Scientific Research Report

A multicentre tobacco cessation intervention study in the dental setting in Japan

Toru Nagao [a*], *Jinichi Fukuta* [b], *Takashi Hanioka* [c], *Yohei Nakayama* [d], *Saman Warnakulasuriya* [e], *Tadaaki Sasaki* [f], *Makoto Shiota* [g], *Keisuke Ohno* [h], *Yoshiki Ishigaki* [i], *Kazuhito Satomura* [j], *Shuji Hashimoto* [k], *Mitsuo Goto* [a], *Kanichi Seto* [l], *on behalf of Tobacco Cessation Intervention Study for Oral Diseases*

[a] *Department of Maxillofacial Surgery, School of Dentistry, Aichi Gakuin University, Nagoya, Japan*
[b] *Department of Oral and Maxillofacial Surgery, Shin-Yurigaoka General Hospital, Kawasaki, Japan*
[c] *Department of Preventive and Public Health Dentistry, Fukuoka Dental College, Fukuoka, Japan*
[d] *Department of Periodontology and Research Institute of Oral Science, Nihon University School of Dentistry at Matsudo, Matsudo, Japan*
[e] *Faculty of Dentistry, Oral & Craniofacial Sciences, King's College London, WHO Collaborating Centre for Oral Cancer, London, UK*
[f] *Department of Oral and Maxillofacial Surgery, Utsunomiya Memorial Hospital, Utsunomiya, Japan*
[g] *Department of Oral Implantology and Regenerative Medicine, Graduate School of Tokyo Medical and Dental University, Tokyo, Japan*
[h] *Department of Oral and Maxillofacial Surgery, Tokyo Dental College, Suidobashi Hospital, Tokyo, Japan*
[i] *Department of Oral and Maxillofacial Surgery, The Nippon Dental University Hospital, Tokyo, Japan*
[j] *Department of Oral Medicine and Stomatology, School of Dental Medicine, Tsurumi University, Yokohama, Japan*
[k] *Department of Hygiene, Faculty of Medicine, Fujita Health University, Toyoake, Japan*
[l] *Oral Cancer Center, Southern Tohoku General Hospital, Koriyama, Japan*

ARTICLE INFO

Article history:
Received 28 January 2021
Accepted 8 February 2021
Available online 18 March 2021

Key words:
Tobacco cessation
Clinical trial
Oral diseases
Dental setting

ABSTRACT

Objective: The objective of this study was to assess the efficacy of a tobacco cessation intervention conducted by different dental specialists directed at a group of patients with tobacco-related oral diseases or undergoing implant treatment.

Methods: The study design was a multicentre, nonrandomized prospective cohort study to examine the effects of smoking cessation. The target patients were current smokers (aged ≥20 years) with an oral potentially malignant disorder or periodontitis and those seeking dental implants. A total of 74 patients were enrolled in the study. All dental specialists who participated in the trial completed an e-learning Japan Smoking Cessation Training Outreach Project (J-STOP) tobacco cessation education programme. Nicotine dependence was evaluated by the Fagerstrom Test for Nicotine Dependence. Cessation status was verified biochemically by measurement of salivary cotinine or exhaled carbon monoxide. Tobacco cessation intervention was implemented for 8 weeks with or without nicotine replacement therapy with follow-up for 12 months.

Results: A total of 61 patients agreed to the tobacco cessation intervention. The mean biochemically confirmed tobacco abstinence rate was 37.7% at month 3, 34.4% at month 6, and 32.8% at month 12. The highest rate of biochemically confirmed tobacco abstinence at month 12 was among patients receiving implant treatment (42.9%) followed by patients with oral potentially malignant disorder (37.1%), and those with periodontitis (21.1%).

Conclusion: This interventional study demonstrates the challenges encountered and the feasibility of tobacco cessation intervention among Japanese patients attending dental

* *Corresponding author*. Department of Maxillofacial Surgery, Aichi Gakuin University Dental Hospital, 2-11, Suemori-dori, Chikusa-ku, Nagoya, 464-8651 Japan.
E-mail address: tnagao@dpc.agu.ac.jp (T. Nagao).

https://doi.org/10.1016/j.identj.2021.02.002

specialists who had completed an e-learning course on smoking cessation. Making tobacco cessation an integral part of patient management by dental specialists requires further evaluation.

Introduction

Cigarette smoking is a major health risk but is a modifiable risk factor.[1,2] Substantial reduction of mortality from noncommunicable diseases requires policies targeted at the reduction of tobacco and alcohol use.[3] However, a 2019 World Health Organization (WHO) report revealed that many countries do not have adequate policies in place to help their citizens stop smoking to prevent tobacco-induced diseases.[4]

The 2017 National Health and Nutritional Survey Japan quoted in the WHO report on the Global Tobacco Epidemic 2019 reported that 29.3% of men and 7.2% of women aged ≥20 years were current cigarette smokers and that smoking rates were particularly high in the fourth decade among both sexes.[4] Japan's national score for implementing the WHO Framework Convention on Tobacco Control by MPOWER measures was still behind that of most countries in 2019.[5] Consequently, tobacco control remains a health priority in Japan.

A recent questionnaire-based survey in Japan suggested that patients who are willing to quit smoking are likely to accept tobacco cessation counselling and treatment in a dental setting.[6] This will undoubtedly expand the duties of oral health professionals (OHPs) if tobacco cessation counselling is included under the treatment of dental patients covered by national health insurance. Smoking-related oral diseases and disorders include oral cancer, oral potentially malignant disorders (OPMDs), periodontal disease, implant failure, and other benign mucosal disorders (eg, oral pigmentation, nicotine stomatitis).[7] There is a close relationship between smoking and OPMDs, including oral leucoplakia, erythroplakia, and proliferative verrucous leucoplakia. All patients diagnosed with an OPMD should receive tobacco cessation counselling to reduce their risk of future malignancy.[8] Cigarette smoking is a recognised risk factor for periodontitis[7] that can alter the progression of periodontitis.[9] Smoking affects the rate of progression of periodontitis from Grade A to C, and the smoking status (ie, being a nonsmoker, smoking <10 cigarettes/d or ≥10 cigarettes/d) is considered a "grade modifier" in the classification of periodontitis published in 2017.[9] The association of smoking with tooth loss[2] is supported by grade I evidence.[10] For implant failure, the evidence for the effect of smoking is grade II.[9]

A Cochrane review concluded that behavioural interventions for smoking cessation performed by OHPs incorporated into oral examinations in the dental setting may increase smoking cessation rates among both smokers and users of smokeless tobacco.[11] However, tobacco intervention in the dental setting has been limited, and OHPs have not fully accepted the opportunities for tobacco intervention in dental practice.[12,13] The key barriers noted are the lack of training opportunities for dentists and the limited time available for smoking cessation activity in most dental practices.[14] However, lifelong learning web-based programmes aimed at health professionals are available.[15]

The WHO recommends that OHPs should routinely provide brief 3- to 5-minute tobacco cessation interventions for all smokers in primary oral health care using the 5A and 5R models.[2] Although there have been studies on tobacco cessation intervention in dentistry,[11] it is not known if the efficacy of tobacco cessation intervention varies according to the type of tobacco-related oral disease.

The aim of this article is to report the outcome of a tobacco cessation intervention trial by dental specialists in patients with OPMD, periodontitis, or those needing a dental implant conducted in the dental setting in Japan. The trial is registered as the Tobacco Cessation Intervention Study for Oral Diseases (TISOD; ClinicalTrials.gov NCT02737176 and UMIN000021429).

Materials and methods

The study design was a multicentre, nonrandomized prospective cohort study to examine the effects of smoking cessation. The patients were recruited from outpatient dental clinics (hospital and private) in Japan between April 2016 and December 2018. The specialists serving these clinics were affiliated with the Association for the Japanese Academy of Maxillofacial Implants, Association for the Japanese Society of Oral and Maxillofacial Surgeons, Association for the Japanese Society of Oral Implantology, Japanese Society of Oral Medicine, Japanese Society of Periodontology, Japanese Academy of Clinical Periodontology, Japanese Society for Oral Health, Japanese Society of Dentistry for Medically Compromised Patients, or Japanese Society of Oral Oncology. Patients were eligible for inclusion in the study if they were a current smoker (age ≥20 years) with a tobacco-related oral conditions, including OPMD (pathologically diagnosed as oral leucoplakia, erythroplakia, or oral lichen planus), periodontitis, or tooth loss (receiving dental implantation). The smoking habit was defined as lifetime smoking of more than 100 cigarettes, smoking for more than 6 months, or having smoked daily or regularly in the past month as defined by the Ministry of Health, Labour, and Welfare of Japan. These criteria published by the Japanese Ministry were based on the 1998 WHO guidelines for controlling and monitoring the tobacco epidemic.[16] A histopathological diagnosis of OPMD was confirmed prior to intervention in all cases. Patients with a clinical diagnosis of nicotine stomatitis were also included. Current smokers with periodontitis had at least 30% of teeth with a periodontal pocket depth of ≥4 mm and 3 or more sites with a periodontal pocket depth of ≥6 mm. In cases of tooth

loss, the treatment plan included the placement of a dental implant. Patients who had already received any form of tobacco cessation intervention within the previous 3 months, those with periodontitis and using anti-inflammatory drugs or steroids, those who had received periodontal treatment within the previous 6 months, those who had undergone surgery for oral mucosal disease, and those who were pregnant were excluded. The study was approved by the institutional review board of the Japanese Society of Oral and Maxillofacial Surgeons (No. 2015-004) and received ethical approval from each study centre's local ethics committee. Written informed consent was obtained from all study participants.

Standardisation of tobacco cessation skills was essential for planning this multicentre tobacco cessation intervention study. Figure 1 shows the time course of the e-learning tobacco cessation skills programme provided to all dental specialists enrolled in the study. As a result of exploratory meetings held by each professional society before the study, 186 dental specialists were recruited from 112 facilities. In total, 133 dental specialists (71.5%) completed a 10- to 12-hour e-learning tobacco cessation education programme known as the Japan Smoking Cessation Training Outreach Project (J-STOP).[17] The Internet Data and Information Center for Medical Research (INDICE) at University Hospital Medical Information Network (UMIN) was used for central registration of subjects.

The patients received tobacco cessation advice and counselling by their dentists 2 weeks before their quit date. The components of the counselling package were as follows: (i) smoking cessation methods; (ii) assistance with smoking cessation, a solution strategy during smoking cessation, and use of nicotine replacement therapy (NRT) products; (iii) brief instructions on smoking cessation; (iv) components of follow-up (counselling during smoking cessation, positive reinforcement for maintaining smoking cessation, and risk of relapse); (v) clinic attendance time required to receive smoking cessation instructions (first and second instructions, less than 15 minutes; third, fourth, and fifth instructions, less than 5 minutes); (vi) number of visits required for examination and consultation; and (vii) setting a quit date for smoking cessation.

Nicotine dependence status was evaluated using the Fagerstrom Test for Nicotine Dependence (FTND).[18] A score of 3 or more out of 10 was considered as moderate or high tobacco dependence requiring tobacco cessation intervention. Even if the score was <3, the patient was eligible if they requested a tobacco cessation intervention. During the tobacco cessation intervention period, the attending dental specialists implemented standard dental or oral surgery as indicated for the presenting primary condition. The planned treatment was continued even if study participants failed to abstain from smoking. Patients who agreed to use NRT were supplied with over-the-counter nicotine patches (Nicotinell, GlaxoSmithKline Consumer Healthcare Japan K.K.) free of charge for 8 weeks (on 4 occasions at 2-week intervals). Alternatively, patients were permitted to use nicotine gum of their choosing for 12 weeks on a self-funded basis. Those who did not express an intention to quit smoking were allocated to a nonintervention (control) group and offered the same treatment for their specific oral conditions as that provided in the tobacco cessation intervention group. Treatment for periodontitis included standard periodontal therapy with or

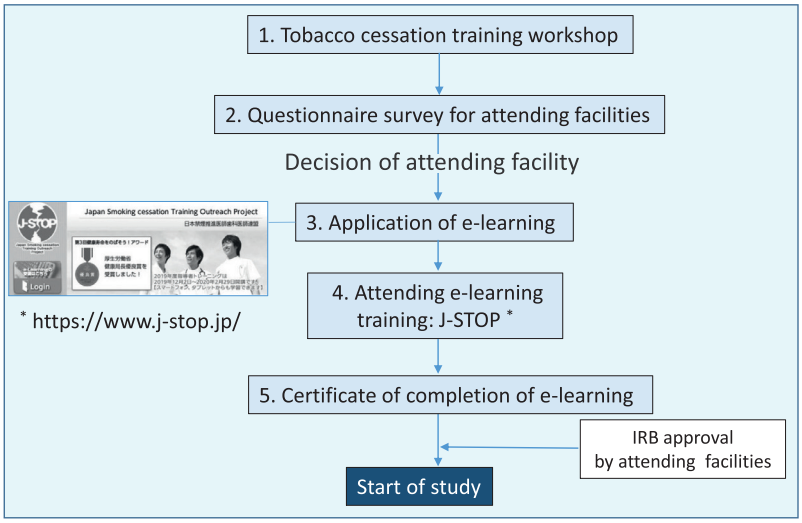

Fig. 1 – Flowchart showing standardisation of tobacco cessation skills by an e-learning programme. Three of 9 attending societies (Japanese Academy of Maxillofacial Implants, Association for the Japanese Society of Oral and Maxillofacial Surgeons, and the Japanese Society of Periodontology) conducted a tobacco cessation training workshop at their national meeting in 2015. An e-learning training programme developed by the Japan Smoking Cessation Training Outreach Project (J-STOP) (https://www.j-stop.jp/) (in Japanese) was made available for standardisation of the tobacco cessation counselling skills of the attending dental specialists. The training programme consisted of 3 stages (smoking cessation treatment, smoking cessation advice, and smoking cessation support) to improve knowledge, attitude, self-efficacy, and behaviour upon its completion. The time required to complete the e-learning programme was generally 10-12 hours. Attending dentists were required to obtain a certificate on completion of the e-learning programme. OPMD = oral potentially malignant disorder.

without periodontal surgery. Surgical resection of OPMD was undertaken based on the severity of epithelial dysplasia in a diagnostic biopsy specimen before or after the intervention.

The trial outcome was the tobacco abstinence rate at 3, 6, and 12 months, which was evaluated by patients' self-reports and confirmed by biochemical validation tests in all subjects. Comparisons were made between the intervention group and the nonintervention group and among the 3 oral diseases.

Expired carbon monoxide was measured at each attendance during the study period by a breath analyser if it was available in the clinic. Otherwise, the salivary cotinine level was analysed by the semi-quantitative NicAlert method (Nymox Pharmaceutical Corp.). Smoking relapse was defined as erratic adherence to the intervention, dropping out, failure of the investigator to perform a biochemical validation test, or refusal of the offer of a biochemical validation test by the patient. Levels of carbon monoxide ≥8 ppm and salivary cotinine levels >10 ng/mL were defined as indicating a relapse in their quit attempt. Use of e-cigarettes or heat-not-burn tobacco products during the quitting period was recorded as relapse in the self-report. Upon completion of the study, we sent a questionnaire via Google Forms to nonparticipating practices to explore their reasons for noncompliance. The questionnaire contained 16-item prompted reasons that could be selected from a drop-down menu to allow assessment of their reasons for nonparticipation.

Comparisons among OPMD, periodontitis, and implant patients regarding tobacco cessation rates were performed by Fisher exact test. Demographic differences between patients who achieved tobacco abstinence and those who relapsed or dropped out of the study were analysed by χ^2 test or Fisher exact test for categorical data and 2-tailed *t*-test for continuous variables. Differences in rates of smoking cessation were evaluated by comparison between use and nonuse of NRT in the intervention group and between the intervention and nonintervention groups. Odds ratios and 95% CIs were calculated by univariate and multivariate logistic regression analysis adjusted by age and sex for continuous abstinence in the intervention group relative to the nonintervention group. All statistical analyses were performed using JMP 13.0 software (SAS Institute Inc.). All statistical tests were 2-sided, and a *P* value of .05 was considered statistically significant.

Results

A total of 112 dental facilities accessed the e-learning programme, and dental specialists at these facilities registered for the study upon completion of the programme. During the study period, 27 facilities (24.1%) recruited 79 dental patients; the remaining 85 facilities did not recruit any participants. The mean number of potential study patients recruited from each facility was 2.7 (range 1-11). Five of the 79 recruits declined the opportunity to participate, leaving 74 dental patients for enrolment in the trial (Table 1).

The mean patient age was 52.4 ± 11.6 years and 52.7% of the patients were male. More than half (55.4%) of the patients with oral disease had an OPMD, followed by periodontitis

Table 1 – Patient demographic and clinical characteristics.

Variable		Total *n* = 74 (%)	Intervention group *n* = 61 (%)	No-intervention group *n* = 13 (%)	*P* value*
Sex	Male	39 (52.7)	33 (54.1)	6 (46.2)	.602
	Female	35 (47.3)	28 (45.9)	7 (53.8)	
Age, years, mean and SD		52.4 ± 11.6	52.1 ± 12.0	53.5 ± 9.7	.706
Disease	OPMD	41 (55.4)	35 (57.4)	6 (46.2)	.628
	Periodontitis	25 (33.8)	19 (31.1)†	6 (46.2)	
	Implant	8 (10.8)	7 (11.5)	1 (7.6)	
Smoking, median, (range)	Cigarettes/d	20 (2-40)	20 (2-40)	15 (6-25)	.072
	Years	30 (2-50)	30 (2-50)	35 (15-47)	.276
	Pack-years	28 (0.2-86)	28 (0.2-86)	32 (8-43)	.950
Alcohol consumption	Regular	29 (39.2)	21 (34.4)	8 (61.5)	.102
	Occasional	34 (46.0)	29 (47.5)	5 (38.5)	
	Never	11 (14.8)	11 (18.0)	0	
Systemic disease	Yes	28 (37.8)	24 (39.3)	4 (30.8)	.755
	No	46 (62.2)	37 (60.7)	9 (69.2)	
Medications	Yes	24 (32.4)	19 (31.1)	5 (38.5)	.746
	No	50 (67.6)	42 (68.9)	8 (61.5)	
Level of nicotine addiction‡	High (≥7)	20 (27.0)	17 (27.9)	3 (23.1)	.500
	Moderate (3–6)	48 (64.9)	40 (65.6)	8 (61.5)	
	Low (≤2)	6 (8.1)	4 (6.5)	2 (15.4)	
Willingness to quit smoking	Strong	55 (74.3)	52 (85.2)	3 (23.1)	<.0001
	Weak	11 (14.9)	9 (14.8)	2 (15.4)	
	None	8 (10.8)	0	8 (61.5)	
NRT use§	Yes	38 (51.4)	38 (62.3)	0	<.0001
	No	36 (48.6)	23 (37.7)	13 (100)	

NRT = nicotine replacement therapy; OPMD = oral potentially malignant disorder; SD = standard deviation.

* χ^2 test or Fisher exact test was used to compare differences between groups.
† 1 subject had both periodontitis and tooth loss requiring implantation.
‡ Fagerstrom Test for Nicotine Dependence.
§ Free of charge over-the-counter nicotine patches were supplied by the investigators.

(33.8%), and implant placement (10.8%). The median number of cigarettes smoked per day was 20 (range 2-40) and the median number of pack-years was 28 (range 0.2-86). In total, 85.2% of the patients consumed alcohol regularly or on a social basis, 37.8% had systemic disease, and 32.4% were taking regular prescription medications.

The nicotine addiction level (median FTND) in this cohort of dental patients was 5 (range 1-8) and was high (≥7) in 27.0%, moderate (3-6) in 64.9%, and low (≤2) in 8.1%. A total of 61 patients (82.4%), including 4 with a score of <3, opted to receive tobacco cessation intervention and were enrolled in the intervention group. The other 13 participants (17.6%) had no intention of quitting smoking or did not satisfy the inclusion criteria and agreed to enrolment in the nonintervention group (Figure 2).

Men were more likely to agree to a cessation intervention than women (84.6% vs 80.0%). Acceptance of the cessation intervention was significantly higher for those who had a strong willingness to quit smoking than those who did not (85.2% vs 23.1%; $P < .0001$), which was consistent with nicotine addiction levels (Table 1). Most (87.5%) of the patients who requested a dental implant were likely to accept the intervention at various time points during the study period, followed by patients with an OPMD (85.4%) and those with periodontal disease (76.0%). However, the proportion who wanted to quit smoking at the first visit was highest ($P = .014$) among patients with an OPMD (85%), followed by those with periodontitis (63%) and those seeking an implant (60%) (data not shown).

The self-reported tobacco abstinence rate in the intervention group was 62.3% (38 out of 61) at month 3, 42.6% (26 out of 61) at month 6, and 41.0% (25 out of 61) at month 12 (Table 2); however, the respective biochemically confirmed abstinence rates were 37.7% (23 out of 61), 34.4% (21 out of 61), and 32.8% (20 out of 61). The patients receiving implant treatment achieved the highest rate of biochemically

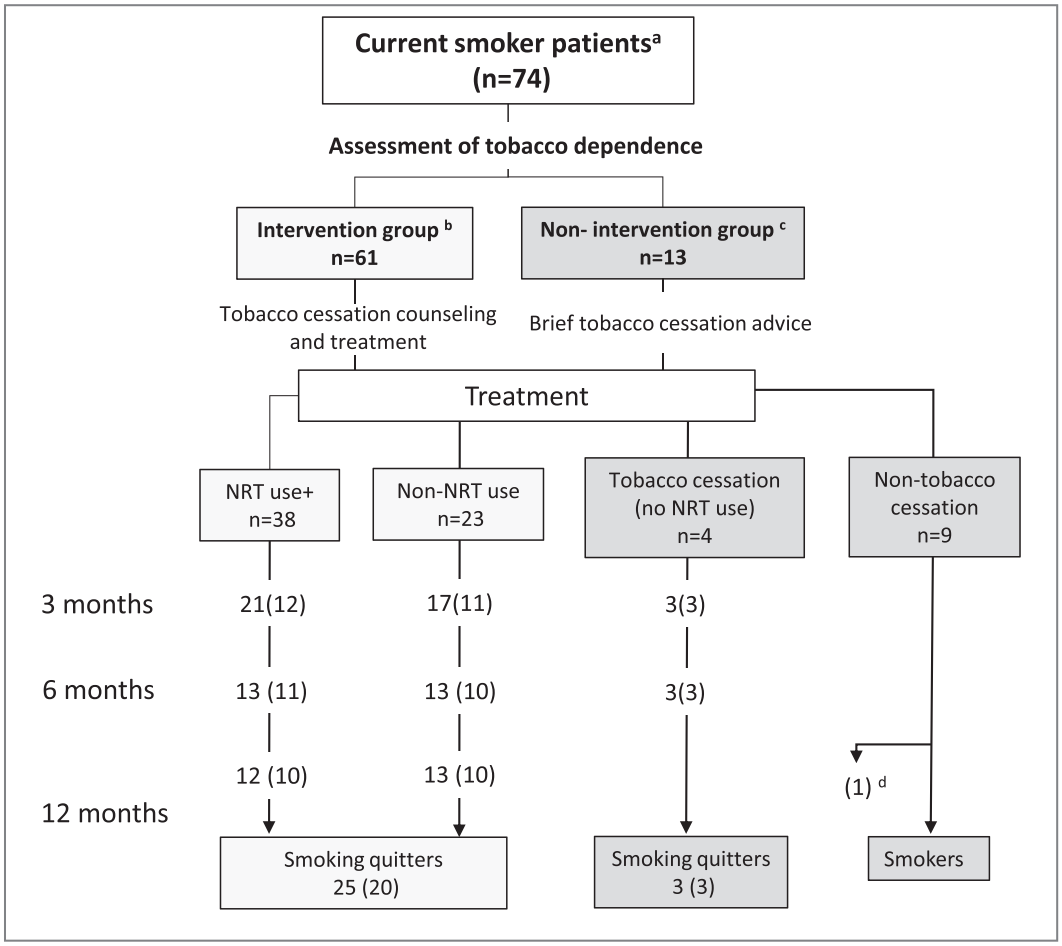

Fig. 2 – Flowchart showing tobacco cessation interventions and outcomes. Number in parentheses means biochemically confirmed. The intervention group was divided into those who used NRT and those who did not. Attending specialist dentists implemented the tobacco cessation intervention at the same time as providing standard dental care. Smoking cessation status was confirmed by patient self-reporting at 3, 6, and 12 months and by measurement of cotinine in saliva or expired CO for biochemical confirmation of smoking cessation. a, OPMD, periodontitis, and tooth loss (implant treatment scheduled). b, Strong ($n = 52$) or weak ($n = 9$) intention to quit smoking. c, No ($n = 8$), weak ($n = 2$), or strong ($n = 3$) intention to quit smoking. d, Tobacco cessation (3 months) at 9 months after entry. CO = carbon monoxide; NRT = nicotine replacement therapy; OPMD = oral potentially malignant disorder.

Table 2 – Tobacco abstinence rates in the intervention group after tobacco cessation by self-reporting or validated biochemically, grouped according to the presence of 3 oral conditions.

Method	Duration (months)	Total $n = 61$ (%)	OPMD $n = 35$ (%)	Periodontitis $n = 19$ (%)*	Implant $n = 7$ (%)	P value†
Self-reported abstinence	3	38 (62.3)	21 (60.0)	11 (57.9)	6 (85.7)	.445
	6	26 (42.6)	17 (48.6)	6 (31.6)	3 (42.9)	.452
	12	25 (41.0)	16 (45.7)	6 (31.6)	3 (42.9)	.561
Biochemically confirmed abstinence‡	3	23 (37.7)	15 (42.9)	5 (26.3)	3 (42.9)	.480
	6	21 (34.4)	14 (40.0)	4 (21.1)	3 (42.9)	.311
	12	20 (32.8)	13 (37.1)	4 (21.1)	3 (42.9)	.451

OPMD = oral potentially malignant disorder.

* 1 subject had both periodontitis and tooth loss requiring implantation.
† Fisher exact test was used to compare differences between groups.
‡ Confirmed by the saliva cotinine level (0-10 ng/mL; NicAlert test) or carbon monoxide (0-7 ppm) by breath analyser as quitters.

confirmed tobacco cessation at 42.9% (3 out of 7) at month 12, followed by 37.1% (13 out of 35) of those with OPMD and 21.1% (4 out of 19) of those with periodontitis. One male patient with oral leucoplakia was considered a relapse in the self-report due to opportunistic use of a heat-not-burn tobacco product while successfully quitting smoking; however, a biochemical test was negative.

There were demographic differences between the tobacco quitters (≥12 months) and nonquitters in the intervention group; however, these differences were not statistically significant (Table 3). Female patients were more likely to quit smoking than their male counterparts. Patients with a high nicotine dependence score (≥7 by FTND) had a higher quitting rate (41.2%) than those with a moderate score (3-6 by FTND; 30.0%) or low score (≤2 by FTND; 25.0%; $P = .820$).

Five (12.8%) of 38 patients who used NRT dropped out of the trial during the 8-week NRT supplementation period, and 12 failed to quit smoking during the first 3-month period (Figure 2). In the intervention group, there were no significant differences in the self-reported or biochemically confirmed

Table 3 – Demographic differences between patients who achieved tobacco abstinence [n=20] and those who relapsed or dropped out of the study [n=41]

Variable and number in each subgroup [n]		Abstinence (≥12 months)* n=20 (%)	Relapsen=41 (%)	P value†
Age, years, mean, and SD		52.9 ± 14.3	51.9 ± 11.0	.539
Sex	Male [33]	8 (24.2)	25 (75.8)	.173
	Female [28]	12 (42.9)	16 (57.1)	
Disease	OPMD [35]	13 (37.1)	22 (62.9)	.451
	Periodontitis [19]	4 (21.1)‡	15 (78.9)	
	Implant [7]	3 (42.9)	4 (57.1)	
Smoking	Cigarettes [40] (median, range)	20 (50) (2-30)	20 (50) (5-40)	.427
	Years, mean, and SD	29.6 ± 14.6	27.6 ± 10.4	.553
	Pack-years, mean, and SD	26.8 ± 14.0	27.5 ± 16.0	.854
Alcohol consumption	Regular [21]	6 (28.6)	15 (71.4)	.877
	Occasional [29]	10 (34.5)	19 (65.5)	
	Never [11]	4 (36.4)	7 (63.6)	
Systemic disease	Yes [24]	7 (29.2)	17 (70.8)	.628
	No [37]	13 (35.1)	24 (64.9)	
Medications	Yes [19]	7 (36.8)	12 (63.2)	.650
	No [42]	13 (31.0)	29 (69.0)	
Level of nicotine addiction§	High (≥7) [17]	7 (41.2)	10 (58.8)	.820
	Moderate (3-6) [40]	12 (30.0)	28 (70.0)	
	Low (≤2) [4]	1 (25.0)	3 (75.0)	
Willingness to quit smoking	Strong [52]	18 (34.6)	34 (65.4)	.704
	Weak [9]	2 (22.2)	7 (77.8)	
Use of NRT	Yes [38]	10 (26.3)	28 (73.7)¶	.166
	No [23]	10 (43.5)	13 (56.5)	

NRT = nicotine replacement therapy; SD = standard deviation.

* Biochemically confirmed.
† χ^2 test for categorical data and *t*-test for age, smoking year, and pack-years were used to compare differences between groups.
‡ 1 subject includes both implant and periodontitis.
§ Fagerstrom Test for Nicotine Dependence.
¶ Includes 1 nicotine gum use.

Table 4 – Univariate and multivariate logistic regression analysis for abstinence rates according to whether a tobacco cessation intervention was provided.

Method	Duration (months)		Intervention group			No intervention groups (all no reported-NRT use)	*P* value*
			NRT use	No reported-NRT use	Total		
			n = 38 (%)	*n* = 23 (%)	*n* = 61 (%)	*n* = 13 (%)	
Self-reported abstinence	3	Quit	21 (55.3)	17 (73.9)	38 (62.3)	3 (23.1)	
		OR	—	—	5.51 [1.51, 26.50]†	1	.009
		Adjusted OR‡	—	—	7.19 [1.82, 37.80]	1	.005
	6	Quit	13 (34.2)	13 (56.5)	26 (42.6)	3 (23.1)	
		OR	—	—	2.31 [0.63, 11.1]	1	.213
		Adjusted OR‡	—	—	2.74 [0.71, 13.8]	1	.150
	12	Quit	12 (31.6)	13 (56.5)	25 (41.0)	3 (23.1)	
		OR	—	—	2.16 [0.59, 10.37]	1	.255
		Adjusted OR‡	—	—	2.47 [0.59, 10.37]	1	.216
Biochemically confirmed abstinence§	3	Quit	12 (31.6)	11 (47.8)	23 (37.7)	3 (23.1)	
		OR	—	—	2.02 [0.55,9.69]	1	.303
		Adjusted OR‡	—	—	2.19 [0.58,10.75]	1	.255
	6	Quit	11 (28.9)	10 (43.5)	21 (34.4)	3 (23.1)	
		OR	—	—	1.88 [0.51, 9.04]	1	.356
		Adjusted OR‡	—	—	2.10 [0.55, 10.38]	1	.288
	12	Quit	10 (26.3)	10 (43.5)	20 (32.8)	3 (23.1)	
		OR	—	—	1.63 [044, 7.84]	1	.483
		Adjusted OR‡	—	—	1.80 [0.47, 8.92]	1	.405

NRT = nicotine replacement therapy; OPMD = oral potentially malignant disorder; OR = odds ratio.

* Univariate and multivariate logistic regression analysis were used to compare between intervention group vs. non-intervention group.
† 95% confidence interval.
‡ Adjusted for age and sex.
§ Confirmed by the saliva cotinine level (0-10 ng/mL; NicAlert test) or carbon monoxide (0-7 ppm) breath analyser.

abstinence rates between patients who did and did not use NRT during any of the 3 study periods (data not shown). None of the patients in the nonintervention group used NRT during the follow-up period; the biochemically confirmed abstinence rate was 23.1% (3 out of 13) across all study periods (Table 4). The respective adjusted odds ratios (95% CIs) for biochemically confirmed continuous abstinence in the intervention group relative to the nonintervention group at months 3, 6, and 12 were 2.19 (0.58-10.75), 2.10 (0.55-10.38), and 1.63 (0.44-7.84), respectively (Table 4). No adverse events, such as irritation of the skin or oral mucosa or an increased risk of cardiovascular toxicity, were noted among NRT users.

The preliminary questionnaire survey to assess noncompliance was sent out to the dental specialists at 85 facilities who had attended the e-learning tobacco cessation education programme but had failed to participate in the study. A total of 25 (29%) facilities responded to the survey. Table 5 shows the characteristics of the dental specialists and facilities who failed to register any patients to the trial. Figure 3 shows the reasons and difficulties that led to noncompliance.

Discussion

To our knowledge, this is the first multicentre interventional study in Japan performed by dental specialists, oral and maxillofacial surgeons, oral medicine specialists, periodontists, and oral implantologists to elucidate the efficacy of a tobacco cessation intervention with or without NRT for patients with tobacco-related oral disease and conditions. An earlier randomised clinical trial conducted in Japan by Hanioka et al[19] evaluated the effectiveness of a smoking cessation intervention consisting of behavioural therapy and NRT delivered by

Table 5 – Characteristics of dental specialists who failed to register any patients.

Items		Number (*n* = 25)	(%)
Age	30s-40s	15	(60)
	50s-60s	10	(40)
Specialty	OMS	20	(80)
	Periodontist	1	(4)
	Implantologist	3	(12)
	Dental anaesthesiologist	1	(4)
e-learning	Received	19	(76)
	Not completed	1	(4)
	Not received	5	(20)
IRB approval	Yes	13	(52)
	Got delayed	8	(32)
	Not applied	2	(16)
Cessation intervention is a dentist's role	Yes	19	(76)
	Neither	6	(24)
	No	0	0

IRB = institutional review board; OMS = oral and maxillofacial surgeons.

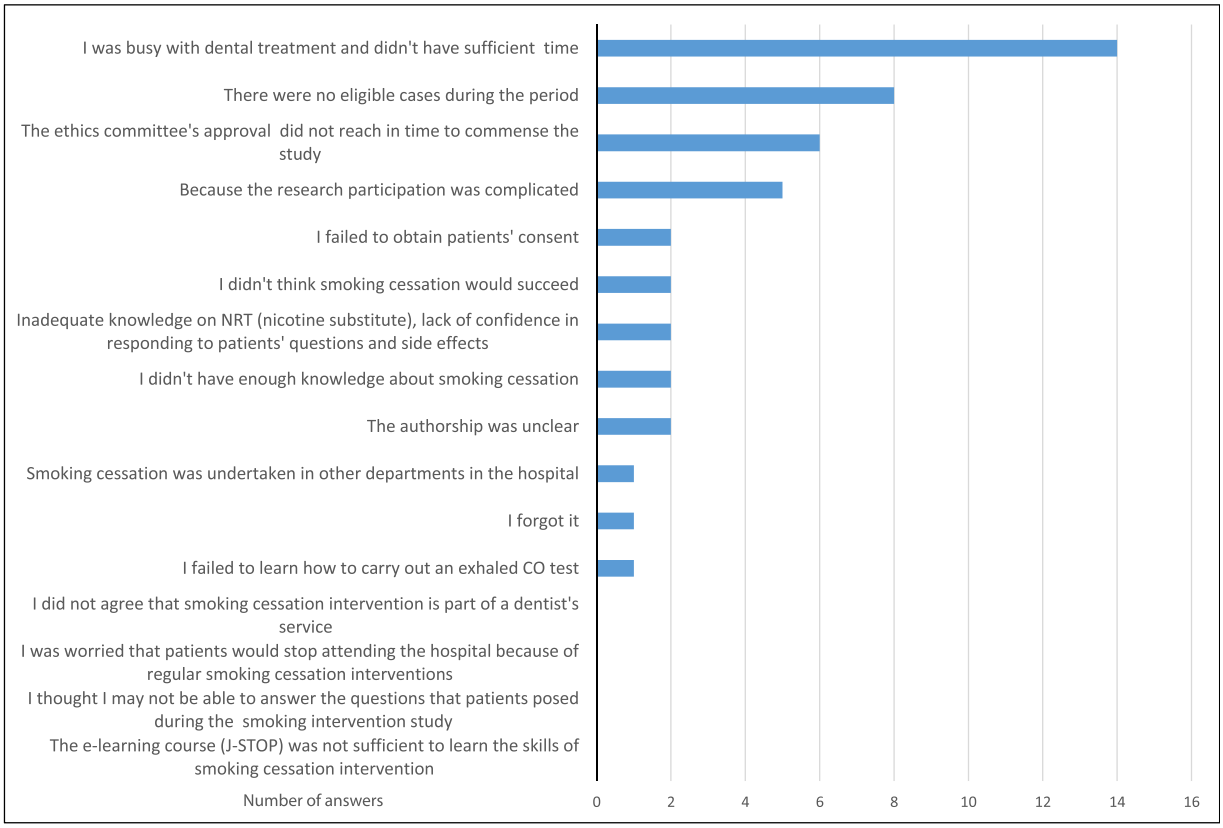

Fig. 3 – Reasons for not joining the study or failing to register cases. The post-completion survey provided an insight into the reasons for noncompliance by the dental specialists (multiple answers allowed).

dental professionals in primary care. In that earlier study, the results of continuous abstinence rate at month 12 in the intervention group (36.4%) and nonintervention group (13%) were similar to our results. Our recruitment rate was low with considerable variation among centres (range, 0-11). This could reflect the workload of dental specialists despite completion of the e-learning course. A previous study conducted in a dental setting in the United Kingdom concluded that involvement of the entire practice team, including nurses, could enhance the success of recruitment for smoking cessation studies.[20]

Three-quarters of the biochemical confirmation tests in this study were performed by semiquantitative analysis of the salivary cotinine level. Earlier studies in dental practice have reported that the salivary cotinine assay is a useful chair-side test for assessing tobacco dependence.[20,21] There is a positive correlation between the results obtained by the saliva NicAlert™ and breath carbon monoxide measured by a breath analyser.[22] However, Etter[23] observed that semiquantitative analysis (using NicAlert) yielded a high rate of false-positive results when evaluating levels of cotinine indicative of recent cigarette use. With regards to patient compliance, our study found a discrepancy between self-reported and biochemically confirmed abstinence rates. This may be due to a false declaration by the patient that he or she had failed to quit smoking. Alternatively, it may be related to the low accuracy of the semiquantitative analysis of salivary cotinine. Given that salivary sample testing is convenient in a dental setting, further studies that include semiquantitative analysis of salivary cotinine levels are warranted.

The 2018 National Health and Nutrition Survey in Japan reported that 31.4% of male smokers and 37.0% of female smokers (≥20 years of age) wished to quit smoking. Recognition of smoking as a disease of nicotine dependence prompted approval of physician-delivered tobacco cessation treatment by the Japanese national health insurance system in 2006. Several studies have reported the results of smoking cessation trials in medical settings in Japan.[24,25] The rates of quitting in our intervention group (32.8%) and nonintervention group (23.1%) at 12 months are higher than those reported in these medical settings. The higher quit rate in the dental setting may reflect the need for patients to attend dental treatment more regularly after recruitment into the study to provide opportunities for monitoring to help the cessation programme to be successful.[19,26] Patients who were undergoing implant surgery accepted tobacco cessation intervention more readily than those with OPMD or periodontitis and achieved the highest rate of tobacco cessation. It is likely that considering the costs, implant services, these patients were motivated against failure and were determined to quit.

The Ministry of Health, Labour and Welfare of Japan supports further improvements in tobacco addiction treatment and has proposed that tobacco cessation intervention in the dental setting be covered by the national health insurance system.[27] Prior to this study, there was no clear evidence of the efficacy of

tobacco cessation intervention by OHPs or its cost-effectiveness. This led to the release of an official statement by the Japanese Ministry on national tobacco control by OHPs.[6]

The use of NRT with appropriate advice is an effective strategy for tobacco abstinence.[28] Of note, we observed no significant difference in the cessation rate according to whether NRT was used. A systematic review of studies that compared the effectiveness of NRT and behavioural support with that of brief advice for harm reduction in ongoing tobacco users similarly revealed that although use of NRT had a significant effect on reducing the frequency of smoking, it had no significant effect on actual cessation.[29] Our finding that NRT lacked a significant effect could reflect the fact that our study was not a randomised controlled trial of NRT use but was designed such that NRT could be used voluntarily. Our results indicate that patients were well-motivated by their dentists to quit smoking for the sake of their health and were confident in their ability to quit smoking, independent of pharmaceutical support. Although we supplied nicotine patches free of charge, we could not demonstrate a benefit of NRT in our cohort of patients.

The postcompletion survey (Figure 3) provided us an insight as to the reasons for noncompliance. Though none of the dental specialists commented negatively on the e-learning course, it was clear that many of these nonparticipants had failed to gain enough skills to provide cessation advice in practice. It is important to note that none selected the option "I don't think smoking cessation education is part of dentist's service." Other reasons provided by the survey participants have already been reported in previous studies conducted in dental practices.[19]

This study has several limitations. Only 27 out of 112 facilities participated in the study; both the number of dental specialists and patients who registered did not reach our expectation for a multicentre trial. We explored the reasons for noncompliance, and studying their answers (Figure 3) will help in planning and improving future studies. Furthermore, due to the limited number of participating clinics equipped with a breath carbon monoxide analyser to assess smoking cessation status, we could not standardise the biochemical test; instead salivary cotinine levels were analysed. Another limitation was that the extent of tobacco cessation advice given to the patients at each centre varied depending on the setting. Most participating specialists pointed out that they did not have enough time to provide smoking cessation advice to patients to the level required by the study protocol. Furthermore, there was a concern that patients who failed to quit smoking might be unwilling to continue their dental treatment. In this study, 12 of 61 patients in the intervention group dropped out, mostly without notice. The number of pack-years and severity of nicotine addiction was similar between the intervention group and the nonintervention group (as shown in Table 1). Therefore, there would not be a selection bias regarding the number of lighter smokers between the intervention and nonintervention groups. However, regarding willingness to quit smoking, there was a significant difference in the intention to quit (85.2% in the intervention group and 23.1% in the nonintervention group). Nevertheless, the results of this study reflect the tobacco abstinence rates achievable by specialists in dentistry when providing dental or oral surgical treatment.

Conclusions

In conclusion, the results of this multicentre study illustrate the challenges encountered in delivering a tobacco cessation intervention in different dental settings. However, the study also demonstrates that motivated practitioners can effectively contribute to smoking cessation while treating different dental conditions. Use of NRT did not enhance quit rates over brief counselling by dentists. Dental teams have a responsibility to encourage their patients to commit to tobacco cessation as an integral part of dental and oral surgery practice.

Acknowledgements

The authors thank the following president of each academic society for their support of this study: Dr Jun Shimada, Japanese Academy of Maxillofacial Implants; Dr Kanchu Tei, Association for the Japanese Society of Oral and Maxillofacial Surgeons; Dr Takashi Miyazaki, Association for the Japanese Society of Oral Implantology; Dr Seiji Nakamura, Japanese Society of Oral Medicine; Dr Shinya Murakami, Japanese Society of Periodontology; Dr Tomoko Takeda, Japanese Academy of Clinical Periodontology; Dr Yoshihisa Yamashita, Japanese Society for Oral Health; Dr Yutaka Imai, Japanese Society of Dentistry for Medically Compromised Patients; and Dr Tadaaki Kirita, Japanese Society of Oral Oncology.

The authors thank the following Tobacco Cessation Intervention Study for Oral Diseases (TISOD) investigators for their cooperation in formulating the research planning and its implementation: Drs Keietsu Saigo, Kenichi Kurita, Masashi Yamashiro, Mikio Kusama, Yuichi Izumi, Koji Mizutani, Norio Aoyama, Yuka Tsumanuma, Masahiko Nikaido, Hiroyuki Yoshino, Suguru Hamada, Miki Ojima, Yasunori Sato, Tomo Yokoi, Yoshimasa Kitagawa, Fumihiko Watanabe, Kazue Miura, Hiromasa Kawana, Akira Matsuo, Toshiro Sugai, Yoshiki Ishigaki, Kazuhito Satomura, and Hideo Miyazaki.

The authors also thank the following dental specialists for their participants of the study: Drs Takahiro Yagyuu, Takashi Yasuda, Tsuyoshi Kaneda, Shinichi Taniguchi, Hiroshi Takano, Shin-ichi Yamada, Yasuo Hanazawa, Senri Oguri, Hajime Shimizu, Kunio Yoshizawa, and Iwai Tohnai.

The facility names of e-learning participants are listed in the supplementary materials. The manuscript was copyedited for English language by Editage of Wiley Editing Services.

Funding

This study was supported by the Japan Society for the Promotion of Science KAKENHI Grants, Grant-in-Aid for Scientific Research (C), 17K12033 to TN, and a Grant-in-Aid for Project Research from Japanese Association for Dental Science, No.2015D-1 to TN.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.identj.2021.02.002.

REFERENCES

1. Warnakulasuriya S. Global epidemiology of oral and oropharyngeal cancer. Oral Oncol 2009;45:309–16.
2. World Health Organization (WHO). Monograph on Tobacco Cessation and Oral Health Integration. Geneva, Switzerland: WHO; 2017.
3. NCD Countdown 2030 Collaborators. NCD Countdown 2030: worldwide trends in non-communicable disease mortality and progress towards Sustainable Development Goal target 3.4. Lancet 2018;392:1072–88.
4. World Health Organization (WHO). WHO Report on the Global Tobacco Epidemic 2019. Available from: https://www.who.int/tobacco/global_report/en/. Accessed 13 May, 2020.
5. World Health Organization (WHO). Country profile Japan. WHO report on the global tobacco epidemic 2019. Available from: https://www.who.int/tobacco/surveillance/policy/country_profile/jpn.pdf?ua=1. Accessed 13 May, 2020.
6. Nagao T, Fukuda J, Seto K, et al. A national opinion study supports tobacco cessation by oral health professionals in Japan. Transl Res Oral Oncol 2017;2:1–8.
7. Warnakulasuriya S, Dietrich T, Bornstein MM, et al. Oral health risks of tobacco use and effects of cessation. Int Dent J 2010;60:7–30.
8. Warnakulasuriya S. Oral potentially malignant disorders: a comprehensive review on clinical aspects and management. Oral Oncol 2020;102:104550. doi: 10.1016/j.oraloncology.2019.104550.
9. Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: Framework and proposal of a new classification and case definition. J Periodontol 2018;89(Suppl 1):S159–72.
10. US Department of Health and Human Services. The health consequences of smoking–50 years of progress: a report of the Surgeon General. Available from: https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm. Accessed 13 May, 2020.
11. Carr AB, Ebbert J. Interventions for tobacco cessation in the dental setting. Cochrane Database Syst Rev 2012;13:CD005084.
12. Gordon JS, Albert DA, Crews KM, et al. Tobacco education in dentistry and dental hygiene. Drug Alcohol Rev 2009;28:517–32.
13. Hanioka T, Ojima M, Kawaguchi Y, et al. Tobacco intervention by dentists and dental hygienists. Jpn Dent Sci Rev 2013;49:47–56.
14. Warnakulasuriya S. Effectiveness of tobacco counselling in the dental office. J Dent Educ 2002;66:1079–87.
15. Smoking cessation training. Available from: http://smoking-cessationtraining.com. Accessed May 13, 2020.
16. World Health Organization (WHO). Guidelines for Controlling and Monitoring the Tobacco Epidemic. Geneva, Switzerland: WHO; 1998.
17. Nakamura M, Masui S, Hagimoto A, et al. Effectiveness of an e-learning program for training health professionals in smoking cessation. Jpn J Health Educ Promotion 2017;25:180–94.
18. Fagerström KO. A comparison of psychological and pharmacological treatment in smoking cessation. J Behav Med 1982;5:343–51.
19. Hanioka T, Ojima M, Tanaka H, et al. Intensive smoking-cessation intervention in the dental setting. J Dent Res 2010;89:66–70.
20. Smith SE, Warnakulasuriya KA, Feyerabend C, et al. A smoking cessation programme conducted through dental practices in the UK. Br Dent J 1998;185:299–303.
21. Kulza M, Wozniak A, Przybylowska SM, et al. Saliva cotinine determination using high-performance liquid chromatography with diode - array detection. Przegl Lek 2012;69:837–40.
22. Marrone GF, Paulpillai M, Evans RJ, et al. Breath carbon monoxide and semiquantitative saliva cotinine as biomarkers for smoking. Hum Psychopharmacol 2010;25:80–3.
23. Etter JF. Assessment of the accuracy of salivary cotinine readings from NicAlert strips against a liquid chromatography tandem mass spectrometry assay in self-reported non-smokers who passed carbon monoxide but failed NicAlert validation. Addiction 2019;114:2252–6.
24. Takahashi E, Yamakado M, Nakadate T. Smoking cessation rate by the stages of self-change of smoking behavior. Ningen Dock 2005;20:43–6.
25. Hagimoto A, Nakamura M, Morita T, et al. Smoking cessation patterns and predictors of quitting smoking among the Japanese general population: a 1-year follow-up study. Addiction 2010;105:164–73.
26. Hanioka T, Ojima M, Hamajima N, et al. Patient feedback as a motivating force to quit smoking. Community Dent Oral Epidemiol 2007;35:310–7.
27. Ministry of Health, Labour and Welfare of Japan. Smoking and Health. Available from: https://www.mhlw.go.jp/file/05-Shingikai-10901000-Kenkoukyoku-Soumuka/0000172687.pdf. Accessed 13 May, 2020.
28. Hartmann-Boyce J, Chepkin SC, Ye W, et al. Nicotine replacement therapy versus control for smoking cessation. Cochrane Database Syst Rev 2018;31:CD000146.
29. Lindson-Hawley N, Hartmann-Boyce J, Fanshawe TR, et al. Interventions to reduce harm from continued tobacco use. Cochrane Database Syst Rev 2016;13:CD005231.