

Brief Report

Tobacco use and reported bruxism in young adults: A nationwide Finnish Twin Cohort Study

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Abstract

Introduction: Higher levels of smoking, leading to increased levels of nicotine and dopamine release, may be more strongly related to bruxism, although this relationship has remained unclear. Thus, the aim of the present study was to investigate the possible effect of cumulative tobacco use on bruxism in a large sample of young adults.

Methods: The material of the present study derives from the *FinnTwin16*, which consists of five birth cohorts born in 1975–1979. A total of 3,124 subjects (mean age 24 years, range 23–27 years) provided data in 2000–2002 on frequency of bruxism and tobacco use. Multinomial logistic regression was used to explore the relationships of frequency of bruxism with smoking and smokeless tobacco use while controlling covariates (alcohol intoxication, alcohol problems [Rutgers Alcohol Problem Index, RAPI], illicit drug use, psychological distress [General Health Questionnaire], and coffee use).

Results: Based on subjective response and multivariate analyses, weekly bruxers were more than two times more likely to report heavy smoking than never bruxers (odds ratio [OR] 2.5, 95 % CI 1.8–3.4). The significant association between heavy smoking and bruxism held when the effects of other tobacco use and multiple covariates were controlled. In addition, the use of smokeless tobacco emerged as an independent risk factor for bruxism.

Discussion: Given the observed associations with both heavy smoking and smokeless tobacco and a dose–response relationship, the present results support our hypothesis of a link between nicotine intake and bruxism.

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Introduction

Bruxism, namely, grinding or clenching of teeth during sleep, is thought to be centrally regulated (Lobbezoo, Van Der Zaag, & Naeije, 2006). The following factors have been associated with bruxism: disorders in the dopaminergic system, stress, sleep disturbances, smoking, and alcohol consumption as well as age, gender, and genetic factors (Hublin, Kaprio, Partinen, Heikkilä, & Koskenvuo, 1998; Ohayon, Li, & Guilleminault, 2001). But, more detailed relationship of smoking and bruxism has remained far from clear. To date, only six studies report on the association between smoking and bruxism, despite large variation in study design, sample size, definition of smoking, assessment of bruxism, and control for covariates (Ahlberg, Savolainen, Rantala, Lindholm, & Kononen, 2004; Ahlberg et al., 2005; Johansson et al., 2004; Lavigne, Lobbezoo, Rompre, Nielsen, & Montplaisir, 1997; Molina et al., 2001; Ohayon et al.). However, these papers focused mainly on bruxism and smoking status.

Although the underlying mechanism between smoking and bruxism is not known, there are several possibilities. Nicotine is known to induce acetylcholine and glutamate synaptic transmission and enhance dopamine release (Li, Mao, & Wei, 2008). This may have influence on the genesis of bruxism. Higher levels of smoking, leading to increased levels of nicotine and dopamine release, might be more strongly related to bruxism. The dose–effect relationship of smoking with bruxism has not been explored in representative population-based datasets. However, this association may arise from other factors common to both, such as genetic variability, which is known to underlie both smoking (Rose, Broms, Korhonen, Dick, & Kaprio, 2009) and bruxism (Hublin et al., 1998).

Thus, the aim of the present study was to further investigate the association of tobacco use with bruxism by examining the role of different forms and amount of tobacco use. A discordant twin pair design was used to control for genetic and environmental factors that may underlie the association.

Materials and methods

Material

The material of the present study derives from the nationwide longitudinal *FinnTwin16* study (Kaprio, Pulkkinen, & Rose, 2002) comprising five birth cohorts (3,065 twin pairs) born in 1975–1979. The fourth wave survey was conducted in 2000–2002 (mean age 24 years, range 23–27 years) with a response rate of 88% (Kaprio, 2006).

The questionnaires assessed lifestyle as well as general, mental, and oral health. The bruxism question was not included in the questionnaire sent to subjects born in 1979. The study protocol was approved by the Ethical Committee of the Department of Public Health, University of Helsinki, and the Institutional Review Boards of Indiana University. Subjects were told of the goals of the study and provided informed consent.

Bruxism was evaluated with the following question: Do you grind your teeth? The options for the answer were 1) every night, 2) weekly, 3) once in a while, 4) never, and 5) I do not know. We classified those responding to the first two alternatives as at least “weekly bruxers” and those responding to alternative 3 as “rarely bruxers.” The group of “never bruxers” was our reference category, while those who did not know were excluded from the analyses. For some analyses, those responding to the first three alternatives were defined as having “any bruxism.”

Tobacco use was evaluated by three questions as follows:

What of the following options describes best your present smoking? The options were 1) I smoke at least 20 cigarettes a day, 2) I smoke 10–19 cigarettes a day, 3) I smoke no more than 9 cigarettes a day, 4) I smoke weekly or often but not on daily basis, 5) I smoke less than once a week, 6) I do not smoke at the moment or I have quit smoking, and 7) I have never smoked. We classified smokers as heavy smokers (at least 10 cigarettes daily), light smokers (less than 10 daily including those not smoking daily), former smokers (alternative 6), and never-smokers, who were the reference category in analyses.

Do you smoke cigars, cigarillos or the pipe? The options for the answer were 1) never, 2) once in a while, and 3) regularly. Regular smokers were so rare that we dichotomized the use of these other tobacco forms as cigar users (alternatives 2 and 3) versus never.

Have you tried smokeless tobacco (placed in the sulcus of the upper lip)? How many times so far? The options for the answer were 1) I have never tried, 2) I have tried once, 3) I have used 2–50 times, 4) I have used more than 50 times, and 5) I use smokeless tobacco regularly. The smokeless tobacco (snuff) used in Finland is mainly Swedish “snus” brought by tourists back from Sweden or got by postal order for their own use but occasionally sold illegally in Finland. We classified smokeless tobacco users as never, occasional lifetime users (1–50

times), or regular users (used >50 times or use regularly by own self-report).

As potential confounders, we considered behavioral factors that have been associated both with smoking and with bruxism (Winocur, Gavish, Voikovitch, Emodi-Perlman, & Eli, 2003). The questionnaire provided information on frequency of drinking to intoxication, the Rutgers Alcohol Problem Index (White & Labouvie, 1989), use of illicit drugs (Korhonen, Kujala, Rose, & Kaprio, 2009), use of coffee, and psychological stress using the General Health Questionnaire (GHQ; Goldberg, 1972; Penninkilampi-Kerola, Miettunen, & Ebeling, 2006).

Method

The association of tobacco use and bruxism was assessed using multinomial logistic regression models (Hosmer & Lemeshow, 2000) adjusted for covariates. Odds ratios (ORs) and their 95% CIs of all models were adjusted for correlated observations within twin pairs using Stata 9.0 (StataCorp, 2005). We also analyzed the risk (conditional logistic regression) of bruxism using twin pairs discordant for smoking status, namely, examining the ratio of the number of pairs in which a smoking twin reports bruxism (weekly or any), while his/her twin brother/sister neither smokes nor experiences bruxism contrasted with the number of pairs in which the opposite was true: A smoking twin does not report bruxism (weekly or any), while the cotwin does not smoke but experiences bruxism.

Results

Among all respondents ($N = 3,124$ subjects), 8.7% had experienced bruxism weekly, 23.4% rarely, and 67.9% never. Altogether 23.6% of men and 14.3% of women reported heavy smoking, while the proportions of never-smokers were 39.6% and 47.4%. Bruxism was more frequent among cigarette smokers both in men and in women. The proportions of regular snuff use were 3.1% in men and 0.1% in women, while 45.0% of men and 82.6% of women had never used snuff. Among all respondents, 87.5% never smoked cigar/pipe, and 12.5% smoked cigar/pipe sometimes or regularly.

According to multinomial logistic regression, while the effects of age and gender were controlled, both weekly and rarely reported bruxism was significantly associated with cigarette smoking (Table 1). There was no significant effect of age, but women were more likely to report weekly bruxism even when adjusted for smoking status. Heavy smokers were more than twice as likely to be weekly bruxers compared with never-smokers ($OR\ 2.5$, 95% $CI\ 1.8$ – 3.4). The significant association between heavy smoking and bruxism held when the effects of other tobacco use were controlled (Table 2). In addition, the use of smokeless tobacco emerged as an independent risk factor for bruxism (Table 2). The ORs were somewhat attenuated, but there was still a twofold risk for weekly bruxism associated with heavy smoking ($OR = 1.93$) and smokeless tobacco ($OR = 2.05$) when the effects of other tobacco use and alcohol drinking to intoxication, RAPI score, illicit drug use, GHQ, and coffee use were controlled (Table 2).

Among all discordant pairs, heavy smoking had an OR of 1.64 (95% $CI\ 0.64$ – 4.26 , $p = .31$) for weekly bruxism and 1.53

Table 1. Proportions (%) of “weekly” and “rarely” bruxism by smoking status in men and women. Multinomial logistic regression: independent effects of cigarette smoking on “weekly” and “rarely” reported bruxism compared with the reference group of never bruxers. ORs and 95% CI adjusted for age and gender

N = 3,124	% of bruxers		Multinomial regression		
	Men	Female	OR	95% CI	p value
Weekly					
Never-smoker	6.1	7.8	1	(Reference category)	
Former smoker	7.6	8.2	1.16	0.76–1.76	.494
Light smoker	6.3	11.1	1.38	0.99–1.94	.058
Heavy smoker	10.3	16.3	2.45	1.75–3.44	<.001
Rarely					
Never-smoker	20.8	20.5	1	(Reference category)	
Former smoker	21.6	22.6	1.11	0.85–1.45	.434
Light smoker	24.2	24.1	1.27	1.02–1.59	.035
Heavy smoker	28.2	23.4	1.86	1.47–2.36	<.001

Note. OR = odds ratio.

(0.98–2.38, $p = .06$) for any bruxism. Further analyses of monozygotic and dizygotic were not possible due to small sample sizes.

Discussion

The present study shows a clear association among individuals between both cumulative cigarette smoking and use of smokeless tobacco with more frequent self-reported bruxism, which association held even after adjustment for known confounders. The study was based on a large cohort of twins with high response rates, thus supporting the reliability and generalizability of the results.

To date, six studies have found some degree of association of smoking with bruxism. However, they have large variation in study design, sample size, definition of smoking, assessment of bruxism, and control for covariates. A Swedish cross-sectional study among 50-year-old men and women, based on a questionnaire ($n = 6,343$) and clinical examinations ($n = 941$) for validating and qualifying responses, showed a significant association in a multivariate model (with many covariates) between self-reported bruxism and daily tobacco use (either cigarette smoking or smokeless tobacco; Johansson et al., 2004). No difference in the prevalence of bruxism was found by tobacco use status prior to adjustment for covariates.

A 1-year follow-up study among Finnish 30- to 55-year-old workers in a media company ($n = 211$) revealed a significant association between tobacco use and bruxism (Ahlberg et al., 2004). Smokers reported bruxism 2.4 (95% CI 1.2–4.9) times more likely than nonsmokers. Bruxism was based on responses to baseline and follow-up surveys. All tobacco use (including cigars, pipe, and smokeless tobacco) was categorized as smoking. In comparison, in the present study, the OR for weekly bruxism was 2.5 for heavy smokers compared with never-smokers. Another survey in the same company ($n = 874$) showed that increasing smoking frequency and frequent bruxism were slightly associated (Ahlberg et al., 2005). This association was, however, not significant.

In interviews of 13,057 adults in Europe, 8.2 % reported tooth grinding during sleep at least weekly (Ohayon et al., 2001). The crude ORs were 1.6 for both smoking less and more than 20 cigarettes daily compared with nonsmokers, but after adjustment for multiple variables, the OR for heavier smokers was 1.0, while that for light smokers was 1.3. Among 2,019 Canadians, Lavigne et al. (1997) found a significant OR of 1.9 for a smoker to report bruxism. Sampling 15 subjects from that survey, they also found in sleep laboratory that smokers (mean age 29 years, SD 5 years) had five times more bruxism episodes during sleep than nonsmokers (mean age 25 years, SD 4 years).

The earlier studies have all used subject reports of bruxism by questionnaire or interview for the epidemiological analyses. Using questionnaires may cause difficulties in defining the actual prevalence of bruxism: It may be even more common among populations than surveys indicate but not recognized as a behavior by individuals. Moreover, reporting of bruxism may be influenced by negative affectivity (Turner, Dworkin, Mancl, Huggins, & Truelove, 2001). In our own analyses, subjective distress assessed using the GHQ was strongly associated with bruxism, but this did not account for the smoking association.

In most epidemiological studies, the causal nature of the association between exposure (such as tobacco use) and putative outcome (such as bruxism) is explored by examining whether it can be accounted for by confounding, that is, third variables that would eliminate the observed association. The potential confounders only slightly attenuated the association between smoking and bruxism, providing evidence for a causal relationship despite the cross-sectional nature of the data. The discordant twin study tests whether the association is present even after adjustment for unmeasured familial and genetic factors, but our analysis was underpowered to resolve this. Thus, our twin study provides novel evidence for a possible link between tobacco use and bruxism. Replication of this result in other twin datasets is needed.

The present study shows a clear association between cumulative cigarette smoking and more frequent bruxism, which is in line with the few previous findings. In our study, the use of smokeless tobacco was also significantly associated with bruxism. As the

Table 2. Multinomial logistic regression: independent effects of tobacco use (cigarette smoking, snuff use, and ever use of cigars or piper) on risk of “weekly” and “rarely” reported bruxism compared with those with no bruxism. Age and gender are included in the “crude” age–sex adjusted model ($n = 3,113$ for subjects with data on all variables), while the “multi” multivariate model adjusted also for alcohol drinking to intoxication, RAPI score, illicit drug use, GHQ-21, and coffee use^a

	Crude OR	95% CI	p value	Multi OR	95% CI	p value
Weekly						
Gender (female)	1.89	1.37–2.61	<.001	1.73	1.24–2.41	.001
Age	0.90	0.74–1.09	.29	0.90	0.74–1.09	.28
Never-smoker	1.00	(Reference category)		1.00	(Reference category)	
Former smoker	1.09	0.71–1.68	.68	1.12	0.72–1.74	.61
Light smoker	1.26	0.89–1.77	.19	1.13	0.80–1.61	.49
Heavy smoker	2.26	1.58–3.23	<.001	1.93	1.29–2.88	.001
No snuff use	1.00	(Reference category)		1.00	(Reference category)	
Snuff occasionally	1.29	0.92–1.80	.14	1.20	0.85–1.70	.29
Snuff regularly	2.45	1.44–4.18	.00	2.06	1.19–3.56	.01
Cigar smoking (yes)	1.06	0.69–1.61	.80	1.01	0.66–1.56	.95
Rarely						
Gender (female)	1.22	1.00–1.49	.05	1.19	0.97–1.47	.1
Age	0.98	0.86–1.11	.74	0.99	0.87–1.12	.84
Never-smoker	1.00	(Reference category)		1.00	(Reference category)	
Former smoker	1.06	0.80–1.39	.70	1.04	0.79–1.38	.76
Light smoker	1.17	0.93–1.48	.18	1.07	0.83–1.38	.59
Heavy smoker	1.68	1.30–2.18	<.001	1.53	1.14–2.03	.004
No snuff use	1.00	(Reference category)		1.00	(Reference category)	
Snuff occasionally	1.29	1.04–1.60	.02	1.26	1.01–1.57	.04
Snuff regularly	1.21	0.80–1.81	.36	1.13	0.75–1.70	.56
Cigar smoking (yes)	1.16	0.88–1.52	.29	1.10	0.83–1.45	.51

Notes. GHQ = General Health Questionnaire; OR = odds ratio.

^aCovariates and classification: frequency of alcohol intoxication with four categories: at least weekly drinking, at least bimonthly drinking, less frequent, and abstinence. Use of illicit drugs (“Have you ever used hashish, marijuana or other drugs, or for example sniffed glue?”): 1) Never, 2) 1–3 times, 3) 4–9 times, 4) 10–19 times, and 5) 20 times or more. Coffee use: “never,” “few times in a month or less often,” “few times in a week,” “daily,” or “several times a day.” GHQ (standard 20-item GHQ and one additional item [score range 0–63]) as a continuous variable. Rutgers Alcohol Problem Index (23 items) as a continuous variable.

association was found with both forms of tobacco and a dose–response relationship was found, the present results support our hypothesis of a link between nicotine intake and bruxism.

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Declaration of Interests

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