

Tooth Mortality in Two US Populations Living a Century Apart

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Abstract

Purpose: To determine the frequency of tooth loss of individuals who lived during the nineteenth century and compare it to the current prevalence of tooth loss of an adult population in the US.

Materials and Methods: A group of 177 full maxillary and mandibular casts from patients with restorative needs currently assisted at the University of Pittsburgh and a collection of 52 adult skulls that belongs to the University of Pittsburgh, School of Dental Medicine were examined. The human skulls were likely from individuals of lower socioeconomic status and were expected to have more tooth loss than individuals living today who can benefit from modern dentistry. Teeth that were either missing or required extraction were identified in both groups and non-parametric statistical analysis was performed.

Results: Of the 177 casts studied, 36 had complete dentition, 20 were fully edentulous, and 121 were partially dentate. In the skulls population, 17 of the 52 skulls still retained their full dentition ($p = 0.06$). No skulls were found to be fully edentulous ($p = 0.004$). Specific tooth loss was mostly consistent between the two study groups. Overall, all first molars tended to be the most commonly missing teeth in both population groups. The casts from the current adult population had canines, lower central incisors, upper and lower left lateral incisor, lower left second premolar, lower right first molar, and

lower left second molar more frequently missing ($p < 0.05$).

Conclusions: This study found that a sampling of today's adult population from Pittsburgh has equal or greater tooth loss compared to a population that lived more than a century ago in the northeast of the United States.

Keywords: Dental Caries; Epidemiology; Dental Forensics

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Introduction

The two most common, yet preventable, oral diseases, dental caries and periodontal disease, continue to persist and affect millions of people [1]. Dental caries is, by far, the most common chronic disease affecting children and adolescents in the United States [2]. In most developing countries, the levels of dental caries were low until recent years but prevalence rates of dental caries and dental caries experience are now tending to increase. This is largely due to the increasing consumption of sugars and inadequate exposure to fluorides. In contrast, a decline in caries has been observed in most industrialized

countries over the past 20 years or so. This pattern was the result of a number of public health measures, including effective use of fluorides, together with changing living conditions, lifestyles and improved self-care practices [3].

Worldwide, the prevalence of dental caries among adults is high as the disease affects nearly 100% of the population in the majority of countries [4]. In several industrialized countries, older people have often had their teeth extracted early in life because of pain or discomfort, leading to reduced quality of life. The proportion of edentulous adults aged 65 years or more is still high in some countries, although in many industrialized countries there has been a positive trend of reduction in tooth loss among older adults in recent years [5, 6]. Although the prevalence of edentulism has continued to decline over the last two decades, it still is relatively common in the older population [7].

Tooth loss is a serious public oral health concern among older people. Age, sex, race, socioeconomic factors, tobacco use, attitude toward dental care, inadequate oral hygiene, caries experience, periodontal health and use of prostheses have been associated with tooth loss. Systemic health, cognitive function and physical disability also are associated with tooth loss in older people with special needs [7].

In the first national oral health survey, conducted in 1988, missing teeth accounted for 65.4% of Decayed/Missing/Filled Teeth (DMFT) in adults aged 35-44 years, and 93% of DMFT in elderly individuals (aged 65-74 years) [8]. Older adults are at increased risk for root caries because of both increased gingival recession that exposes root surfaces and increased use of medications that produce xerostomia. Approximately, 50% of persons aged 75 years and older have root caries affecting at least one tooth, and approximately, 25% of older adults have loss of tooth-supporting structures because of advanced periodontal disease [9]. The results of the Third National Health and Nutrition Examination Survey (NHANES III) showed in the United States aged 65 to 74 years have lost their teeth². The oral health status of Americans as measured by *Healthy People* 2010 (HP 2010) objectives mostly showed improvement or remained unchanged

between 1998-1994 and 1999-2004 [10]. Among adults aged 35-44 years, periodontal disease significantly declined in the U.S. from 22% to 16% and more adults retained all of their natural teeth (30% to 38%) [11].

Tooth loss in adult life may also be attributable to poor periodontal health. Severe periodontitis, which may result in tooth loss, is found in 5–20% of most adult populations worldwide. The data available from the WHO Global Oral Health Data Bank indicate that symptoms of periodontal disease are highly prevalent among adults in all regions [12]. Furthermore, most children and adolescents worldwide have signs of gingivitis. Aggressive periodontitis, a severe periodontal condition affecting individuals during puberty and which may lead to premature tooth loss, affects about 2% of youth [13].

Although the prevalence of caries and periodontal disease is still high, it is expected that the oral health of the American population improved during the last century. The University of Pittsburgh, School of Dental Medicine possesses a collection of skulls that was organized in the first half of the 20th century. Those individuals are likely to have lived in the northeast United States during the late 19th century and the early 20th century. The aim of this study was to determine the frequency of tooth loss of individuals who lived during the nineteenth century and compare it to the frequency of tooth loss of an adult population in the US.

Materials and Methods

A group of 177 full maxillary and mandibular casts from patients with restorative needs (77 females, 100 males, Figure 1) currently assisted at the University of Pittsburgh and a collection of 52 adult skulls that belongs to the University of Pittsburgh, School of Dental Medicine (17 from females, 35 from males, Figure 2) were examined. The distribution of females and males between the two groups is not statistically significant different ($\chi^2 = 1.9$, p-value = 0.16). Patients that provided casts had no records of extractions due to orthodontic reasons or trauma. This study was approved by the University of Pittsburgh's Institutional Review Board.



Figure 1: Maxillary and mandibular casts from patients with prosthodontic needs



Figure 2: Adult skulls that belongs to the University of Pittsburgh School of Dental Medicine.

The human skulls were likely from individuals of lower socioeconomic status and were expected to have more tooth loss than individuals living today who can benefit from modern dentistry. Teeth that were either missing or only had radicular remains were identified in both groups and non-parametric statistical analysis was performed. It was possible to determine sex of these samples and individuals were likely to be older than 40 years of age. Age and sex could be estimated using anthropological parameters.

There are 100 skulls in the University of Pittsburgh, School of Dental Medicine's collection. The work has been approved by the University of Pittsburgh's ethical committee. The official set of archives of the skulls has been misplaced, so our first task was to compile a new set of records. All the information left were notes written actually in the skulls. Some had annotated sex and age. Most of them had an indication that they were acquired from a seller in New York City around the 1930s. That is an indication that these individuals lived in the east coast of the United States and were not from the higher classes otherwise they would have received proper burials.

First, the probable sex, age, and ethnicity were determined using various markers of the skulls. To determine the age, the eruption time of teeth were used only in estimating the age of the children. However of 100 skulls, only six were children. Ectocranial suture status, open vs. closed, was used as an age estimator because most of the skulls were adults. Closed sutures are indicative of an individual greater than 40, whereas open sutures represent an individual less than 40 [14].

To distinguish the sex of the skeleton, general differences between the male and female skull were used. The male skull is generally larger, heavier, and less rounded (at the forehead). Also, muscular ridges, such as temporal lines, the frontal sinuses, the palate, the supra-orbital ridges and the teeth are often larger and more prominent in males. The mastoid process is more developed and the upper margin of the orbit is more rounded. The mandible is more robust and the ramus of the

mandible is broader and longer in males with a better-developed coronoid process. The female skull tends to retain more of an adolescent form [15].

For determining the race, various nasal features are commonly used by forensic anthropologists in order to determine ancestry. Caucasians usually have a narrow and tall nasal opening, high nasal bone, a more prominent chin, and greater brow-ridging. Asians commonly possess a medium and short nasal opening, low nasal bone, and more protruding jaw. Africans tend to have a wide and short nasal opening, medium nasal bone, and an oblong orbital shape [16].

The skulls were assessed for several other dental characteristics or anomalies including: dental caries, periodontal loss, abscesses, ante-mortem tooth loss, dental calculus, enamel defects, malocclusion, abrasion, supernumerary teeth, and tooth agenesis. Tooth loss of the casts was recorded by tooth. The frequency of tooth loss among the skulls by tooth was compared to the frequency of tooth loss by tooth in the casts. Chi-square and Fisher's exact tests were used to determine statistical significant different distributions between the two groups ($\alpha = 0.05$).

Results

Of the 177 casts, 36 had complete dentition, while 20 were fully edentulous. Thus leaving 121 casts that were partially dentate. Of the 52 skulls that were used, 17 still retained their full dentition. No skulls were found to be fully edentulous.

Figures 3 and 4 show that certain teeth (6, 10, 11, 18, 20, 22, 23, 24, 25, 27, and 30) were more commonly missing in the casts in comparison to the skulls. Tooth 25, a mandibular incisor, had the most significant variability between the two populations. 33 dentitions in the group of casts had tooth 25 missing, while only one dentition was missing 25 in the group of skulls. Mandibular anterior teeth (22-25, 27) were more likely to be present among the group of skulls than among the group of casts. Interestingly, both maxillary canines (6, 11) and first molars (3, 15) also showed significant differences between the two populations. However, overall, all first molars in both

populations tended to be the teeth with higher mortality. Lower incisors missing are likely to be consequence of periodontal disease. More upper canines missing in the group of casts is probably due to the inability in our study to confirm these teeth were impacted.

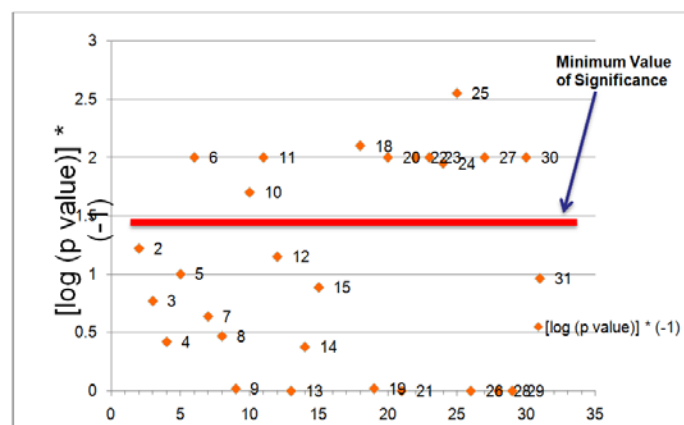


Figure 3: Chart shows that certain teeth (6, 10, 11, 18, 20, 22, 23, 24, 25, 27, and 30) were more commonly missing in the casts in comparison to the skulls. Tooth numbering based on the Universal Numbering System, which is the one adopted by the American Dental Association (ADA).

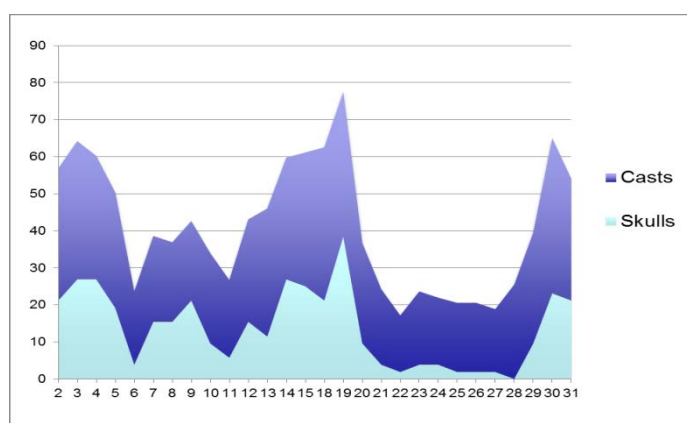


Figure 4: Chart represents frequency of tooth mortality [y axis depicts the frequency by tooth (x axis)]. The blue arrows indicate first molars. Tooth numbering based on the Universal Numbering System, which is the one adopted by the American Dental Association (ADA).

Discussion

This study found that a sampling of today's population from the Pittsburgh has an equal or greater tooth loss compared to a population living 100 years ago, likely in the New England area. The population of skulls is assumed to be from a low socioeconomic status, which would usually indicate a higher degree of caries and thus tooth mortality. It may be assumed that the group of casts would come from people that have lower tooth mortality due to modern advances in dentistry, despite the likelihood that this population is also from a low socioeconomic status. However, the group of skulls had a lower tooth mortality rate than the group of casts.

The skulls we studied were from an American population living in the 19th century, living before the discovery of penicillin (1928) and prior to the era of advanced dental care. During this time, dental procedures were limited to extractions, primarily due to an infected or damaged tooth. Periodontal disease was prevalent because oral hygiene practices were not commonly performed. Dental procedures were mostly carried out by barbers and general physicians, in which they only performed extractions in order to alleviate the pain and remove the infected tooth [17]. The first publications on the positive influence of prophylaxis on oral health are from the 1800s [18] and this knowledge slowly permeated dental education and had the impact that can be measured in national surveys [1].

All these historical facts indicate that likely differences in demographics between a group of individuals that lived in the United States 150 years ago and the current American population are likely to have little influence compared to the fact that no formal preventive dentistry would be available to dramatically interfere with the oral disease status of that time. These individuals are more likely to have lived in the east coast of the United States 150 years ago and belong to a low social stratum, based on the fact that their specimens were for sale rather than have received proper burial.

The oral health status of Americans as measured by HP2010 objectives mostly showed improvement or remained unchanged between 1998–1994 and 1999–2004 [11]. In this study it is found that a sampling of today's population from the

Pittsburgh has an equal or greater tooth loss compared to a population living 100 years ago.

Poverty is a significant social determinant for oral health. However, some changes in oral health status for some traditionally low-risk groups, such as non-poor children, may be reversing improvements in oral health that have consistently been observed in previous decades. These results suggest that poverty status is an important factor for planning and monitoring future national oral health goals [11]. In this study, the skulls are assumed to be from people with a low socioeconomic status and the casts are also from a low socioeconomic status. A sampling of today's population from Pittsburgh has an equal or greater tooth loss compared to a population living 100 years ago.

Several reports indicate that the oral health status of Americans has improved dramatically in the past several decades [19, 20]. However, oral diseases still can be considered as a “silent epidemic” because they affect the most vulnerable and lowest socioeconomic subgroups within our society, and remain unnoticed by the majority of Americans [21]. Caries and periodontal disease are treatable and preventable, but they continue to exist at a high prevalence within the US.

The results from this study suggest that despite the advances of organized dentistry, a portion of the adult population treated at the University of Pittsburgh School Of Dental Medicine still presents higher levels of oral disease, comparable to times before dentistry became an organized profession.

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