Smoking status and oral health-related quality of life among adults in the United Kingdom

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Objective  The primary objective of this study was to examine the association between smoking and oral health-related quality of life (OHRQoL) among dentate people aged 16 years and above in England. Methods  Cross-sectional study, based on the Adult Dental Health Survey (ADHS) 2009. ADHS 2009 involved data collection from 11,380 face-to-face interviews and 6,469 dental examinations from England, Wales and Northern Ireland. This study focuses on the dentate sample from England, consisting of 5,622 individuals who underwent dental examination. OHRQoL was measured by two indices; Oral Health Impact Profile-14 (OHIP-14) and Oral Impacts on Daily Performance (OIDP). Unadjusted and adjusted zero-inflated regression models were used. Adjustment was sequentially done for socio-demographics, clinical oral conditions and self-reported general health.

Results  Prevalence of those who had never smoked, past smokers and current smokers were 45.6%, 35.3% and 19.2% respectively. Current smokers had considerably higher mean OHIP-14 and OIDP scores than non-smokers. There was a statistically significant association between smoking and OHRQoL (both OHIP-14 and OIDP) even in the fully adjusted models. Current smokers were more likely to report worse OHRQoL compared to those who had never smoked in both OHIP-14 and OIDP score. There was no statistically significant difference between past smokers with those who had never smoked in reporting OHIP-14 and OIDP. Among those reporting OHRQoL, there was a stepwise gradient risk of reporting no oral impact, where the probability was higher among those who had never smoked, followed by past smokers and current smokers both in OHIP-14 and OIDP.

Conclusion  Smoking was independently associated with worse OHRQoL, even after adjusting for a range of socio-demographic factors, clinical oral conditions and self-reported general health.

Introduction

Many studies have shown the harmful effect of smoking behaviour in relation to oral cancer,1–3 periodontal disease incidence and tooth loss,4–8 precancerous lesions,9 dental caries10–12 and teeth staining.13,14 These oral conditions may affect the physical, psychological and social well-being of an individual.15 For instance, caries cause pain and discomfort from acute and chronic infection, which may disturb eating and sleeping. Coping with oral pain is one of the reasons for children’s absence from school and this affects their school performance.16 Moreover, tooth loss affects chewing abilities, limits food choice and reduces the enjoyment of food intake.17 The impacts of smoking-related diseases have been felt at individual, societal and national level and the costs of treating these diseases are high worldwide.18,19

Oral health-related quality of life (OHRQoL) is the self-perceived impact of the oral conditions on the social, functional and psychological well-being of individuals. OHRQoL measures are used to capture the impact of oral conditions on the well-being of individuals.20 In addition, OHRQoL measures together with clinical measures and indicators of behavioural propensity, can be used to access the oral care need of individuals and populations in general.21,22

In the past three decades, researchers have been trying to comprehend which factors influence the subjective perception of quality of life. Many studies have successfully addressed the relationship between OHRQoL and health determinants including clinical conditions, socio-demographic and behavioural factors.23–26

As a common behavioural cause of preventable illness and death worldwide, many studies have observed on the role of smoking behaviour on quality of life among patients with general health problems such as cardiovascular diseases, respiratory problems and cancers.27 However, despite the harmful effects of smoking to oral health, the role of smoking on OHRQoL is not well-researched.

Few studies have examined the effect of
smoking on OHRQoL from various countries. Maida et al. and Saunders examined the US national survey, Astrom et al. examined people aged 50 years in Sweden using a longitudinal study, Mykola et al. examined school children from Tanzania, Christensen et al. examined schoolchildren in Denmark, Yiengprugsawat et al. examined people in a national cohort study and Espinosa et al. examined a nationally representative sample in Chile. One randomised experimental study among adults with human immunodeficiency virus (HIV) looked at the impacts of HIV severity on OHRQoL. The study concluded that smoking has a strong correlation with OHRQoL among HIV patients. 

There are various studies that looked directly on the association between smoking and OHRQoL, found that smokers reported poorer OHRQoL compared to those who never smoked.32,33 Moreover, studies that looked indirectly on the association between smoking and OHRQoL did also support the association between smoking and poorer OHRQoL,34,35,36 with the exception of only one study.35 

These studies employed different methodological designs, and varied in the age of respondents and the chosen OHRQoL measure. With different methodology design, age of respondents, and OHRQoL measure used, it is difficult to make a direct comparison between these studies. Moreover, some of these studies used a validated OHRQoL measure while other studies used modified versions of OHRQoL measure, therefore they are not directly comparable with other studies. In addition, all previous studies relied on one indicator to measure OHRQoL. None examined OHRQoL using more than one indicator. This is a drawback for comparing between the different OHQoL measures. Therefore, the aim of this study is to examine the association between smoking behaviour and OHRQoL among dentate people aged 14 years and above in England.

Methodology

This study examined data from the Adult Dental Health Survey (ADHS) 2009, taken from the UK data archives. ADHS 2009 has obtained the ethical approval from the Oxfordshire Research Ethics Committee. This study does not require further ethical approval as no personal or small area level identifiers were used in these analyses. ADHS 2009 involves a collection of data from 11,880 face to face interviews and 8,469 dental examinations. This study focuses on England thus leaving the original sample of 9,663. Among the 8,017 dentate participants, 5,622 underwent a clinical dental examination and hence were eligible for inclusion in this analysis. Cases with missing data (n = 88, 1.6%) on any of the variables were excluded from the analysis. 

The outcome variable was OHRQoL. Two validated measures were used: the Oral Health Impact Profile (OHIP-14) and the Oral Impacts on Daily Performances (OIDP). 

The OHIP-14 is a shortened version of OHIP-49 developed using a conjoint model of oral health by Locker.37 The OHIP-14 measures the frequency of oral impacts in seven dimensions, two questions for each dimension, namely: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap.38 For each question, answering options were ‘Never’ = 0, ‘Hardly ever’ = 1, ‘Occasionally’ = 2, ‘Fairly often’ = 3 and ‘Very often’ = 4. The OHIP-14 score was calculated by adding the score of the 14 questions with the range from zero to 56. The higher score indicates higher levels of impacts on the quality of life. 

The OIDP measures the frequency and severity of oral impacts on the abilities to carry out nine daily activities, eating, speaking, cleaning teeth or dentures, going out, relaxing, smiling, carrying out major role work, maintaining emotional state and enjoying contact with people.39 Severity of the oral impacts was assessed through a Likert scale ranging from 0 (no effect) to 5 (very severe effect).

The ODP score was calculated by adding the scores from the nine items, then dividing this by the maximum score (45) and multiplying it by 100 to get a percentage score. Higher OIDP indicates more severe oral impacts.

Exposure variable was smoking status, used as a categorical variable. To assess current smoking status, the specific questions was asked: ‘Have you ever smoked a cigarette, a cigar, or a pipe?’ Individuals who answered ‘Yes’ were further asked ‘And do you smoke cigarettes at all nowadays?’ Answer for both questions were either ‘Yes’ or ‘No’. Individuals who answered ‘No’ in the first question were categorised as ‘never smoke’, individuals who answered ‘Yes’ for the first and ‘No’ for the second question were categorised as ‘past smoker’ and individuals who answered ‘Yes’ for both questions were categorised as ‘current smoker’.

The socio-demographic covariates considered were age (16–34, 35–54, 55 and over), sex (male or female), marital status (married/civil partnership, separated/divorced/ widowed and single) and education level (degree or superior, below degree and no qualification).

The oral clinical covariates considered were number of natural teeth, dental caries, PUsA (pulpal involvement, ulceration, fistula and abscess), bleeding on probing (BOP) and pocket depth. The number of natural teeth was categorised as (i)25–32, (ii) 17–24, (iii) 9–16 and (iv) < 9. Dental caries was categorised as ‘Yes’ (at least one tooth decayed including roots) or ‘No’. PUsA (pulpal involvement, ulceration, fistula and abscess) (Monse 2010) was measured as ‘Yes’ (at least one PUsA) or ‘No’. Bleeding on probing (BOP) was categorised as ‘Yes’ (at least one BOP site) and ‘No’. Pocket depth ≤ 4 mm was categorised as ‘Yes’ (at least one pocket ≤ 4 mm) or ‘No’. Self-reported general health was measured as ‘Very good’/’Good’/’Fair’/’Bad’/’Very bad’.

To determine the OHRQoL of participants who had no oral impacts (OHIP-14 ≤ 0.187) or no oral impacts for having no oral impacts compared to those who had never smoked. However, past smokers had no difference in OHIP-14 score with those who had never smoked (OR: 1.0, 95% CI: 0.9–1.1). In terms of the zero-inflated part of the model (OHIP-14 = 0), current smokers and past smokers had lower odds (OR: 0.5, 95% CI: 0.3–0.9) and (OR: 0.8, 95% CI: 0.7, 0.9 for past smokers) for having no oral impacts compared to those who had never smoked.

The aforementioned RRR for current smokers attenuated slightly but remained statistically significant in Model 2 (adjusted for socio-demographic factors) and Model 3 (adjusted for socio-demographic factors and clinical oral conditions). Past smokers contributed the part of the model (OHIP-14 > 0), the respective estimates were unchanged in Model 2 and attenuated slightly while remaining statistically significant.
This study has shown that smoking has a significant independent association with OHRQoL. This finding has implications for the design of socio-demographic background, clinical conditions and self-reported general health. Among those reporting oral impacts, current smokers were more likely to report worse OHIP-14 scores compared to those who had never smoked, but the same was not the case for past smokers. Smoking cessation should be encouraged for smokers as past smokers have equal chance to gain better OHQoL than those who never smoked.

**Conclusion**

This study has shown that smoking has a significant independent association with OHRQoL. This finding has implications for the design of socio-demographic background, clinical conditions and self-reported general health. Among those reporting oral impacts, current smokers were more likely to report worse OHIP-14 scores compared to those who had never smoked, but the case was not the case for past smokers. Smoking cessation should be encouraged for smokers as past smokers have equal chance to gain better OHQoL than those who never smoked.

**Discussion**

This study has shown that smoking was statistically significant associated with oral OHRQoL, and the results were very similar for both OHIP-14 and the OIDP. Among those reporting oral impacts, current smokers were more likely to report worse OHIP-14 scores compared to those who had never smoked. However, there was no such difference between past smokers and those who had never smoked. Furthermore, there was a stepwise gradient of risk among reporting no oral impacts, with current smokers having the lowest probability of no oral impacts, followed by past smokers, and then people who had never smoked.

This study has shown that smoking was statistically significant associated with smoking and OHIP-14 for scores for those that reported oral impacts and separately look at the odds of having no oral impacts between the three groups. The main findings of our study were consistent with previous studies used one OHIP-14 measure, while we used the two most widely used and internationally comparable measures. This allowed us to compare our results across different OHIP-14 versions. After accounting for the effect of confounders, the statistically significant association towards OHIP-14. Therefore, public health action should focus on health promotion interventions against smoking, as non-smokers are healthier and have better quality of life than smokers. It is well-known that smoking is harmful to oral and general health. Despite the preventive program, efforts and legislation that have been put against this behaviour, the prevalence of smoking both in men and women is still high in England. Our study has shown that people who smoked had worse OHIP-14 compared to those who had never smoked. OHIP-14 in past smokers was the same as those who never smoked. The findings from this study may be used to emphasize the importance of smoking cessation programmes and policies that may be appropriate to improve the quality of life. For instance, it may be used to encourage people to stop smoking after being a smoker for a longer period. Rewards from not smoking go beyond gaining better oral health, it also contributes to a superior quality of life.

A possible explanation is that people who did not smoke have a better life and feel happier, thus less likely to engage with unhealthy habits, and smoking cessation should be encouraged to allow robust analysis and comparison.

Smoking statuses are more prone to reporting smoking bias. There are objective ways to measure smoking status through carbon monoxide concentration in expired air and serum concentration of cotinine in blood. It is well-known that smoking has an independent negative effect on the quality of life. For instances, it may be used to provide evidence about worse oral impacts among those with oral impacts and separately look at the odds of having no oral impacts when compared to those who had never smoked. OHIP-14, the 4, estimate the past smoker group and the impact of the Poisson regressions, whereby there was no statistically significant association. The statistically significant association between smoking and OHIP-14, the final model (OHIP-14 = 0), current smokers and past smokers had lower odds (OR: 0.6–95% CI 0.5, 0.7) for having no oral impacts compared to those who had never smoked. The variable with OIDP. Among those with oral impacts (OIDP > 0), past smokers had a lower odds (OR: 0.7; 95% CI: 0.6, 0.8) for having no oral impacts when compared to those who had never smoked. OHIP-14, the 4, estimate the past smoker group and the impact of the Poisson regressions, whereby there was no statistically significant association. The statistically significant association between smoking and OHIP-14, the 4, estimate the past smoker group and the impact of the Poisson regressions, whereby there was no statistically significant association. The statistically significant association between smoking and OHIP-14, the 4, estimate the past smoker group and the impact of the Poisson regressions, whereby there was no statistically significant association.
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