Commentary: Is tooth loss good or bad for general health?

Yu-Kang Tu1,2 and Mark S Gilthorpe1*

Abnet et al.1 show that tooth loss is associated with increased risk of mortality from upper gastrointestinal, heart diseases, and stroke. In the last decade, those working in oral health research, especially within periodontology, have shown increasing interest in studying the possible link between oral health and systemic health outcomes. The study by Abnet et al. evidently shows the difficulties and limitations in study design faced by proponents of a causal relationship. It is simple to think of a randomized controlled trial to test the hypothesis of a relationship between oral health status and systemic health outcomes (not surrogate endpoints such as inflammatory cytokine levels): patients with advanced periodontal disease are randomly allocated to two groups in which one receives standard treatment and maintenance care and the other receives no treatment. However, this study design would be considered unethical. Furthermore, differences in treatment outcomes between the two groups, such as episodes of stroke, will take many years to manifest, and it can be assumed that the treatment reduces/reverses the risk generated by periodontal diseases. Consequently, the only practical alternative research data must come from large-scale cohort studies, such as that reported by Abnet et al., or from case–control studies.

A persistent problem, however, is the assessment of oral health. Although the pathological mechanism in the connection between oral infection and systemic health is not yet known, it is widely thought that the chronic infection due to periodontal diseases is more likely to cause systemic hazard because periodontal infection is chronic and periodontal pathogens enter the systemic blood circulation. However, diagnosis of periodontal diseases is not straightforward and clinical examination to establish diagnosis is time-consuming. Simple indices to screen and summarize periodontal diseases have been used in epidemiological research, but it is questionable that these indices can reliably represent the underlining disease status. An alternative is to use the number of lost teeth, which seems to be a reliable measure of oral health status.

Although we accept that tooth loss is less prone to measurement error, the interpretation of tooth loss remains debatable. For the rural Chinese population, Abnet et al. argue that periodontal disease, not dental caries, is the main cause of tooth loss, and this supposition affects only the biological mechanisms they propose and not the accuracy of the risk estimates they report. This supposition might be true, though there is more than one interpretation of their risk estimates.

Let us first accept that periodontal diseases caused tooth loss. To Abnet et al., tooth loss represents an accumulative measure of life-time exposure to periodontal disease. However, with no teeth remaining, periodontal pathogens cannot cause inflammation. It is therefore arguable that tooth loss itself actually reduces the risk of patients’ exposure to periodontal infection;2 people without teeth have no risk of periodontal disease. For people living in rural China, without access to free dental care, it is open to interpretation whether or not people with fewer teeth at baseline have more or less exposure to periodontal infection. Therefore, the relationship between tooth loss and the increased risk ratio of systemic health outcomes may be interpreted as either: (i) periodontal disease is harmful to general health (as interpreted by Abnet et al.); or (ii) periodontal disease is protective (Figure 1).

Certainly, the reality is far more complex. The consequence of tooth loss is not only limited to the reduced exposure to periodontal infection. Losing a few teeth (e.g. wisdom teeth) causes little inconvenience, though losing most teeth can have a dramatic impact on patients’ lives, such as chewing, speaking, and appearance. Seeking dental treatment and replacement of lost teeth can be a long and stressful experience. For instance, it has been proposed that tooth loss might cause changes in patients’ diet,3 such as reduced intake of fibres, and this might in turn contribute to an increased risk of cardiovascular disease.

It is obvious that the impact of tooth loss varies within individual patients and within populations. People who have access to free dental care will encounter different experiences, when seeking tooth replacement and maintenance, from those who struggle to pay for their dental care. Therefore, tooth loss as a proxy for life-time cumulative oral health experiences represents a complex interaction between biological and social factors.4

Another controversial issue in the relation between oral (or periodontal) health and systemic health outcomes is confounding. It has been argued that the observed increased risk in these studies is due to inadequate adjustment of smoking,5 which is a well established risk factor for both periodontal diseases and systemic health. As smoking increases both the risk of periodontal diseases and adverse systemic health outcomes, residual confounding would remain if smoking status were measured with error (Figure 2). Table 3 in Abnet et al. shows that the risk ratio of tooth loss for total mortality, gastrointestinal cancer mortality, and heart disease mortality amongst females was the lowest compared with male smokers and male non-smokers, also >99% of women never smoked. The risk ratio of tooth loss for total mortality in male

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1 Biostatistics Unit, Centre for Epidemiology and Biostatistics, Leeds Institute for Genetics, Health and Therapeutics, 30/32 Hyde Terrace, Leeds, LS2 9LN, UK.
2 Department of Periodontology, Leeds Dental Institute, Clarendon Way, Leeds, LS2 9LU, University of Leeds, UK.
3 Corresponding author: Biostatistics Unit, Centre for Epidemiology and Biostatistics, Leeds Institute for Genetics, Health and Therapeutics, 30/32 Hyde Terrace, Leeds, LS2 9LN, UK. E-mail: m.s.gilthorpe@leeds.ac.uk
non-smokers was also lower than that amongst male smokers, though this was not so for gastrointestinal cancer mortality and heart disease mortality. As this study used self-reported smoking status at baseline interview, it might suffer misclassification in smokers/non-smokers. Residual confounding caused by any misclassification of male non-smokers and smokers in Abnet et al. might not be substantial; however, it raises an interesting question about whether or not the impact of tooth loss on mortality in this study demonstrates an interaction with gender, or if the relation between tooth loss and mortality is confounded by gender. As females consistently showed the weakest association between tooth loss and mortality, it is interesting to understand whether or not this is due to biological differences or contrasting life-style (social) factors between females and males. Moreover, these biological and/or social factors might need to be considered in future studies.

This study by Abnet et al. provides indirect evidence of an association between oral health and systemic health outcomes, even though the biological/pathological mechanisms behind these associations remain unclear. This reminds us that teeth, as part of the human body, should not be overlooked for their possible role in general health.

References