Factors Associated with Untreated Decayed Teeth in Male Sales Workers: An Internet Survey

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Abstract

The purpose of this study was to identify factors associated with untreated decayed teeth (DT) in male sales workers. The participants were recruited by screening a pool of Japanese registrants in an online database for eligibility for inclusion in the study. Between 20 February 2015 and 11 March 2015, those deemed eligible were asked to complete a questionnaire on the status of their oral health. Responses from a total of 142 male sales workers aged between 30 and 49 years were analyzed. Of these, 40 reported DT and 102 no untreated decayed teeth (NDT). The percentage of participants with DT was higher than that with NDT among night shift workers ($p < 0.001$). A higher percentage of participants with DT reported pain when eating or drinking something cold ($p = 0.041$), pain in the teeth or gingiva ($p < 0.001$), or frequent stomatitis ($p = 0.030$). A higher percentage of participants with DT reported eating between meals ($p = 0.027$) and a lower percentage visiting a dental clinic in the past 6 months ($p = 0.017$) compared with among participants with NDT. Those with NDT were more likely to report an inability to visit a dental clinic when they wanted to ($p = 0.033$), but those with DT were more likely to report that their reasons for not visiting a dental clinic were that multiple visits were required for treatment ($p = 0.012$) or that they did not like the treatment ($p = 0.005$). Working the night shift (Odds Ratio [OR], 3.492; 95% Confidence Interval [CI], 1.347–8.725) and visiting a dental clinic in the past 6 months (OR, 0.084; 95%CI, 0.010–0.733) were identified as independent variables correlated with leaving DT untreated. Requiring oral health education and dental checkups at least once every 6 months may have a positive effect on oral health among male sales workers, especially those doing night shifts.

Key words: Occupational oral health — Sales workers — Untreated decayed teeth — Oral health behavior — Night shift work

Introduction

Work-related diseases are multifactorial, with the work environment playing a partial role in causation. Such diseases include chronic non-communicable diseases affecting working populations⁷⁾. They also include musculoskeletal disorders²⁴⁾, stress and mental health disorders²⁹⁾, work-related cancer¹⁴⁾, skin diseases³⁾, and work-related diseases arising from exposure to biological agents¹⁹⁾. Various studies have reported an association between job type and particular diseases, with professional drivers being reported to be at risk for diseases such as cardiovascular disease, diabetes mellitus, and lower back pain, for example^{16,18)}. Again, other studies have reported an association between sales work and testicular cancer³²⁾ or lingual dystonia³³⁾ due to the working environment characteristic of this occupation.

An association between job type and oral conditions has also been reported. Some studies have suggested that oral health status may be associated with job classification in Japan^{10,11,20,21,35)}. Only a few studies have investigated associations between oral conditions and job type, however. One study found that professional drivers had fewer teeth than white-collar workers³¹⁾.

Caries and periodontitis are the most common causes of loss of permanent teeth globally, and Japan is no exception in this respect^{1,22,34)}. Caries and its sequelae (43.3% combined) and periodontal disease (41.8%) were reported to be the main reasons for tooth extraction in Japan, and extraction due to caries or root fracture were commonly observed in all age groups over 15 years of age¹⁾. Furthermore, the incidence of vertical root fracture, which is mainly caused by endodontic treatment, is increasing³⁴⁾. Taken together, this indicates the importance of workers seeking treatment for decayed teeth as soon as possible.

Previous studies by the present group have investigated oral health status and behavior in workers by means of Internet-based surveys^{12,31)}. The focus in the present study, how-

ever, was on sales workers alone, as oral conditions differ depending on occupation. Our hypothesis was that sales workers who had a bad lifestyle, especially those who ate between meals, would have untreated decayed teeth (DT). The purpose of this study was to reveal factors associated with DT in male sales workers.

Methods

1. Selection of participants

This Internet-based survey was conducted in Japan between 20 February 2015 and 11 March 2015. Participants were selected from a pool of people registered with an online research company called Macromill (<https://www.macromill.com/>) who had agreed to participate in oral health-related surveys when they registered. These registrants were invited to participate in this survey and provided informed consent by clicking the corresponding button, after which they were screened for eligibility for enrolment. The questionnaire for this study was then sent to those registrants who met the following criteria: age, 30–49 years; sex, male; occupation, sales worker. The registrants then filled out the questionnaire and sent their responses *via* e-mail.

Data were collected from a total of 182 initially eligible respondents, among whom 40 whose annual family income was more than 10 million yen or unknown were subsequently excluded from the analysis to minimize the effect of income. A total of 142 male sales workers were therefore included in the final analysis. Among these, 40 had DT and 102 no DT (NDT). Respondents who had DT were defined as those who answered having one or more untreated teeth with a cavity or hole in the questionnaire described below. Participants were divided into two age groups: those aged 30–39 years and those aged 40–49 years.

2. Questionnaire items

Respondents were asked to report the following: annual household income; the num-

ber of years of service in their job; their work schedule (night shift workers were defined as those working on a shift rotation schedule that included the 10 p.m. through 5 a.m. period); smoking status (current smoker or not); diabetes and hypertension status (yes or no); and height and weight (the body-mass index (BMI) was then calculated and categorized as <25 or ≥ 25). Oral health status items comprised the number of present teeth; the presence or absence of at least one untreated tooth with a cavity or hole; and the presence or absence of the following symptoms: pain when eating or drinking something cold, pain in the teeth or gingiva, bleeding from the gingiva, swelling in the gingiva, difficulty opening the mouth, bad breath, and frequent stomatitis. Concerning oral health behavior, respondents were asked whether they brushed their teeth every day or not; how frequently they brushed their teeth every day (<2 or ≥ 2); whether they brushed before going to bed or not; whether they used fluoride toothpaste or not; how many minutes they spent brushing their teeth (<3 or ≥ 3); whether they used dental floss or an interdental brush or neither (yes or no); whether they ate between meals or not; whether they had a regular dental clinic or not; whether they had visited a dental clinic within the past 6 months or not; whether they were able to visit a dental clinic when they wanted to or not; and the reasons why they were unable to visit a dental clinic (unable to go during the hours the clinic was open, cost of treatment, too busy, multiple visits required for treatment, and disliking treatment).

3. Statistical analysis

A chi-squared test (or Fisher's exact test in cases with fewer than 5 cells in the contingency table) was used to make comparisons between the NDT and DT groups. The Mann-Whitney *U* test was used for an inter-group comparison of number of teeth.

Odds ratios (ORs) and 95% confidence intervals (CIs) were determined using multiple logistic regression analyses (forced entry method). The dependent variable was set as

participants with untreated decayed teeth. The model included variables showing a difference in association between NDT and DT. Age, annual household income, eating between meals, night shift, and visiting a dental clinic in the past 6 months were set as the independent variables. The data was analyzed using IBM SPSS Statistics, Version 25.0 (IBM Corp., Armonk, NY, USA). This study was approved by the Ethics Committee of Tokyo Dental College (Approval no: 602).

Results

Table 1 shows a comparison of the basic characteristics, general health behavior, and diseases in the DT and NDT groups. Significant differences were observed between the two groups in annual family income among participants aged 30–39 years ($p=0.032$). Significant differences were also observed between the two groups in night shift work among participants aged 30–39 years ($p=0.001$), and among all participants in aggregate ($p<0.001$).

Table 2 shows self-assessed oral health status in the DT and NDT groups. In the 30–39 age group, a higher percentage of participants with DT reported pain in the teeth or gingiva ($p=0.009$), bad breath ($p=0.048$), or frequent stomatitis ($p=0.035$). In the 40–49 age group, a higher percentage of participants with DT reported pain when eating or drinking something cold ($p=0.002$). This was also true for participants in both age groups combined ($p=0.041$ for pain when eating or drinking something cold; $p<0.001$ for pain in the teeth or gingiva; and $p=0.030$ for frequent stomatitis).

Table 3 shows the results for oral health behavior, again comparing the two groups. In the 40–49 age group, the percentage of participants with DT reporting eating between meals was higher ($p=0.047$) and having a regular dental clinic lower ($p=0.013$) than among those with NDT. Among all age groups combined, the percentage of participants with DT reporting eating between meals was

Table 1 Comparison of basic characteristics, general health behavior, and diseases between DT and NDT by age group

		30–39 years		40–49 years		Total	
		%	n	%	n	%	n
	DT	50.0	20	50.0	20	100.0	40
	NDT	50.0	51	50.0	51	100.0	102
		p value		p value		p value	
Annual family income							
<4 million yen	DT	50.0	10	30.0	6	40.0	16
	NDT	23.5	12	17.6	9	20.6	21
4–6	DT	35.0	7	10.0	2	22.5	9
	NDT	31.4	16	31.4	16	31.4	32
≥6	DT	15.0	3	60.0	12	37.5	15
	NDT	45.1	23	51.0	26	48.0	49
Years of service							
<10 years	DT	85.0	17	55.0	11	70.0	28
	NDT	64.7	33	45.1	23	54.9	56
≥10 years	DT	15.0	3	45.0	9	30.0	12
	NDT	35.3	18	54.9	28	45.1	46
Night Shift	DT	50.0	10	30.0	6	40.0	16
	NDT	11.8	6	15.7	8	13.7	14
Current smoker	DT	50.0	10	30.0	6	40.0	16
	NDT	31.4	16	33.3	17	32.4	33
Diabetes	DT	0.0	0	10.0	2	5.0	2
	NDT	2.0	1	5.9	3	3.9	4
Hypertension	DT	15.0	3	10.0	2	12.5	5
	NDT	3.9	2	15.7	8	9.8	10
BMI 25 and over	DT	45.0	9	35.0	7	40.0	16
	NDT	33.3	17	31.4	16	32.4	33

DT: sales workers with untreated decayed teeth; NDT: sales workers with no untreated decayed teeth.

Chi-squared test (or Fisher's exact test in cases with fewer than 5 cells in contingency table) was used to compare between two groups.

higher ($p=0.027$) and visiting a dental clinic in the past 6 months lower ($p=0.017$) than in those with NDT. In the 30–39 age group, participants with NDT were more likely to report an inability to visit a dental clinic when they wanted to ($p>0.05$), whereas those with DT more often reported that the reason for being unable to visit a dental clinic was that multiple visits were required for treatment ($p=0.016$). In the 40–49 age group, participants with

NDT were again more likely to report an inability to visit a dental clinic when they wanted to ($p=0.005$), whereas those with DT more often reported that the reason for being unable to visit a dental clinic was that they did not like treatment ($p=0.001$). Among all age groups combined, participants with NDT were more likely to report an inability to visit a dental clinic when they wanted to ($p=0.033$), whereas those with DT were more likely to

Table 2 Comparison of oral health symptoms between DT and NDT by age group

Mean number of teeth		30–39 years			40–49 years			Total		
		p value			p value			p value		
		DT	25.3 ± 5.9	0.931	25.0 ± 6.2	0.157	25.1 ± 6.0	0.356	26.1 ± 5.7	
	NDT	25.1 ± 6.1			27.1 ± 5.1					
Symptoms		%	n	p value	%	n	p value	%	n	p value
Pain when eating/drinking something cold	DT	30.0	6	0.787	65.0	13	0.002	47.5	19	0.041
	NDT	33.3	17		25.5	13		29.4	30	
Pain in the teeth or gingiva	DT	35.0	7	0.009	25.0	5	0.105	30.0	12	<0.001
	NDT	7.8	4		7.8	4		7.8	8	
Gingival bleeding	DT	30.0	6	0.699	25.0	5	0.760	27.5	11	0.621
	NDT	25.5	13		21.6	11		23.5	24	
Gingival swelling	DT	20.0	4	0.092	20.0	4	0.491	20.0	8	0.100
	NDT	5.9	3		13.7	7		9.8	10	
Difficulty opening the mouth	DT	10.0	2	0.189	10.0	2	0.314	10.0	4	0.098
	NDT	2.0	1		3.9	2		2.9	3	
Bad breath	DT	45.0	9	0.048	20.0	4	0.491	32.5	13	0.054
	NDT	21.6	11		13.7	7		17.6	18	
Frequent stomatitis	DT	25.0	5	0.035	5.0	1	0.487	15.0	6	0.030
	NDT	5.9	3		2.0	1		3.9	4	

DT: sales workers with untreated decayed teeth; NDT: sales workers with no untreated decayed teeth.

Chi-squared test (or Fisher's exact test in cases with fewer than 5 cells in contingency table) was used to compare between two groups.

Mann-Whitney *U* test was used to compare number of teeth between two groups.

report that the reasons for being unable to visit a dental clinic were that multiple visits were required for treatment ($p=0.012$) and that they did not like treatment ($p=0.005$).

Table 4 shows which factors were revealed to contribute to the presence of DT by multiple logistic regression analysis. The independent variables found to be correlated with leaving decayed teeth untreated were night shift (OR, 3.492; 95%CI, 1.347–8.725) and visiting a dental clinic in the past 6 months (OR, 0.084; 95%CI, 0.010–0.733).

Discussion

Previous reports have indicated that a self-reported questionnaire is a feasible tool for measuring oral health conditions, such as number of present and decayed teeth^{2,27}. Oral

health status is influenced by educational background, socioeconomic status, job stress, and sex^{4,6,17,23,25}. Therefore, to avoid interference from confounding factors as much as possible it is desirable to investigate participants with similar characteristics. With this in mind, male sales workers only were selected for inclusion in this study.

After adjusting for confounding factors, night shift work and not having visited a dental clinic in the past 6 months were determined to be risk factors for the presence of DT. The present finding that night shift work is a risk factor for the presence of DT supports that of an earlier study by Ishizuka *et al.*¹². Furthermore, another earlier study found an association between shift work and periodontal health⁸, where it was found that shift workers aged ≥ 45 years were at higher risk for periodontitis. Unfavorable health conditions

Table 3 Comparison of oral health behavior between DT and NDT by age group

		30–39 years			40–49 years			Total		
		%	n	p value	%	n	p value	%	n	p value
Behavior										
Brushing teeth every day	DT	95.0	19	1.000	90.0	18	1.000	92.5	37	1.000
	NDT	92.2	47		92.2	47		92.2	94	
Brushing twice or more per day	DT	65.0	13	0.423	68.4	13	0.860	66.7	26	0.491
	NDT	74.5	38		70.6	36		72.5	74	
Brushing before bed	DT	60.0	12	0.405	57.9	11	0.606	59.0	23	0.340
	NDT	49.0	25		51.0	26		50.0	51	
Using fluoride toothpaste	DT	55.0	11	0.129	40.0	8	0.951	47.5	19	0.263
	NDT	35.3	18		39.2	20		37.3	38	
Spending 3 minutes or more when brushing	DT	40.0	8	0.810	42.1	8	0.420	41.0	16	0.455
	NDT	43.1	22		52.9	27		48.0	49	
Using dental floss or an interdental brush	DT	50.0	10	0.408	40.0	8	0.493	45.0	18	0.924
	NDT	39.2	20		49.0	25		44.1	45	
Eating between meals	DT	75.0	15	0.259	75.0	15	0.047	75.0	30	0.027
	NDT	60.8	31		49.0	25		54.9	56	
Having a regular dental clinic	DT	65.0	13	0.530	30.0	6	0.013	47.5	19	0.184
	NDT	56.9	29		62.7	32		59.8	61	
Visited a dental clinic in the past 6 months	DT	5.0	1	0.263	0.0	0	0.053	2.5	1	0.017
	NDT	17.6	9		17.6	9		17.6	18	
Unable to visit a dental clinic when wanted to	DT	40.0	8	0.810	30.0	6	0.005	35.0	14	0.033
	NDT	43.1	22		66.7	34		54.9	56	
Reasons for being unable to visit a dental clinic										
Cannot go when clinic is open	DT	35.0	7	0.632	30.0	6	0.333	32.5	13	0.719
	NDT	41.2	21		17.6	9		29.4	30	
Cannot afford treatment cost	DT	0.0	0	0.571	15.0	3	0.132	7.5	3	0.712
	NDT	7.8	4		3.9	2		5.9	6	
Too busy with work	DT	35.0	7	0.242	35.0	7	0.128	35.0	14	0.053
	NDT	21.6	11		17.6	9		19.6	20	
Multiple visits required for treatment	DT	25.0	5	0.016	10.0	2	0.314	17.5	7	0.012
	NDT	3.9	2		3.9	2		3.9	4	
Dislike treatment	DT	10.0	2	0.616	25.0	5	0.001	17.5	7	0.005
	NDT	5.9	3		0.0	0		2.9	3	

DT: sales workers with untreated decayed teeth; NDT: sales workers with no untreated decayed teeth.

Chi-squared test (or Fisher's exact test in cases with fewer than 5 cells in contingency table) was used to compare between two groups.

among night workers have been reported. With respect to lifestyle, night shift nurses had more unhealthy dietary behaviors than those without night shifts in a study of 340 hospital nurses⁹⁾. Moreover, shift work was associated

with stress and behavioral changes and eventually caused disease¹³⁾. Taken together, these studies suggest that night shift work causes behavioral changes and has a negative effect on not only general health, but also oral

Table 4 Factors contributing to leaving decayed teeth untreated by multiple logistic regression analysis (n = 142)

Independent variable		OR	95%CI	p value
Age	30–39 years	1		
	40–49	1.154	0.509–2.620	0.731
Annual household income	<4 million yen	1		
	4–6	0.339	0.113–1.018	0.054
	≥6	0.448	0.164–1.226	0.118
Eating between meals	No	1		
	Yes	2.322	0.959–5.624	0.062
Night shift	No	1		
	Yes	3.492	1.347–8.725	0.010
Visited a dental clinic in the past 6 months	No	1		
	Yes	0.084	0.010–0.733	0.025

OR: odds ratio; CI: confidence interval.

health. Indeed, in the current study it is clear that despite a higher percentage of those in the DT group reporting pain when eating or drinking something cold and pain in the teeth or gingiva, they were still leaving their decayed teeth untreated, eating between meals, and fewer of them had visited a dental clinic in the past 6 months compared to in the NDT group.

Night work was found to disturb regular dental attendance, with the percentage of employees adhering to <70% of appointments being higher among night workers (23.5%) than among non-night workers (7.5%)³⁰⁾. Not visiting a dental clinic in the past 6 months was associated with having at least one untreated decayed tooth (OR, 0.084) in the present study. Previous reports have also shown a negative association between regular dental visits and decayed teeth^{6,23)}. Irregular dental visitation was associated with at least one decayed surface (OR, 2.03)⁶⁾. This indicates that regularly visiting a dentist decreases the likelihood of DT.

Low socioeconomic status was identified as a barrier to dental attendance, and such barriers appear to have negative effects on oral health^{5,15)}. Universal health insurance in Japan covers most illnesses, so anyone can receive care at any hospital in the country. Therefore,

Japanese people can access treatment more easily and at a lower cost than in most areas of the world²⁶⁾. However, it was not possible to obtain detailed information regarding socioeconomic status in the present study. Therefore, there is a need for future inquiry into how this factor influences sales workers' behavior.

In this study, participants in the DT group were more likely to be night shift workers and eat between meals than those in the NDT group. Despite a higher percentage of participants in the DT group reporting pain when eating or drinking something cold and pain in the teeth or gingiva, more of those in the DT group were leaving decayed teeth untreated, and fewer of them had visited a dental clinic in the past 6 months compared to in the NDT group. Those in the DT group were less likely to report an inability to visit a dental clinic when they wanted to, and they reported that the reasons for being unable to visit a dental clinic were that multiple visits were required for treatment and that they disliked treatment, not because they could not go when the clinic was open or because they were too busy with work. Dental anxiety is a major impediment to dental attendance, contributing to irregular dental attendance patterns²⁸⁾. The dental profession should con-

sider these factors when planning programs to enhance access to dental care service.

This study had several limitations, the first of which is the possibility of selection bias due to the data being obtained by means of an Internet survey. The second limitation is that the oral health status information was self-assessed and self-reported. The third limitation is that data regarding the night shift workers' schedules, such as those concerning overtime, use of flexitime, break time, and number of holidays, were not taken into consideration. The final limitation of this study is that it was based on a cross-sectional survey.

Despite these limitations, however, the present results revealed that night shift work and not visiting a dental clinic in the past 6 months were associated with leaving decayed teeth untreated among male sales workers. These findings suggest that requiring oral health education and dental checkups at least once every 6 months may have a positive effect on oral health among male sales workers, especially those undertaking night shifts.

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