Mean** ± **SD** |
| Age | 300 | 73.7 ± 6.8 |
| Number of Teeth | 296 | 17.5 ± 9.9 |
|  |  | **Percentage (%)** |
|  Gender | 300 |  |
| * Male
 |  |  41.3  |
| * Female
 |  | 58.7  |
|  Race | 300 |  |
| * White
 |  | 49.3 |
| * Black
 |  | 42.3  |
| * Other
 |  | 8.4 |
|  Insurance | 300 |  |
| * Public
 |  | 29.7 |
| * Private
 |  | 70.3  |
| **Health Behavior** |  |  |
| Smoking  | 295 |  |
| * Yes
 |  | 7.1  |
| * No
 |  | 92.9 |
|  Alcohol  | 293 |  |
| * Yes
 |  | 28.3  |
| * No
 |  | 71.7  |
| **Systemic Health**  |  |  |
|  Diabetes  | 294  |  |
| * No
 |  | 75.5  |
| * Type I
 |  | 0.7  |
| * Type II
 |  | 23.8  |
|  Cardiovascular Disease | 297  |  |
| * Yes
 |  | 69  |
| * No
 |  | 31 |

Table 2: Linear regression model for Age and Demographic, Health Behavior and Systemic Health Status attributes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **R2** | **P-value** | **95% CI**  |
| Number of teeth |  - 0.14 | 0.001 | - 0.22 |  - 0.6 |
| Gender |  0.27 | 0.744 | - 1.35 | 1.88 |
| Race |  0.3 | 0.443 | - 0.48 | 1.09 |
| Insurances |  - 0.24 | 0.795 | - 2.02 |  1.6 |
| Smoking  |  - 4.09 | 0.007 | - 7.05 |  - 1.13 |
| Alcohol  |  - 0.9 | 0.315 | - 2.67 | 0.86 |
| Diabetes  |  - 0.48 | 0.313  |  - 1.4 | 0.45 |
| Cardiovascular Disease | 1.47 | 0.097 | - 0.27 | 3.22 |
| Constant (Number of teeth) |  75.48 | 0.000 |  71.29 | 79.7 |

Model was adjusted for gender, race, poverty line, dental insurance coverage, smoking, alcohol, diabetes and cardiovascular disease.

Table 3: Association between Ethnicity and Systemic Health/Health behavior Attributers

|  |  |  |  |
| --- | --- | --- | --- |
| **Systemic Health / Health Behavior**  | **Prevalence** | **OR** | **95% CI**  |
|  | **Yes** | **No** |  |  |
| Smoking W | 140 | 7 | 2.09 | 0.82 |  5.34 |
|  B | 134 | 14 |  |  |  |
| Alcohol W | 93 | 55 | 0.40 | 0.24 | 0.69 |
|  B | 117 | 28 |  |  |  |
| Diabetes W | 114 | 29 | 1.49 | 0.87 | 2.57 |
|  B | 108 | 41 |  |  |  |
| Cardiovascular Disease W | 55 | 93 | 1.79 | 1.09 | 2.95 |
|  B  | 37 | 112 |  |  |  |

 \* Whites (W), Black (B)