predictors of tooth loss in the 1921 lothian birth cohort

sir—

Last scene of all,
That ends this strange eventful history,
Is second childhood and mere oblivion,
Sans teeth, sans eyes, sans taste, sans everything.

Shakespeare, As You Like It Act II, scene VII

Tooth loss has long been associated with human ageing. Tooth retention significantly impacts on the quality of life in old age [1]. In Scotland between 1972 and 1998, the proportion of older people who retain none of their natural teeth fell from 44% to 18%, whilst the proportion attending for regular dental check-ups doubled from 29% to 60% [2]. Data from a large study of Swedish twins supported the hypothesis that adult oral diseases have their origin in childhood [3]. A number of risk factors for tooth loss originate in childhood and, if so, whether this relates to child or parental characteristics.

Methods

Sample

The sample has been extensively described previously [9]. The SMS 1932 tested the mental ability in people born in 1921 and who attended schools in Scotland from June 1932 (n = 87,498). The SMS 1932s Moray House Test (MHT) was validated against the Stanford Binet test and includes verbal reasoning, numerical, spatial and other items. From 1999 to 2001, we traced and retested 550 people from Edinburgh who were born in 1921 (the Lothian Birth Cohort 21). Uniquely, in Scotland, the childhood cognitive ability of the subjects tested here can be described with reference to the entire population. The mean (SD) raw MHT score for Scotland was 34.5 (15.5). The mean of the scores for the children tested in Edinburgh city schools was 37.3 (14.8). The mean of the scores for those who survived and were recruited into the Lothian Birth Cohort of 1921 was 46.4 (12.1).

Measures

As part of a general physical health assessment the number of remaining teeth for each participant was counted. Edentulous participants were asked the year in which they lost their last tooth. Participants were also asked about their father’s occupation when they were around 11 years old. This was also recorded by the SMS 1932. In addition they were asked about their own main occupation, the number of years of full-time education, alcohol and smoking history, and ex-smokers were defined by cessation from a regular habit.

Statistical analyses

After initial data description, the age at which the last tooth was lost was calculated for the edentulous participants. Logistic regression models were constructed using the forward conditional entry at P<0.05 to identify the risk factors.
Research letters

Factors for being edentulous, and then the Cox proportional hazards model was used to test the effect of independent variables of interest on the age at which the last tooth was lost. Hazard ratios (HR) with 95% confidence intervals (CI) were expressed as per the year of the last tooth retained. For participants who retained at least one tooth, general linear modelling was performed to test the effect of independent variables of interest on the number of teeth retained. All tests were performed with the SPSS 14.0 statistical package.

Results

At age 79 years tooth loss data were available for 549 participants, 211 (38.6%) of whom were edentulous. Dentate participants had a mean number of 15.1 (median 16.0) teeth. Edentulous participants lost their last tooth at the mean age of 40.9 (median 39.0, range 7–79) years. Logistic regression with forward conditional entry identified the participant’s social class (OR 1.48, 95% CI 1.12–1.96 per class category, \( P = 0.006 \)), education (OR 82, 95% CI 0.73–0.893, \( P = 0.003 \)) and paternal social class (OR 1.45, 95% CI 1.11–1.88, \( P = 0.006 \)) as significant predictors of being edentulous at the age of 79 years.

For edentulous participants, Cox proportional hazards models for each risk factor entered on its own showed no significant effect for sex (HR 1.24, 95% CI 0.93–1.65 for women versus men, \( P = 0.14 \)), IQ age 11 (HR 0.99, 95% CI 0.98–1.00 per IQ point, \( P = 0.13 \)), social class (HR 1.18, 95% CI 0.998–1.40 per class category, \( P = 0.052 \)), paternal social class (HR 1.15, 95% CI 0.98–1.34 per class category, \( P = 0.082 \)), number of units of alcohol consumed per week (HR 0.99, 95% CI 0.98–1.01 per unit, \( P = 0.20 \)) or smoking (HR 0.39 overall effect, \( P = 0.29 \) non-smokers versus current smokers, \( P = 0.17 \) ex-smokers versus current smokers). Only education was found to have a significant effect (HR 0.91, 95% CI 0.84–0.99 per year of education, \( P = 0.021 \)). Figure 1 shows that this effect was largely due to tooth loss between the ages of 20 and 40 years.

For dentate participants general linear modelling identified education (F = 11.9, \( P = 0.001 \), 0.50 teeth retained per additional year spent in full-time education, 95% CI 0.21–0.78 teeth per year education), sex (F = 5.77, \( P = 0.017 \), men mean 12.4 teeth, women mean 15.3 teeth) and smoking (F = 5.38, \( P = 0.005 \), smokers mean 11.1 teeth, ex-smokers mean 14.5 teeth, non-smokers mean 16.1 teeth) as significant independent predictors of the number of teeth retained at the age of 79 years.

Discussion

Data from this sample support the hypothesis that tooth loss in adulthood has its origins in childhood conditions as indicated by the significant effects of education and paternal social class. The participant’s own social class also had a significant effect on whether participants had lost all their teeth by the age of 79 indicating some independent influence from adult exposures. Childhood IQ was not significantly related to tooth loss suggesting that any effect of education is independent of mental ability. For those participants who had lost all their teeth, the age at which this occurred was affected only by education. The effect is largely seen between the ages of 20 and 40 years. For those who retained some teeth at the age of 79 years, people with more education, women and non-smokers were likely to have more number of teeth left.

The data are consistent with previous reports [4–8]. Education and paternal social class are likely to be indices of childhood socio-economic resources [11], potentially confounding each other, and support the need for a life-course approach to health status in old age. Retention of teeth, with its impact on quality of life, is a further reason to encourage smoking cessation since those participants who were still smoking at the age of 79 years had fewer teeth.
than those who had given up. Social class was significantly associated with being edentulous, but not with the age of the tooth loss or the number of teeth retained in those participants who still had teeth. This may indicate that, smoking aside, exposures in adulthood have little influence on the rate of tooth loss. However, it may be that tooth hygiene-related behaviours learnt in childhood persist into early adulthood when teeth are lost at the fastest rate [12].

Although a narrow age sample has advantages in controlling the effects of age, a corollary is that it is open to cohort effects. These are well recognised for tooth loss where dental health policies have favoured total clearances in the past [13]. Our data do not fit with such an effect even though the cohort lived through the introduction of a publicly-provided dental service during their late twenties. The cohort's mean age 11 IQ is higher than that for Scotland, partly due to attrition bias; however, adjusting for this bias is likely to have accentuated our findings. In addition to temporal variations, geographic variation in tooth loss is reported [14]. It would be helpful to replicate the finding of childhood origins of adult tooth loss persisting into old age in samples from other regions.

A dental assessment is a common component of the health assessment of older people. Beyond its importance in itself for effects on quality of life (nutrition, communication etc), dental status can be a useful indicator of the conditions experienced by the person during childhood. Old age may not be a 'second childishness' as Jaques imagines it in 'As You Like It', but in terms of tooth loss it owes a debt to our 'first childishness'.

Key points
- Paternal social class, the participant’s education and the participant’s social class predict who is edentulous at the age of 79 years.
- People with lesser education are more likely to lose teeth between 20 and 40 years of age.
- For those who retained their teeth at the age of 79 years, women, non-smokers and those with more education were likely to have more number of teeth.
- Dental status in old age reflects the influences across one’s life course and can be a useful indicator of conditions experienced during childhood.

Conflicts of interest
None

Funding
The study was supported by a grant from the Biotechnology and Biological Sciences Research Council.

Acknowledgements
We wish to thank Martha Whiteman for her help in the collection of data.

John M. Starr1*, Alison Pattie2, Lawrence J. Whalley3, Ian J. Deary2

1Geriatric Medicine Unit, University of Edinburgh, Royal Victoria Hospital, Edinburgh, EH4 2DN, UK
E-mail: jstar@staffmail.ed.ac.uk

2Department of Psychology, University of Edinburgh, 7 George Square, Edinburgh, EH8 9JZ, UK

3Department of Environmental and Occupational Medicine, Aberdeen University, Foresterhill, Aberdeen, AB25 2ZD, UK
*To whom correspondence should be addressed

References
Research letters


doi:10.1093/ageing/afm160
Published electronically 21 November 2007