

Dental Loss in the Lower Socioeconomic Stratum of a Sample of the Chilean Population Born in the 19TH and 20TH Centuries

Pérdida Dental en el Estrato Socioeconómico Bajo de una Muestra de la Población Chilena Nacida en los Siglos XIX y XX

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QUEVEDO-DÍAZ, M. F.; BUCCHI, A. & FONSECA, G. M. Dental loss in the lower socioeconomic stratum of a sample of the Chilean population born in the 19th and 20th centuries. *Int. J. Morphol.*, 42(2):458-461, 2024.

SUMMARY: Partial or total dental loss (edentulism) is associated with decreased quality of life. Chile has large socioeconomic gaps, which are also recognized in oral health, but it is not known how Edentulism has evolved throughout the country. The aim of this study was to determine the edentulism in people born during the 19th and 20th centuries in Chile, who died in the 20th century, and to compare it with current data from the Chilean Ministry of Health (MINSAL) to observe its evolution in the country. For this purpose, 60 3D models of skulls from the Subactual Osteological Collection of Santiago were analyzed (30 individuals per sex), in which the presence and absence of teeth in antemortem in the maxilla were analyzed. A high percentage of tooth loss was observed, with 65 % partial edentulism, a 30 % total edentulism, and only 5 % had complete dentition in this osteological collection. In addition, a significant decrease over time was found; in 2017, the percentage of complete dentition at the national level was 32.8 %. A higher frequency of edentulism was also found in females from the osteological collection, with a significant probability of twice as much edentulism as in males. However, this sex difference was smaller than those found in the current study. Our study is the first to compare edentulism in Chile in two different time periods, since, in addition to studying it in the 19th and 20th century, it is carried out with data from the present day and in line with previous research, reveals the importance of socioeconomic and sex variables for dental loss.

KEY WORDS: Edentulism; Tooth loss; Subactual collection; Chile; Prevalence; Social class.

INTRODUCTION

Edentulism is defined as the loss of teeth, which can be partial when teeth remain in the mouth or total when there are no teeth in any of the arches (Friel & Waia, 2020). Tooth loss is negatively associated with people's quality of life as it affects the biological (chewing and phonetics), psychological, and social aspects of the individual (Hugo *et al.*, 2009).

The aim of this article was to visualize edentulism in 19th and 20th century Chile, and to compare it with the current indicators in order to see how tooth loss has evolved in this country. For this purpose, we analyzed dental loss in the subactual collection in Santiago, which is the most complete anthropological collection in Chile of the Chilean population that was born between the 19th and 20th centuries and died in the 20th century (Meza-Escobar *et al.*, 2023).

This offers a historical context with enriching data for the study of the dentition of the Chilean population and its evolution over time in this socioeconomic stratum by comparing the data with the current reports of the Ministry of Health (Ministerio de Salud, 2003, 2019). This is especially relevant because Chile has large socioeconomic gaps, which are reflected in its oral health (Delgado *et al.*, 2013). Although studies have been conducted in representative samples of different Chilean native peoples, for example, those reported by Urzúa Araya *et al.* (2012), who studied the pre-Hispanic Atacameño population, and that of Arteaga *et al.* (2009), who studied edentulism in the same population as us, but only in people born in the nineteenth century, our study is the first to compare partial and total edentulism in two different time periods, the 20th and the present.

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FUNDING. This study was partially funded by the FONDECYT Postdoctoral ANID 3210026, and by the Dirección de Investigación, Universidad de La Frontera PP23-0042.

MATERIAL AND METHOD

Sixty 3D models of skulls from the Colección Osteológica Subactual de Santiago were analyzed, which is a documented skeletal collection from Santiago, Chile, consisted of 1,635 individuals living in low socioeconomic areas of the capital in the late 19th and early 20th centuries. It is currently housed in the Department of Anthropology at the University of Chile (Meza-Escobar *et al.*, 2023).

In a previous study, we digitized parts of these skulls using photogrammetry (Bucchi *et al.*, 2022). For this study, we selected 60 adults of known sex in a good state of preservation. Thirty individuals were female and 30 were male, and antemortem dentition in the maxilla was analyzed. It is important to note that, as this is an osteological collection, not all individuals were complete. Therefore, we decided to study only the maxilla and excluded the mandible from the analysis.

The presence or absence of teeth in the sample from the Subactual collection in Santiago was evaluated using these models. The percentages of total edentulous (total absence of teeth) and partially edentulous teeth in the sample were calculated. The results were compared between males and females and recorded in an Excel spreadsheet. These results were then compared with Chilean Ministry of Health (MINSAL) records collected in 2003 and 2019.

It should be noted that due to the nature of the collection, some teeth were lost post-mortem. In these cases, it was estimated that the tooth was present, despite not being attached to the socket. In cases where the alveolus was resorbed into the alveolar bone, it was considered an ante-mortem loss; this parameter has been used in other forensic anthropology studies (Meller *et al.*, 2009; Garizoain *et al.*, 2016).

RESULTS

The results indicated that only 3 individuals had complete maxillary dentition (Fig. 1). The total number of antemortem edentulous individuals was 18, of which 12 were females and 6 males (Fig. 2a). A significant relationship was found between edentulism and sex ($\chi^2=5.5$, $p=0.02$), with females being more likely to have total tooth loss than males. Females were twice as likely to have total tooth loss (40 %) as males (20 %) (Fig. 2b). In addition, the average age of females was 49 years and males 45.56 years. Figure 3 shows the maxillary remnant teeth for the total sample from the Subactual collection in Santiago.

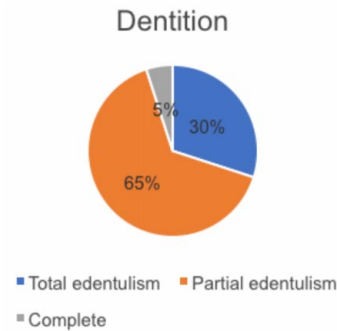


Fig. 1. Complete dentition, partial and total edentulism of the maxilla in the sample from the Subactual collection in Santiago.

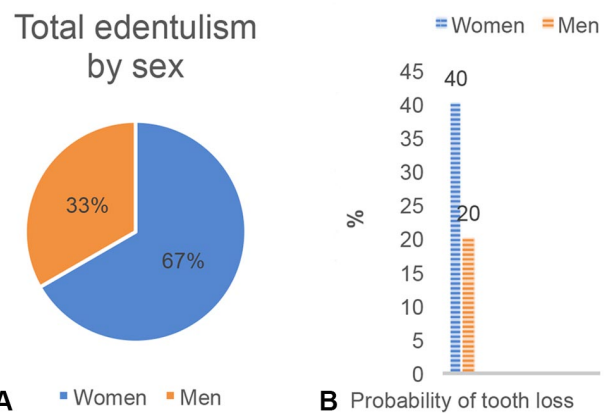


Fig. 2. Comparison of edentulism by sex of the Subactual collection sample from Santiago. a) Total maxillary edentulism in males and females; b) Probability of maxillary dental loss according to sex.

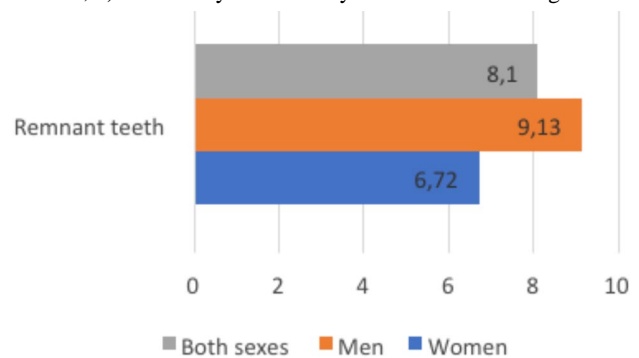


Fig. 3. Remnant teeth in the maxilla of a 20th century specimen.

DISCUSSION

In this study, we evaluated the oral health of Chileans who died in the mid-20th century, in terms of antemortem tooth loss. For this purpose, we analyzed the Subactual collection from Santiago, a collection of numerous individuals of known sex. It is important to note that our data are consistent with those of previous studies (Arteaga *et al.*, 2009; Cortés *et al.*, 2014). However, to our knowledge, there are no other reports that provide the

possibility of visualizing and comparing the historical context of oral health in the 20th century in Chile in terms of tooth loss with the present.

The fact that in the osteological sample, the results were obtained only in the maxilla is a limitation of our study because it makes comparison difficult with other reports that normally study both arches, as current indicators of tooth loss, such as Kennedy classes, indicate differences according to the arch, where there is a greater tendency for tooth loss in the maxilla when it is Kennedy class III and IV, and in the mandible Kennedy class I and II (Bharathi *et al.*, 2014; de Souza *et al.*, 2015). Even so, it allows us to understand the evolution of tooth loss by connecting it with current data, evaluating changes over time, and depending on the sex of individuals.

The results indicated that there was a significant decrease in dental loss from the 19th and 20th centuries to the present, as in the Subactual sample, only 5 % of the people had complete maxillary dentition (Fig. 1). By 2003, the percentage was 28 % for both arches (Ministerio de Salud, 2003) and by 2017, 32.8 % of the Chilean population had completed dentition (Ministerio de Salud, 2019). The median number of remaining teeth in both arches in the country was 23 in 2017 and 20 in 2003. In women, it increased from 18 remaining teeth to 23 teeth in the same years, and in men, from 22 remaining teeth to 24 (Ministerio de Salud, 2003, 2019).

Given the large amount of tooth loss in the 19th and 20th centuries, it is important to examine the risk factors for dental loss in both Chile and the world. Our results indicate that socioeconomic factors could be relevant to tooth loss, considering that the sample comes from low socioeconomic strata. This is consistent with other studies performed in different populations (Adams *et al.*, 2003; Olofsson *et al.*, 2018; Jiang *et al.*, 2023), which showed that low income is associated with both total and partial edentulism. For this reason, we found it unusual that none of the data obtained from MINSAL from 2003 to 2019 mentioned socioeconomic factors as risk or conditioning factors for oral health. We believe that this may be an important bias that does not provide the possibility of knowing with certainty how it is associated with edentulism in a country. Therefore, we consider it important that future national studies consider socioeconomic status as a risk factor for edentulism.

One of the risk factors for edentulism is the sex of the person, and a study by Bharathi *et al.* (2014) showed that males have greater tooth loss as a consequence of fewer dental check-ups. However, this is in contrast to what was found in our sample, where it was found that women were twice as likely to present edentulism (Fig. 2A). This coincides with the current

data in the country, as the comparison of complete dentition according to sex for 2003 was higher in men (29 %) than in women (26 %) (Ministerio de Salud, 2003), and in 2017, the comparison was 36.0 % in men and 29.7 % in women (Ministerio de Salud, 2019). The same pattern is evident in Brazil, according to the study of de Souza *et al.* (2015), who found a higher percentage of toothless women compared to male individuals, which was influenced by the greater number of population and dental visits of women, which could affect the information collected. Globally, this situation does not differ (Adams *et al.*, 2003; Medina-Solís *et al.*, 2006; Li *et al.*, 2022). According to Musacchio *et al.* (2007) factors related to being a woman that may influence dental loss: Living alone, aging, and female events, such as menopause and pregnancy. The latter, as is well known, can cause gestational diabetes, which is closely related to periodontal disease, and if aggravated, can lead to dental loss. Additionally, the fact that women have a longer life expectancy (Instituto Nacional de Estadísticas, 2010) may have an impact on greater edentulism by sex. Therefore, it is an important risk factor that should be analyzed in future studies.

It would be important to establish future studies with data on socioeconomic levels provided by ministerial entities, as they could contribute to a historical recognition of the advances in oral health and to understanding the limitations of socioeconomic strata in this area. This would allow projections to be made for the coming decades, as in the studies published by Schwendicke *et al.* (2020) and Jordan *et al.* (2021), where a long study on projections for 2030 in Germany was conducted. Finally, it would help generate public policies that further reduce the gap in oral health quality in socially marginalized sectors.

CONCLUSION

Here, we have presented a description of dental loss in Chileans who died in the 20th century and have made a historical comparison with the current data. These results indicate that dental loss is a widespread problem in osteological samples and that the probability of dental loss decreases over time. However, we also found that sex differences have increased over these centuries, with females being more prone to edentulism.

Our data further suggest that socioeconomic status may be a risk factor for dental loss and indicate that it is a relevant variable to measure to analyze the historical relationship between dental loss and socioeconomic status.

ACKNOWLEDGEMENTS. We would like to thank the Universidad de Chile and curator Nicole Barreaux for allowing access to the Subactual Collection in Santiago.

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RESUMEN: La pérdida parcial o total de dientes (edentulismo) se asocia a una disminución de la calidad de vida. Chile tiene grandes brechas socioeconómicas, que también se reconocen en la salud oral, pero se desconoce cómo ha evolucionado el edentulismo en el país. El objetivo de este estudio fue determinar el edentulismo en personas nacidas durante los siglos XIX y XX en Chile y fallecidas en el siglo XX, y compararlo con datos actuales del Ministerio de Salud de Chile (MINSAL) para observar su evolución en el país. Para ello, se analizaron 60 modelos 3D de cráneos de la Colección Osteológica Subactual de Santiago (30 individuos por sexo), en los que se analizó la presencia y ausencia de dientes en dentición antemortem en el maxilar. Se observó un alto porcentaje de pérdida dentaria, con un 65 % de edentulismo parcial y un 30 % de edentulismo total, y sólo un 5 % presentaba dentición completa en esta colección osteológica. Además, se encontró una disminución significativa a lo largo del tiempo; en 2017, la dentición completa a nivel país fue del 32,8 %. También se encontró una mayor frecuencia de edentulismo en las mujeres de la colección osteológica, con una probabilidad significativa del doble de edentulismo que en los hombres. Sin embargo, esta diferencia de sexo fue menor que la hallada en datos actuales. Este estudio es el primero que compara el edentulismo en Chile en dos épocas diferentes, ya que además de estudiarlo en los siglos XIX y XX, se realizó con datos de la actualidad y, en línea con investigaciones previas, revela la importancia de las variables socioeconómicas y de sexo en la pérdida dental.

PALABRAS CLAVE: Edentulismo; Pérdida dental; Colección subactual; Chile; Prevalencia; Clase social.

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