

Is tooth loss associated with oral health-related quality of life among young men? Findings from southern Brazil

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Objective: To determine the association between tooth loss and oral health-related quality of life (OHRQoL) among young men from southern Brazil. **Methods:** Cross-sectional study of 518 young men aged 18-19 years enlisted for mandatory military service in the Brazilian Army in two cities of southern Brazil in 2019-2021. Participants were clinically examined regarding gingivitis, dental caries experience (caries lesions, missing and filled surfaces), and malocclusion. A questionnaire collected socioeconomic information and the Oral Health Impact Profile 14 (OHIP-14). The outcome was OHRQoL, modeled as a discrete variable. The main explanatory variable was tooth loss due to caries (0 or ≥ 1). Negative binomial regression analysis was used; rate ratios (RR) and 95% confidence intervals (CI) were estimated. **Results:** Tooth loss prevalence was 22.2%. Associations were detected between tooth loss and OHRQoL in the physical pain and handicap domains. Individuals with at least one missing tooth had 17% higher OHIP-14 scores in the physical pain domain (adjusted RR=1.17; 95%CI=1.01, 1.35) and 49% higher in the handicap domain (adjusted RR=1.49; 95%CI=1.03, 2.15) than those with no tooth loss. **Conclusions:** Tooth loss was negatively associated with OHRQoL among 18-19-year-old Brazilian Army conscripts, and this association was related to physical pain and handicap domains.

Keywords: Adolescent, Tooth loss, Quality of life, Cross-sectional study

Introduction

Tooth loss is an important public health problem that not only affects functional issues related to chewing ability, but may also influence psychological aspects, such as social interaction and self-esteem (Moreira *et al.*, 2010). Different clinical conditions, such as periodontal disease, severe dental caries, traumatic injuries, and malocclusion may lead to tooth loss, with caries being the most common reason during childhood and adolescence. In the last Brazilian national oral health survey, the prevalence of tooth loss in adolescents aged 15-19 years was 17.4%, ranging from 8.1% among the high-income to 24.3% in the low-income population (Peres *et al.*, 2013). The poorest and least educated individuals had 184% and 124% more chance of losing teeth, respectively.

A systematic review with meta-analysis summarized the literature on the association between tooth loss and oral health-related quality of life (OHRQoL) (Gerritsen *et al.*, 2010). After including 35 studies in the qualitative synthesis and 10 in the meta-analysis, tooth loss was associated with impairment in OHRQoL, with the severity of impairment related to the number, location, and distribution of missing teeth. Despite these findings, most studies included in that systematic review included middle-aged and older adults, in whom tooth loss is usually extensive. The assessment of occluding pairs, functional dentition (≥ 20 natural teeth), and use of dental prosthesis make this aspect evident. A more

recent systematic review focusing on the functional dimension of OHRQoL also addressed a similar age group (Schierz *et al.*, 2021). When it comes to adolescence or early adulthood, tooth loss is commonly restricted to a few teeth, mainly first molars. Considering the fewer lost teeth and that these early losses may have occurred during childhood, a question remains: Do adolescents or young adults experience tooth loss negatively? To the best of our knowledge, there is only one study in the literature addressing this topic. A negative impact from a lost tooth in adolescents aged 15-19 years was shown by Peres *et al.* (2013) using secondary data from a national oral health survey, but no primary study has investigated this issue among adolescents or young adults so far.

Thus, the objective of this study was to determine the association between tooth loss and OHRQoL among young men from southern Brazil. We hypothesized that tooth loss is negatively associated with OHRQoL among male young adults.

Methods

We conducted a cross-sectional observational study at two Brazilian Army military bases in southern Brazil. All conscripts attending mandatory military service in the city of Itaqui, during 2019 and 2020 and in the city of Santiago, during 2021 were invited to participate. Mandatory military service in Brazil targets males in the year their 19th birthday falls between January 1st and December 31st.

The protocol was approved by the Research Ethics Committee of the Federal University of Santa Maria (CAAE 20079519.1.0000.5346). All participants were informed about the research purposes and provided a written informed consent. Participants with treatment needs received dental treatment.

Participants were clinically examined in a dental unit, with a dental mirror, a millimeter probe, and a WHO (ball-ended) probe. First, the gingival bleeding index was assessed in each tooth surface as absent or present (Ainamo and Bay, 1975). After professional tooth cleaning with toothbrush and tooth drying, dental caries examination was performed (Maltz *et al.*, 2003). Missing and filled surfaces were recorded to compose the DMFT (decayed, missing, or filled teeth) index. The M component included missing teeth as well as teeth indicated for extraction due to caries (WHO, 1997). Malocclusion was assessed by the Dental Aesthetic Index (DAI).

Participants completed a self-administered questionnaire to collect socio-demographic data and to assess their OHRQoL. We used the Oral Health Impact Profile in its short form (OHIP-14), which is divided into seven domains of functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap (Slade, 1977). It is a valid, reliable, and widely used instrument to assess the impact of oral conditions on OHRQoL and had been translated and adapted to Brazilian Portuguese (Oliveira and Nadanovsky, 2005). Each item is scored on a five-point scale (0, never; 1, almost never; 2, occasionally; 3, reasonably frequent; 4, very often). The OHIP-14 total score was calculated as the sum of the item scores, with higher scores denoting worse OHRQoL.

Clinical examinations were performed by a single examiner (NCL), who was trained and calibrated for the dental caries index and for the DAI. After theoretical training sessions based on photographs, study models, and clinical exams of patients under the supervision of a reference examiner (PKM), another 15 individuals were evaluated twice, after 7 days, to verify the examiner's calibration. The intra-examiner unweighted Cohen's kappa value for dental caries was 0.96. The intraclass correlation coefficient for the DAI was 0.94. Regarding the gingival bleeding index, the examiner was trained by a periodontist with experience in the use of this index, but no calibration was performed due to the temporary nature of this condition.

The primary outcome was OHRQoL, modeled as a discrete variable (each participant contributed their total OHIP-14 score). The main predictor variable was the presence of tooth loss due to caries (0 or ≥ 1 missing teeth or residual root). Teeth lost due to dental trauma, extracted due to orthodontic reasons, or absent due to agenesis were not included in the analysis. Other predictors included in the models as adjusting variables were mother's schooling (≤ 8 years or >8 years), the presence of carious cavities (absent [0] or present [≥ 1]), malocclusion (absent [DAI ≤ 25] or present [DAI >26]) (WHO, 1997), and gingivitis (absent [$<10\%$ of bleeding sites], localized [$\geq 10\%$ to $\leq 30\%$ of bleeding sites], or generalized [$>30\%$ of bleeding sites]) (Trombelli *et al.*, 2018).

Preliminary analysis compared OHIP-14 scores among categories of predictors using the Wald test. The association between tooth loss and OHIP-14 scores was

investigated using negative binomial regression models (unadjusted and adjusted) due to over-dispersion. Mother's schooling, carious cavities, malocclusion, and gingivitis were included and maintained in the adjusted models irrespective of their p-values based on the previous literature. Rate ratios (RR) and their 95% confidence intervals (CI) were estimated. Data analysis was performed using STATA software (Stata 14.2, Stata Corporation, College Station, USA).

Results

All invited individuals agreed to participate. The initial sample consisted of 520 recruits; however, 2 had uncomplete OHIP-14 answers, so data on 518 participants were analyzed. The sample consisted of young men aged between 18 and 19 years, of which 51% had mothers who studied for ≤ 8 years, corresponding to elementary school in Brazil. About a quarter of the individuals included had carious cavities (26.6%) and about two thirds had gingivitis (68.6%) (Table 1).

Mean DMFT was 2.3 (s.d. ± 2.5), ranging from 0 to 14 (median 2, interquartile range [IQR] 0, 4). Almost one quarter (22.2%) had experienced tooth loss. The mean \pm sd number of missing teeth was 0.4 ± 0.9 , ranging from 0 to 4 (median 0, IQR 0, 0). Among those who had at least one missing tooth (n=115), the mean \pm sd number of missing teeth was 1.7 ± 1.0 , ranging from 1 to 4 (median 1, IQR 1, 2). Ninety-one individuals had only extracted teeth, 16 had only residual roots, and 8 had both conditions. All missing teeth were first molars.

Mean OHIP-14 scores was 9.13 (SE ± 0.31). Scores differed between categories of tooth loss in the physical pain and handicap domains, in addition to the overall OHIP-14 score (Table 2).

The unadjusted analysis of the association between tooth loss and OHRQoL showed that individuals missing at least one tooth were more likely to have a poorer OHRQoL in the physical pain, psychological disability,

Table 1. Characteristics of 518 Brazilian army recruits.

Variable	%
Mother's schooling	
≤ 8 years	50.97
>8 years	49.03
Carious cavities	
Absent	73.36
Present	26.64
Malocclusion	
Absent	50.00
Present	50.00
Gingivitis	
Absent	31.47
Localized	42.66
Generalized	25.87
Tooth loss	
Absent	77.80
Present	22.20

Table 2. Total and domain-specific OHIP-14 scores according to predictor variables.

Variable	Functional Limitation Mean (SE)	Physical Pain Mean (SE)	Psycho Discomfort Mean (SE)	Physical disability Mean (SE)	Psycho disability Mean (SE)	Social Disability Mean (SE)	Handicap Mean (SE)	Overall OHIP-14 Mean (SE)
Mother's schooling								
≤8 years	0.85 (0.07) ^A	2.19 (0.10) ^A	2.27 (0.12) ^A	0.78 (0.08) ^A	1.33 (0.10) ^A	1.33 (0.10) ^A	0.63 (0.07) ^A	9.39 (0.46) ^A
>8 years	0.85 (0.07) ^A	2.10 (0.10) ^A	2.30 (0.12) ^A	0.57 (0.07) ^B	1.25 (0.09) ^A	1.25 (0.09) ^A	0.75 (0.07) ^A	8.87 (0.42) ^A
Carious cavities								
Absent	0.80 (0.05) ^A	1.98 (0.08) ^A	2.09 (0.09) ^A	0.54 (0.05) ^A	1.17 (0.07) ^A	1.23 (0.08) ^A	0.52 (0.06) ^A	8.34 (0.33) ^A
Present	0.96 (0.10) ^A	2.61 (0.14) ^B	2.82 (0.17) ^B	1.04 (0.13) ^B	1.62 (0.15) ^B	1.46 (0.15) ^A	0.80 (0.11) ^B	11.31 (0.71) ^B
Malocclusion								
Absent	0.84 (0.07) ^A	2.14 (0.10) ^A	2.13 (0.11) ^A	0.66 (0.07) ^A	1.12 (0.08) ^A	1.21 (0.10) ^A	0.59 (0.07) ^A	8.69 (0.43) ^A
Present	0.85 (0.07) ^A	2.16 (0.10) ^A	2.44 (0.12) ^A	0.69 (0.08) ^A	1.46 (0.10) ^B	1.37 (0.10) ^A	0.60 (0.07) ^A	9.57 (0.45) ^A
Gingivitis								
Absent	0.78 (0.08) ^A	2.19 (0.12) ^{AB}	2.20 (0.14) ^A	0.67 (0.10) ^A	1.15 (0.10) ^A	1.24 (0.13) ^A	0.51 (0.09) ^A	8.75 (0.54) ^A
Localized	0.86 (0.07) ^A	1.99 (0.10) ^A	2.19 (0.12) ^A	0.66 (0.08) ^A	1.25 (0.10) ^{AB}	1.26 (0.10) ^A	0.62 (0.08) ^A	8.83 (0.48) ^A
Generalized	0.90 (0.10) ^A	2.36 (0.15) ^B	2.54 (0.18) ^A	0.72 (0.11) ^A	1.52 (0.14) ^B	1.41 (0.13) ^A	0.64 (0.10) ^A	10.09 (0.64) ^A
Tooth loss								
Absent	0.81 (0.05) ^A	2.05 (0.08) ^A	2.24 (0.09) ^A	0.62 (0.06) ^A	1.22 (0.07) ^A	1.26 (0.08) ^A	0.52 (0.06) ^A	8.73 (0.35) ^A
Present	0.96 (0.11) ^A	2.49 (0.16) ^B	2.43 (0.19) ^A	0.87 (0.13) ^A	1.54 (0.15) ^A	1.39 (0.14) ^A	0.83 (0.12) ^B	10.52 (0.67) ^B
TOTAL	0.85 (0.05)	2.15 (0.07)	2.28 (0.08)	0.68 (0.05)	1.29 (0.07)	1.29 (0.07)	0.59 (0.05)	9.13 (0.31)

Letters indicate difference between categories ($p < 0.05$, Wald test).

and handicap domains and total OHIP-14 score. After adjusting for mother's education, carious cavities, malocclusion, and gingivitis, the physical pain and handicap domains maintained significance (Table 3). Individuals with at least one missing tooth had 17% greater OHIP-14 scores in the physical pain domain than their counterparts ($RR=1.17$; $95\%CI=1.01, 1.35$) and 49% higher scores in the handicap domain than those with no missing tooth ($RR=1.49$; $95\%CI=1.03, 2.15$).

Discussion

Investigating the prevalence of tooth loss in any period of life is fundamental for the dental community, as well as understanding the reasons that preceded the loss of a dental organ and the consequences of this absence. In this study, 22.2% of army recruits had lost at least one permanent tooth due to caries, and their OHRQoL was affected by this loss. This prevalence rate is more than twice that found by Stona et al. (2021) who examined 652 recruits aged 18 years and found a tooth loss prevalence of 9.4% in 2017.

Assessing the population aged 18 years is important to have an overview of the oral disease profile in young adults (Amaral et al., 2005). In addition, this is an important period to acquire healthy habits to be maintained throughout life. Wu et al. (2017) evaluated the effectiveness of motivational interviews related to oral health in adolescents; over 12 months, a significant difference was found in the quality of oral health of those who underwent more intense and incisive speeches and evaluations about improving their hygiene habits than the group that received a softer speech. In addition, early tooth loss has been associated with extensive tooth loss in adulthood

Table 3. Negative binomial regression models for association between tooth loss and OHRQoL.

	Unadjusted		Adjusted*	
	RR	95% CI	RR	95% CI
Functional limitation				
0 missing teeth	1.00		1.00	
≥1 missing teeth	1.19	0.91, 1.54	1.16	0.88, 1.52
Physical pain				
0 missing teeth	1.00		1.00	
≥1 missing teeth	1.21	1.05, 1.40	1.17	1.01, 1.35
Psychological discomfort				
0 missing teeth	1.00		1.00	
≥1 missing teeth	1.09	0.92, 1.29	1.01	0.85, 1.20
Physical disability				
0 missing teeth	1.00		1.00	
≥1 missing teeth	1.40	0.99, 1.97	1.27	0.90, 1.81
Psychological disability				
0 missing teeth	1.00		1.00	
≥1 missing teeth	1.26	1.01, 1.57	1.16	0.93, 1.45
Social disability				
0 missing teeth	1.00		1.00	
≥1 missing teeth	1.10	0.87, 1.39	1.05	0.83, 1.33
Handicap				
0 missing teeth	1.00		1.00	
≥1 missing teeth	1.59	1.12, 2.27	1.49	1.03, 2.15
Overall OHIP-14				
0 missing teeth	1.00		1.00	
≥1 missing teeth	1.20	1.04, 1.40	1.13	0.98, 1.32

RR = Rate ratio; CI = Confidence interval. *Adjusted for mother's schooling, carious cavities, malocclusion, and gingivitis.

(Eklund and Burt, 1994). All these aspects reinforce the importance of investigating tooth loss among adolescents and young adults.

In the age group under investigation, previous studies have assessed caries and periodontal conditions and their relationship with OHRQoL (Chakravathy *et al.*, 2013; Ortiz *et al.*, 2020); however, to the best of our knowledge, there is only one publication regarding the association between tooth loss and subjective oral health among young individuals. Peres *et al.* (2013) analyzed the quality of life related to several oral parameters in 5,445 15-19-year-old individuals included in the national oral health survey (SB Brasil 2010) using the Oral Impacts on Daily Performance (OIDP) questionnaire. Individuals with one or more missing teeth had 44% higher OIDP scores than those with no tooth loss, even after adjusting for sociodemographic variables and several clinical conditions. This poorer OHRQoL among those with missing teeth concurs with the present study. Although we did not find an association with the overall OHIP-14 score, tooth loss was associated with the physical pain and handicap domains of OHRQoL. Specifically, young men with at least one missing tooth had painful aching in the mouth and/or found eating uncomfortable because of problems with teeth, mouth or dentures more often and felt that life in general was less satisfying and/or had been totally unable to function because of problems with teeth, mouth or dentures than those without missing teeth. These findings may be explained in part by our computing residual roots as missing teeth (Martins *et al.*, 2015), based on the WHO guidelines (WHO, 1997) and based on the premise that the difference between an extracted tooth and a residual root is only the access to oral health services to undergo the surgical procedure.

Studying quality of life highlights social and emotional components that make a difference in people's daily lives, thus collecting important subjective data giving greater coverage of patient's health (Christie *et al.*, 1993; Sischo and Broder, 2011). Its pioneering aspect may be seen as a strength of our study. In addition, the homogeneous sample in terms of sex, age, and socioeconomic status may be seen as another strength of the study, since these aspects influence OHRQoL. Regarding the limitations of the study, we should emphasize its cross-sectional design, which does not allow assessing the temporal relationship between variables, thus keeping us from studying causal relationships. Furthermore, no information on the duration of tooth loss was collected, making it unclear whether poorer OHRQoL was associated with recent tooth loss or tooth loss that occurred a long time ago. Future studies might elucidate this aspect. Lastly, the sample was not representative of the Brazilian population aged 18-19 years, as it is composed only of young men enlisted for military service. However, it still manages to provide important data for the beginning of investigations on OHRQoL regarding tooth loss in this group. Although we have included young men attending the mandatory military service in only two southern Brazilian cities, we can assume that the present findings may be generalized for other populations of Brazilian recruits since the profile of individuals who attend mandatory military service in Brazil is usually very similar.

In conclusion, this cross-sectional study showed that tooth loss was negatively associated with OHRQoL among 18-19-year-old conscripts of the Brazilian Army from southern Brazil, and that this association was related to physical pain and handicap domains.

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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