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# Smoking behaviour and attitudes to periodontal health and quit smoking in patients with periodontal disease

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# Abstract

**Objective:** The aim of this study was to assess oral health-related beliefs and attitudes, health behaviour of smokers in relation to the Transtheoretical Model (TTM) of behaviour change, willingness to have smoking cessation provided together with periodontal treatment.

**Material and Methods:** Postal questionnaire was sent to 500 referred patients. Part 1 looked at attitudes and beliefs about periodontal disease, Part 2 aimed at current smokers focused on the TTM and smoking cessation.

**Results:** Response rate was 56% (n = 277); 67% females, 33% males. Mean age was 44.9 years (SD 12.45); 24.5% current smokers, 30.3% past smokers, 45.5% never smokers. Fewer smokers reported "bleeding gums" (p = 0.027), but more smokers reported "having loose teeth" (p = 0.016). The TTM stages of change indicated that 31% of current smokers were in pre-contemplation of quitting smoking, 46% were in contemplation and 23% were in preparation. Twenty-three percent of the past smokers were in action and 77% in maintenance. Smokers showed differences in the "self-re-evaluation" (p = 0.001) and "self-liberation" (p = 0.015) processes of change depending on their stage of change (pre-contemplation or preparation). Nearly half (49%) of the current smokers who wanted to quit requested smoking cessation to be provided alongside their periodontal treatment.

**Conclusion:** A large proportion of periodontal patient smokers may be considering quitting, and nearly half requested provision of smoking cessation intervention in conjunction with the periodontal treatment.

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# **Smoking and Periodontitis**

Smoking is an important environmental risk factor for periodontitis (Palmer et al. 2005). It has been associated with an increased prevalence and severity of periodontal diseases, and there is

# Conflict of interest and source of funding statement

The authors declare that they have no conflict of interests. The study was self-funded by the authors and their institution. evidence that a greater proportion of patients with periodontitis are smokers (Tomar & Asma 2000, Bergström 2006). Smoking has been shown to reduce the effectiveness of both non-surgical and surgical treatment (Labriola et al. 2005, Bergström 2006, Heasman et al. 2006). Quitting smoking may have beneficial effects on periodontal status (Bergström et al. 2000, Brothwell 2001, Johnson & Hill 2004, Preshaw et al. 2005, Thomson et al. 2007).

Data from NHANES III showed that current smokers were more likely to report a need for periodontal treatment and dental extractions than non-smokers, while former smokers had similar perceived periodontal treatment needs as non-smokers (Dye et al. 2006). Despite this increased perceived treatment need there is a lack of patient awareness of the relationship between smoking and periodontal diseases among patients. In one study, only 7% of patients stated that smoking affected the gums (Lung et al. 2005).

Self-reporting of symptoms can be a useful means of assessing population

characteristics, risk factors and diseases, although it has rarely been used for periodontitis. Several studies have attempted to validate self-reported measures for periodontal disease, but results have been inconsistent. A systematic review of these studies (Blicher et al. 2005) found that one of the best selfreported measures was asking the question "Has any dentist/hygienist told you that you have deep pockets?". They concluded that this measure had a high specificity and a high positive predictive value when compared with clinical pocket depth.

However, one of the reviewed studies (Gilbert & Nuttall 1999) found that only four items were weakly predictive of the periodontal status. These were noticing gaps between teeth getting bigger; noticing tooth roots becoming more visible; experiencing pain when consuming hot, cold or sweet things; and smoking. In contrast, they found that questions concerned with whether a dentist had told the patient they had periodontal disease or whether the person was aware of being treated for it had very low sensitivities. They concluded that "selfreporting of periodontal health was not successful, as many people who had some indications of the periodontal diseases appeared to be unaware of their condition and also appeared not to have been informed nor were being treated for it" (Gilbert & Nuttall 1999).

# Health behaviour

Health behaviour is "any activity undertaken by a person believing himself to be healthy for the purpose of preventing disease or detecting it at an asymptomatic stage" (Kasl & Cobb 1966). This area is heavily researched and there are many different ideas and models, with social cognition models in particular being widely used. Social cognition is concerned with how individuals make sense of social situations. An individual's beliefs, attitudes and knowledge are central to many social cognition models (Conner & Norman 2005). The most common social cognition models used to predict health behaviour are the Health Belief Model (Rosenstock 1966), Protection Motivation Theory (Rogers 1975), Social Cognitive Theory (Bandura et al. 1977) and Health Locus of Control (Wallston et al. 1978). A recent review identified that social cognition models have not been widely used in the design of interventions to improve the oral

Other predictive models focus on the idea that behaviour change occurs in a series of stages (stage models). These include the Transtheoretical Model (TTM), referred to as the "stages of change model" (Prochaska & DiClemente 1983), which describes how people modify behaviour over time, and includes several independent variables, the "process of change" measure, and a series of outcome measures, including the "decisional balance" and "self-efficacy/temptation scales" (Cancer Prevention Research Center 2007a).

The "stage" construct is the key construct behind the model and is important as it represents a temporal dimension; unlike other models, the TTM perceives change as a process rather than an event. The five "stages of change" are pre-contemplation, contemplation, preparation, action and maintenance. In pre-contemplation, the individual has no intention to take action in the foreseeable future. Many individuals in this stage are unaware of their problems. Current smokers are classified as being in pre-contemplation if they do not intend to quit smoking within the next 6 months. In contemplation, they are aware that a problem exists and intend to take action within the next 6 months. In preparation, they intend to take action within the next 30 days and have unsuccessfully taken action in the past year. Therefore, those intending to quit within the next 6 months are defined as being in "contemplation", and those individuals intending to quit smoking within the next 30 days and who have reported having had a serious quit attempt in the past year are defined as being in "preparation". In action, the individual has changed to a new behaviour for 1<6 months, while in maintenance, they work to prevent relapse and consolidate the gains attained during action. For addictive behaviours such as smoking, this last stage extends from 6 months to an indeterminate period past the initial action (Cancer Prevention Research Center 2007a).

Individuals are seen to progress through each stage to achieve successful maintenance of a new behaviour. These stages, however, do not always occur in a linear pattern, and an individual may cycle from stage to stage and then back again, i.e. relapse before achieving a long-term behaviour change (Sutton 2005b). Transitions between the "stages of change" are effected by a set of independent variables known as the "processes of change". They refer to the activities and experiences that individuals engage in to progress through the stages to maintenance. The 10 "processes of change" are divided into two broad categories; *experimental (cognitive-affective) processes* which include activities, for example, related to thinking about quitting and *behavioural processes* that are categorized as behaviours which are thought to be helpful in smoking cessation (Prochaska et al. 1988).

The model also incorporates a series of intervening or outcome variables. These include "decisional balance" which are the pros and cons of change, "self-efficacy" which is the confidence that one can engage in health behaviour across different challenging situations and "situational temptation" which is the temptation to engage in unhealthy behaviour across different challenging situations (Cancer Prevention Research Center 2007a).

Subjects in preparation have been shown to have significantly different scores for *self-efficacy* and *process of change* when compared with those in pre-contemplation (DiClemente et al. 1991), and the five *cognitive-affective processes of change* tend to peak in the earlier stages of change, whereas the five *behavioural processes* tend to peak in the later stages of change (Fava et al. 1995). These findings suggest that subjects change their attitudes and intentions before quitting smoking and has been confirmed in a recent meta-analysis (Rosen 2000).

The TTM has been used extensively in research on smoking and smoking cessation. Cross-sectional studies have used the *stages of change* algorithm to identify the distribution of current smokers within the stages in smoking populations (Velicer et al. 1995, Etter et al. 1997, Wewers et al. 2003).

Some studies have attempted to use the TTM variables to predict stage movements. A cross-sectional study with 2 years follow-up confirmed the findings of previous studies that nearly all the processes of change increased from pre-contemplation to preparation. However, baseline values for these measures failed to predict progressive stage movements (Herzog et al. 1999), while others found that the model offered limited predictive power (Farkas et al. 1996, Abrams et al. 2000). Some studies suggest that matching smoking cessation interventions with the subjects' *stage of change* resulted in higher abstinence rates than standard interventions (Prochaska et al. 1993, 2001), or at least promoted forward stage movement (Spencer et al. 2002). However, a recent systematic review of 23 studies found that there was limited evidence for the effectiveness of such stage-matched interventions in changing smoking behaviour (Riemsma et al. 2003).

# Smoking cessation

Dental health care professionals are in an unique position to provide smoking cessation (Christen et al. 1990, Fiore 2000). Many studies show that patients expect dental health professionals to provide advice and support on smoking cessation (Campbell et al. 1999, Rikard-Bell et al. 2003). However, evidence from many studies shows that whilst many dentists asked about smoking, few recorded this in the clinical notes (John et al. 2003, Johnson et al. 2006, Needleman et al. 2006), and the number who offered cessation advice was much lower than among physicians (Needleman et al. 2006, An et al. 2008).

In the United Kingdom, lack of remuneration, training, patient education, materials and knowledge of referral sources were quoted as barriers to effective smoking cessation (Johnson et al. 2006, Stacey et al. 2006). In responses from periodontists, it was found that 99% routinely ask about smoking but only 35% spend more than 5 min. discussing smoking with their patients, and perceive similar barriers (Dalia et al. 2007).

#### Aim

The aim of this study was to examine the self-reported oral health-related beliefs and attitudes of patients referred to a hospital's periodontal department, as well as the health behaviour of smokers in relation to the TTM. A further aim was to find out about smokers' desire to quit and whether or not patients would like to have smoking cessation provided together with their periodontal treatment.

# Material and Methods

A questionnaire survey was mailed to 500 consecutive new patients referred to

Guy's and St. Thomas' NHS Trust Periodontology Department between January and July 2007. The questionnaires were enclosed with the patients' initial assessment appointment letter. These appointments had been agreed to by the patient; therefore, the questionnaires were only sent to patients who had confirmed their willingness to attend the department for an initial assessment. A covering letter briefly explained the purpose of the study and gave assurances that all responses were confidential. A prepaid self-addressed envelope to return the completed questionnaire was enclosed.

All the questionnaires were selfadministered and anonymous. The questionnaire was divided into two parts, Part 1 to be completed by all the respondents and Part 2 to be completed by the current cigarette smokers only. Respondents below the age of 18 were excluded. Ethical approval was obtained from Bexley and Bromley Research Ethics Committee.

# Part 1 answered by all subjects

Part 1 was divided into five sub-sections (1A–1E). Questions in sections 1A–1C were designed to evaluate respondent's attitudes and beliefs with regards to their periodontal disease. Respondents were asked to rate their answers to each statement on a six-point scale, with 1 being "strongly disagree" and 6 being "strongly agree".

Section 1A consisted of nine questions designed to look at *risk perception* and included questions such as "I have noticed my gums bleed when I brush my teeth", "my gum disease causes bad breath" and "I am worried about losing my teeth as a consequence of my gum disease".

Section 1B consisted of six questions looking at attitudes to oral health and perceived severity. Examples of the questions asked were "having gum disease is a bad thing" and "my oral health is very important to me". Scores were reversed appropriately to allow a cumulative score for perceived severity to be calculated.

Section 1C consisted of six questions designed to assess the respondent's health locus of control. The first two questions were designed to assess an individual as having an external locus of control (directed at chance), e.g. "some people are born with a tendency to get gum disease". The next two questions at assessing an individual as having an external locus of control (directed at powerful others), e.g. "only the dentist can achieve changes in my gum disease", and the final two questions were designed to assess an individual as having an internal locus of control, e.g. "I can control my gum disease". Several of these statements were reversed to allow paired statements scores to be created that were then used to determine the respondent's health locus of control.

All the questions used in the first three sub-sections (1A-1C) of the questionnaire were developed within the department of Dental Public Health and Oral Health Services, King's College London Dental Institute (Renz 2007) and have been internally validated, with the exception of the selfefficacy scale which was developed by Schüz et al. (2006). The questions were developed from the existing questions of various social cognition models together with the answers given in structured interviews with patients on their attitudes, beliefs and behaviour with regards to periodontal disease.

#### Part 2 answered by current smokers only

Part 2 was designed to evaluate smoking behaviour and attitudes to quitting smoking. The first section (2A) consisted of questions from the Fagerström Test for Nicotine Dependence (FTND) (Heatherton et al. 1991) which was developed from the original eight-item Fagerström Tolerance Questionnaire (Fagerström 1978). The FTND has six items: number of cigarettes smoked per day, time of the first cigarette after waking, smoking or not smoking when ill in bed, ability to refrain from smoking in non-smoking areas, whether the first cigarette of the day is the most difficult to give up and whether they smoke more heavily in the morning or not. The answers are rated and totalled to give a final score that relates to the smoker's level of nicotine addiction. Scores <4 relate to low dependence, 5 and 6 to medium dependence and those >7 indicate a high dependence.

The rest of Part 2 consisted of measures for smoking based on the TTM developed by the Cancer Prevention Research Centre (CPRC), University of Rhode Island. All the measures are copyright of CPRC and are available on their website for research purposes (Cancer Prevention Research Center 2007b). In this questionnaire, the short form of these measures was used (Fava et al. 1995).

Section 2B consisted of measures for self-efficacy/temptation which assess how tempted people are to smoke. Respondents have to answer on a scale of 1-5 how tempted they are to smoke in nine situations, with "1" being not tempted at all and 5 being extremely tempted. These nine questions are grouped into three groups of three questions that represent each "situational temptation". The three groups are; positive affect/social situations, e.g. "with friends at a party"; habitual/craving situations, e.g. "when I need a lift" and negative affect situations, e.g. "when I am anxious and stressed" (Velicer et al. 1990).

Section 2C consists of measures for the process of change, which were developed by Prochaska et al. (1988). The short form consists of 20 questions in a random order that correspond to each of the 10 processes. The frequency of each event is rated by respondents on a five-point scale, 1 being "never" and 5 being "repeatedly". The 10 processes of change are sub-divided into two experimental processes, three reevaluation processes, four behavioural processes and one management processes.

The paired questions used are similar in their wording, examples of the questions used relating to each process are conscious raising, e.g. "I recall information people have given me on the benefits of quitting smoking"; environmental, e.g. "I stop to think that smoking is polluting the environment"; selfre-evaluation, e.g. "I get upset when I think about my smoking''; social liberation, e.g. "I find society changing in ways that makes it easier for non-smokers"; dramatic relief, e.g. "I react emotionally to warnings about smoking cigarettes"; helping relationships, e.g. "I have someone who listens when I need to talk about my smoking"; selfliberation, e.g. "I tell myself I can quit if I want to''; counter conditioning, e.g. "When I am tempted to smoke I think about something else"; reinforcement, e.g. "I am rewarded by others if I don't smoke" and stimulus control, e.g. "I remove things from my home or place of work that remind me of smoking".

The questionnaire also includes a number of questions for both the smokers and past smokers which contribute to the short-form measure for *stages of*  *change* assessed using the "stages of change algorithm" (DiClemente et al. 1991). There are five questions that assess a smoker's readiness to quit smoking or a past smoker's stage in the quitting process.

The final questions were aimed at those respondents that expressed an interest in quitting smoking. They were asked whether they wanted help with their quit attempt, and if yes, they were asked if they "would like us, the Periodontology Department, to provide this help?". Those respondents who expressed an interest in receiving help within the Department were also asked if they would prefer the quit smoking help to be given as a separate programme or alongside their periodontal treatment. Respondents interested in receiving a combined smoking cessation and periodontal treatment programme were asked to provide contact information so that they could be contacted and included in a future pilot combined programme. Those wanting help with their quit attempt elsewhere were asked to identify from a list where they planned to get help from: including "my doctor", "my local pharmacist" and "NHS quit smoking helpline".

# Statistical methods

Data were analysed using a statistical package (Stata 8.0, Stata Corp., College Station, TX, USA). All the variables except for age and gender were described using medians and inter-quartile ranges (IQR) and analysed using non-parametric methods. Multiple group comparisons were performed using Kruskal-Wallis analysis of variance (ANOVA) and statistical significance was accepted as p < 0.05. Post-ANOVA pair-wise analyses were performed using Mann-Whitney U-tests and regarded as statistically significant when p < 0.02. Relationships between variables were investigated using Spearman's rank correlation, statistical significance accepted at p < 0.05.

# Results

Two hundred and eighty-four completed questionnaires were returned with a response rate of 56%. Two hundred and seventy-seven were analysed after seven questionnaires were excluded, because the respondents were under the age of 18. The mean age of the sample population was 44.9 years (SD 12.45). There were more females (67.1%) than males (32.8%); 24.5% were current smokers. 30.3% were past smokers and 45.5% were never smokers. Smoking status was not equally distributed by gender; 28% of males (n = 91) were current smokers, 31%were past smokers and 41% were never smokers. For the females (n = 186), these figures were 23%, 30% and 47%, respectively. There were no significant differences between groups (Table 1). Current smokers (n = 68) were classified according to the stages of change algorithm (Cancer Prevention Research Center 2007b) as being in pre-contemplation, contemplation or preparation and the past smokers (n = 84) were classified as being in action or maintenance. Those 30.9% of all the current smokers were in pre-contemplation, 45.6% in contemplation and 23.5% were in preparation, while 23% of the all the past smokers were in action and 77% were in maintenance (Table 2).

The smoking histories revealed that the heaviest smokers according to the value for "cigarette score years" were those individuals in contemplation, while those with the lowest scores were past smokers in maintenance. The FTND score for the smokers was also calculated as a measure of the level of nicotine addiction. The median score for

Table 1. Demographics: smoking status by age and gender as a whole and by proportion

n = 277	Ag	ge	Totals b	oy gender	% by gender				
				males $(n = 91)$		females $(n = 186)$	males $(n = 91)$	females ( <i>n</i> = 186)	
	mean	SD	п	п	%	%			
Current smokers $n = 68$	43.5	9.3	25	43	28	23			
Past smokers $n = 84$	47.5	12.6	28	56	31	30			
Never smokers $n = 125$	43.9	13.5	38	87	41	47			

the current smokers was 3.5 (IQR 2–5). Those in the preparation stage had the lowest FTND score, this difference was not statistically significant.

# Questionnaire Part 1A - risk perception

All the 277 respondents answered Part 1 of the questionnaire related to health beliefs regarding their gum disease (Table 3). In general, there were few differences among never smokers, current smokers and ex smokers. There were differences between the groups for two of the questions: "I have noticed my gums bleed when I brush my teeth" (Q1A1, p = 0.027) and "I have noticed one or more of my teeth are loose" (Q1A2, p = 0.016). Further analysis of QA1 indicated a significant difference between never smokers and current smokers (p = 0.009) with never smokers noticing more bleeding. A statistically significant difference was also found between the never smokers and current smokers for Q1A2 (p = 0.008) with current smokers noticing more loose teeth.

A significant difference was also seen for Q1A1 when subjects were grouped according to the five *stages of change* (p = 0.042). Spearman's rank correlation indicated an inverse relationship between the stages of change and the score for perception of bleeding gums (r = -0.113). Thus, as the stage of change moved from pre-contemplation to maintenance, the perception of bleeding among respondents tended to decrease but did not reach statistical significance (p = 0.062).

#### Questionnaire Part 1B – severity and Part 1C – health locus of control

The answers to questions in Part 1, section B, relating to the attitude to oral health were summed to give a cumulative score for severity (Table 3). All the three

Table 2. Demographics of current and past smokers by "stages of change", cigarette score years\* and Fagerstrom test for nicotine dependence (FTND) scores

Stage of change	<i>n</i> =	= 152	Cigarette s	core years	FTND score		
	n	%	median	IQR	median	IQR	
Pre-contemplation	21	13.8	30	20-40	4	1–4	
Contemplation	31	20.4	49	26-66	4	2-4	
Preparation	16	10.5	25	20-44	2	1–5	
Action	19	12.5	40	20-66	N/A	N/A	
Maintenance	65	42.8	24	10-55	N/A	N/A	

groups had similarly high median scores, showing that most respondents agreed or strongly agreed with the statements on severity such as "having gum disease is a bad thing" and "keeping my natural teeth is important to me". Analysis of individual elements showed that there were differences between both the various stages of change and the three smoking status groups for the response to the question "my oral health is very important to me" (p = 0.014 and 0.022, respectively). Further analysis showed that there was a weak but statistically significant inverse relationship between stages of change and the agreement to the above question (r = -0.137, p = 0.023). There were also statistically significant differences in response between the never smokers and current smokers (p = 0.024), and the never smokers and past smokers (p = 0.017), with the never smokers having higher scores (stronger agreement) than both current and past smokers.

The results for questions relating to *health locus of control* indicated no statistically significant differences between the groups. Overall, the median scores were mostly 6 out of 12, indicating a low level of agreement for all the statements.

# Questionnaire Part 2B – self-efficacy/ temptation

Part 2 of the questionnaire was completed only by the respondents who were current smokers (n = 68). Table 4 shows the results for measures of *self-efficacy*/

\*Cigarette score years was calculated by multiplying the number of years smoking by number of cigarettes per day as a score: 1 = 1-10, 2 = 11-20, 3 = 21-30, 4 = 30+ cigarettes.

*Table 3.* Comparison of results from Section A on respondents' strength of agreement<sup> $\dagger$ </sup> to statements on risk perception, severity and locus of control according to smoking status and stages of change (SoC)

	Never smokers		Current smokers		Past smokers		<i>p</i> -values	
	median	IQR	median	IQR	median	IQR	by SoC <sup>2</sup>	by smok. <sup>3</sup>
1A: Risk perception								
I have noticed my gums bleed when I brush my teeth	5	4-6	4	3-5	4	3–5	0.042*	0.027*
I have noticed one or more of my teeth are loose	2	1-5	5	2-6	4	2-5	0.083	0.016*
I avoid certain foods because of my gum disease	2	1-5	2	1-5	2	1.5-4	0.178	0.996
My gum disease causes bad breath	3	1-5	3	2-5	4	2-5	0.418	0.493
My gum disease doesn't cause me any problems	2	1-4	2	1-3	2	1-4	0.862	0.314
I was unaware until my dentist/hygienist told me	3	2-5	3	1.5-5	3	2-5	0.892	0.944
I don't think I am more at risk of gum disease than others	3	2-5	3	2-4	3	2-5	0.348	0.382
I'm worried about losing my teeth due to my gum disease	5	5–6	6	5–6	5.5	5–6	0.438	0.376
It is very likely that my gum disease will get worse	5	2-5	5	4–5	5	3–6	0.670	0.337
1B: Severity/attitude (cumulative score total = $36$ )	32	29-35	32	29-34.5	31	28-34.5	0.634	0.862
1C: Locus of control (paired scores total = $12$ )								
External – chance	6	4-8	6	4–7	6	4–7	0.857	0.940
External – powerful others	6	4-7	5	4–7	5	3.5-7	0.450	0.184
Internal	6	5-8	6	5-8	7	5–9	0.054	0.177

<sup>†</sup>Scoring: 1 = strongly disagree and 6 = strongly agree.

<sup>2</sup>*p*-values from Kruskal–Wallis analysis of differences between stages of change groups.

<sup>3</sup>*p*-values from Kruskal–Wallis analysis of differences between smoking status groups.

\*p-value <0.05, further statistical analysis performed (post-ANOVA).

*temptation.* Looking at the cumulative scores (maximum of 15) for each situation, all the three "stages of change" had similar scores when compared with each other and to current smokers as a whole. When comparing the different situations, there were higher scores for positive affect/social situation and negative affect situations than for habitual craving situations for all the three stages, but this was not statistically significant.

# Questionnaire Part 2C – process of change

Table 5 shows the results for the measures of process of change. Overall, there was an

increase in scores (i.e. increased frequency of the event) when comparing pre-contemplation with contemplation and contemplation with preparation for each process. The two exceptions were environmental and counter conditioning processes of change. The process of change with the highest overall scores was social liberation and the process with the lowest scores was counter conditioning. The scores for experimental/cognitive processes are generally higher than those for *behavioural processes* indicating an increased use of these processes of change.

There were differences between *stages* of *change* groups and two of the processes: "self-re-evaluation" (p < 0.001)

and "self-liberation" (p = 0.002). For the process self-re-evaluation, this difference was significant for the scores between those in pre-contemplation and preparation (p = 0.001), and between those in contemplation and preparation (p = 0.012), with those in preparation having highest scores. For self-liberation, significant differences were also found between pre-contemplation and preparation (p = 0.002), and between those in contemplation and preparation (p =0.015), with those in preparation again having higher scores in both the instances.

The final part of the questionnaire determined whether respondents who

*Table 4.* Measures of "temptation and self efficacy" in current smokers by "stages of change" (SoC); pre-contemplation (n = 21), contemplation (n = 31), and preparation (n = 16)

2B temptation and self efficacy	Smokers		Pre-contemplation		Contemplation		Preparation		p-values1	
	median	IRQ	median	IQR	median	IQR	median	IQR	by SoC	
Positive affect/social situation (O2Bi, O2Bvi, O2Bvii)	11	9–13	11	9–14	11.5	10–13	11	9–13	0.759	
Habitual/craving situation (O2Bii, O2Bv, O2Bviii)	8.5	6–10	8	6–10	8.5	7–10	9	5-12	0.904	
Negative affect (Q2Biii, Q2Bvi, Q2Bix)	12	10–15	12	10–15	12	9–14	13	11.5–15	0.318	

Cumulative scores out of a total of 15.

<sup>1</sup>p-values from Kruskal–Wallis analysis of variance of the differences between temptation measures and "stages of change" (SoC).

*Table 5.* Measures for "process of change" by current smokers and by stages of change: pre-contemplation (n = 21), contemplation (n = 31), and preparation (n = 16)

		Current smokers		Pre- contemplation		Contemplation		Preparation		<i>p</i> -values	
2C	Processes of change	median	IRQ	median	IQR	median	IQR	median	IQR	by SoC	
Experimental processes	Conscious raising O2Civ & O2Cxi	6	4–7	5	3–7	6.5	5–7	7	4-8.5	0.169	
	Environmental Q2Cvi & Q2Cxii	5	3–6	5	3–6	4	4–6	6	3.5–6	0.514	
Re-evaluation	Self-re-evaluation Q2Cviiii & Q2Cxv	6	4–7	4	4–5	6	4–7	8	6-8.5	0.0002*	
	Social liberation Q2Ciii & Q2Cxiv	7	6–9	6	7–8	7	6–9	8	6–10	0.789	
	Dramatic relief Q2Cvii & Q2Cxviii	5	4–7	4	3–6	5	5–7	6.5	4.5-8.5	0.065	
Behavioural processes	Helping relationships Q2Cx Q2Cxvi	4	2–6	3	2–5	4	2–6	4	2–5.5	0.924	
	Self liberation Q2Cii & Q2Cxiii	6	4.5–7	5	3–6	6	5–7	8	6–9.5	0.002*	
	Counter conditioning Q2Ci & Q2Cxvii	5	4–6	5	4–5	5	4–6	5	4–7	0.259	
	Re-inforcement O2Cy & O2Cxx	3.5	2–5.5	3	2–4	4	2–6	4.5	2.5-5.5	0.172	
Management	Stimulus control Q2Cxi & Q2Cxix	4	2.5-5.5	3	2–5	4	3–5	5	2–7	0.093	

Cumulative scores out of a total of 10 for each process.

p-values from Kruskal-Wallis analysis of variance of the differences between process of change measures and stages of change.

\**p*-value <0.05, further statistical analysis performed (post-ANOVA).

stated they were interested in quitting smoking wanted any help to quit and where they would like to receive this help. The results shown in Table 6 demonstrate that a large proportion (74%) of smokers who wanted to quit within the next 6 months (those current smokers in pre-contemplation and preparation) wished to receive help with their quit attempt. Of these, 83% wanted to receive help with their quit attempt from the periodontal department. Of these, 79% stated that they wanted quit help as part of their periodontal treatment. Thus, nearly half (49%) of the current smokers who wanted to quit requested smoking cessation to be provided alongside their periodontal treatment.

# Discussion

The response rate to the questionnaire was 56%. The study design precluded a second wave of questionnaires to be sent to the non-responders; therefore, attempts to improve response rate were not possible. The results may therefore be biased towards the health beliefs of those who chose to respond. However, this response rate is better than the 24% response rate achieved in our pilot study, and this improvement may have been due to the inclusion of a stamped self-addressed envelope. A systematic review showed that this additional effort has been shown to increase response rates by an odds ratio (OR) of 1.26 (Edwards et al. 2002). In addition, the population to which the questionnaire was sent was a consecutive sample of patients referred to and accepted by the Periodontal Department for initial consultation, a proportion of which may not have had periodontitis.

The distribution of smokers within the responding population was similar to that seen in the general population (24.5% current smokers, 30.3% past smokers and 45.1% never smokers). National data show that in the United Kingdom, 24% of adults currently smoke (23% of females and 25% of males) and figures for quitting show that 21% of females and 27% of males are past smokers (Action on Smoking and Health 2007). These figures are representative of the general population. and are slightly different from internal departmental audit data. This data examined over 3000 patients referred to the department between 2001 and

Table 6. Respondents showing an interest in receiving help with their quit attempt

	No		Yes	
	n	%	n	%
2F				
Are you interested in receiving help with your quit attempt? n = 47 (those in precon and contemplation)	12	26	35	74
2Gi				
Would you like us to provide this help here?	6	17	29	83
n = 35 (those that said yes)				
2Gii				
Would you like it along side your gum treatment?	6	21	23	79
n = 29 (those that said yes)				
Percent of total smokers wanting to quit $n = 47$ (those in precon and contemplation)				49

2003. Among males, 33.3% were current smokers, 23.8% were past smokers and 42.9% were non-smokers. For females, these were 31.3%, 17.7% and 50.9%, respectively.

The results for the first part of the questionnaire revealed some interesting findings. When comparing current smokers with never smokers, it was found that never smokers had significantly greater perceived gingival bleeding (p = 0.009), while the observation of having one or more loose teeth was significantly greater among current smokers (p = 0.008). Both these findings confirm studies looking at self-reported symptoms (Preber & Bergström 1986, Dye et al. 2006). These are corroborated by evidence from clinical studies showing that current smokers have less gingival bleeding (Preber & Bergström 1985, Bergström & Bostrom 2001) and more severe periodontal disease, consequently more loose teeth (Tomar & Asma 2000, Bergström 2006).

Nevertheless, it was disappointing to find that despite the apparent awareness of symptoms, there was still a lack of awareness about the presence of periodontal disease among respondents. Questions such as "Has your dentist/hygienist told you that you have deep pockets?" have been shown to be one of the best selfreported periodontal measures available with a sensitivity of 55% and a specificity of 90% (Blicher et al. 2005). The low agreement response and lack of differences between groups to the above questions are therefore likely to be a true reflection of the patients' lack of periodontal disease awareness and its relation to smoking.

Another surprising lack of differences between the groups was for the question "I don't think that I am at more risk of gum disease than other people". It would be expected that current smokers would have been told by their referring dentist that smoking was a major risk factor and therefore they would perceive themselves as being more at risk. However, a recent study of patients attending Restorative Consultant Clinics and Primary Dental Care at the King's College Dental Institute found that while 78% of patients referred were aware that smoking had a negative impact on health, only 7% of patients stated that smoking affected the gums, and only 6% knew specifically of the link between smoking and periodontal disease (Lung et al. 2005).

Despite this apparent lack of awareness, most respondents had a high level of agreement of scores for their attitudes to the severity of the problem, with all respondents regardless of smoking status having similarly high scores. The questionnaire was included as part of a hospital consultation appointment and the fact that their periodontal problem was sufficiently severe to warrant referral may have raised patient perception of severity. While all the respondents confirmed that "my oral health is important to me'', never smokers were found to have significantly higher scores when compared with both the current smokers and past smokers. This attitude is not surprising, because never smokers are more likely to have better health beliefs than smokers and therefore place a higher value on their health and participate in health promoting activities.

Following on from this, according to the health locus of control theory, individuals that are shown to have an internal health locus of control are more likely to engage in health promoting activities. Therefore, never smokers should show higher scores for internal locus of control-related questions. However, the results from this study show that both between and within smoking status groups, there were no differences for the three orientations of health locus of control. All the groups showed equally moderate to low scores, possibly indicating that the respondents were not clear in their own minds as their locus of control. These results are consistent with the other studies which have also had mixed results and shown that overall health locus of control is a relatively weak predictor of health behaviour (Conner & Norman 2005).

While looking at the results for the distribution of smokers by stages of change, there was a more favourable outlook with more smokers in the contemplation (45.6%) and preparation (23.5%) stages than has been shown in the literature. In a large study of the general population conducted in the United States, 59% of current smokers were in pre-contemplation, 32% were in contemplation and only 9% were in preparation (Wewers et al. 2003). Several studies on European populations have shown that more smokers are in precontemplation compared with the United States (Etter et al. 1997). These differences may be due to the differences in prevalence of smoking, as demonstrated in a large-scale study in the United States where a higher prevalence of cigarette smoking was associated with more smokers being in pre-contemplation (Etter 2005). The more favourable results seen in our study may also be due to the fact that the questionnaire was sent together with a hospital appointment. Respondents may therefore have been encouraged to appear more proactive towards quitting smoking than they otherwise would normally be.

Several major concerns have been raised regarding the stages of change algorithm. According to the algorithm, a smoker cannot be in the preparation stage unless they have made a recent quit attempt, even if they state that they wish to quit in the next 30 days. Thus, accordingly, a first time quitter can never be in preparation and are instead staged as being in contemplation. Therefore, several individuals who stated that they wished to quit within the next 30 days were staged in contemplation because they had not made a previous quit attempt, a factor which inevitably would lead to overestimation of the percentage of subjects in contemplation, and underestimation of the percentage of subjects in preparation.

This arbitrary staging of individuals has been criticized along with the fact that the model does not take into account dependence levels, withdrawal symptoms and other key determinants of quitting smoking (Etter 2005, Herzog 2005, Sutton 2005a, West 2005). Therefore, another possible determinant of the higher level of subjects in contemplation and preparation within our population of current smokers is their low to moderate level of nicotine dependence and is indicated by the low scores for FTND. The lower dependence and lower nicotine addiction of those individuals in contemplation may be one reason why these individuals are more ready to quit than others. This has been shown in several studies where smokers in preparation smoked less and had made more quit attempts than smokers in pre-contemplation and contemplation (DiClemente et al. 1991, Farkas et al. 1996).

Several large studies on the interrelationships among the key constructs of the TTM found that pre-contemplators were found to use the processes of change the least and those in preparation use them the most. Pre-contemplators and contemplators are tempted to smoke in more situations than those in preparation (DiClemente et al. 1991, Fava et al. 1995, Herzog et al. 1999). In line with these studies, the results from this study also show that the scores for the process of change increased from pre-contemplation to preparation. However, in the self-efficacy/temptation measures, these differences were not clearcut. For the self-efficacy/temptation measures, all the respondents in this study had similar scores across all the three stages, and none were statistically different.

There was a trend showing higher scores for positive affect/social situation and negative affect situations than for habitual craving situations for all the three stages, this was not statistically significant. These results could be a reflection of the fact that all the current smokers are still tempted to smoke despite their apparent stage of change as they are all current smokers. The lower scores for habitual craving situations across all the three stages may also be a reflection of the moderate addiction of the current smokers in this study sample compared with those in the literature that had higher levels of addiction.

Other studies found that there were significant differences between all of the

processes of change when related to the different stages of change (DiClemente et al. 1991, Fava et al. 1995, Herzog et al. 1999). In contrast, our study found significant differences between only two of the "processes of change", self-reevaluation (p < 0.001) and self-liberation (p = 0.002). The differences between those in pre-contemplation and contemplation, and between those in contemplation and preparation were found to be statistically significant for both of these processes with those in preparation having higher scores in both instances. The use of these processes has been shown to change more than other processes when moving across stages. Self-liberation (committing to change) has been shown to be of increased importance moving from pre-contemplation to action and self-re-evaluation (re-considering effects of one's behaviour) when moving from contemplation to preparation (Prochaska et al. 1992).

Several studies have attempted to see if the observed differences between stages offer any predictive power of stage movement through the model. While some have shown that several of the processes of change are predictive of transition through various stages of the TTM (Prochaska et al. 1992), other investigators have failed to confirm this (Farkas et al. 1996, Herzog et al. 1999, Abrams et al. 2000). This lack of predictive power has been one of the major criticisms of the model with several researchers in the field saying that it offers little more than common sense, i.e. a smoker in contemplation is more likely to quit than a smoker in precontemplation (Sutton 2001, 2005b, West 2005).

The strongest evidence for the TTM model being a useful predictor of behaviour change comes from data regarding the effectiveness of stage-matched interventions. Studies from the developers of the TTM report impressive results using stage-matched smoking cessation interventions

(Prochaska et al. 1993, 2001). However, in a recent meta analysis, others showed that there was limited evidence for the effectiveness of stage-based interventions in changing smoking behaviour (Riemsma et al. 2003), which contradicted the finding of an earlier review (Spencer et al. 2002). No intervention has been shown to be successful in unmotivated smokers (Fiore 2000), and at the most basic level, the TTM could be used to select motivated smokers for intervention.

In fact, most smoking cessation interventions have been shown to be effective (Raw et al. 1999). In the final part of the questionnaire, this study examined respondents' desire to quit and if they wanted any help to quit. Smoking cessation can be delivered in a stepwise approach. The simplest form of smoking cessation intervention is "brief opportunistic advice" from a health care professional, and typically involves: Asking patients about current smoking. Advising them to stop, offering Assistance by referral to a specialist service and Arranging follow-up if appropriate (the four As approach). A fifth step Assess can also be added to the four As in order to determine willingness to make a quit attempt (Fiore 2000).

Brief advice versus no advice (or usual care) significantly increases the OR of quitting (OR 1.74) equivalent to an absolute difference in the cessation rate of about 2.5% (Lancaster & Stead 2004). "Face to face" behavioural support, including a range of methods from focused counselling and advice to stress management can increase abstinence by 7% and is usually provided in specialist smoking cessation clinics (West et al. 2000). Nicotine replacement therapy (NRT) reduces withdrawal symptoms associated with smoking cessation, helping resist the urge to smoke. A Cochrane review concluded that NRT can double quit rates, irrespective of the setting in which it is used (Silagy et al. 2004). Further improvements of 9% in 12 months sustained abstinence rates and reductions in severity of withdrawal symptoms have been shown by combining Bupropion (Zyban) with intensive behavioural support (West et al. 2000).

There is evidence for the role of the dental professional in successful smoking cessation within the dental setting (Carr & Ebbert 2006, Dyer & Robinson 2006, Needleman et al. 2006, Hanioka et al. 2007). A recent study found that a brief intervention given by a dentist to 497 patients was more successful at motivating people in the pre-contemplation stage than those in the contemplation stage (Hanioka et al. 2007). It has been suggested that dentists who implement a structured quit smoking programme may expect to see 10-15% quit rates per year, which is comparable with results seen in general medical practise (Warnakulasuriya 2002).

Smoking cessation should therefore be an important component of periodontal therapy, but little is known about how this is put into practise. Those 74% of respondents in our study who wanted to quit within the next 6 months (those current smokers in pre-contemplation and preparation) wished to receive help with their quit attempt, and of these, 83% wanted to receive help with their quit attempt from the periodontal department. Of these, 79% stated that they wanted this help as part of their periodontal treatment. Thus, nearly half (49%) of the current smokers who wanted to quit requested smoking cessation to be provided alongside their periodontal treatment.

One study has shown that combining non-surgical periodontal treatment with smoking cessation can be successful (Preshaw et al. 2005). They successfully provided individually tailored smoking cessation advice and treatment including NRT or Bupropion in conjunction with non-surgical periodontal treatment (Nasry et al. 2006). After 12 months, 20% of the subjects had quit smoking and a further six patients had quit and relapsed. Their quit rate also compared favourably with that achieved in specialist quit smoking clinics (Nasry et al. 2006).

To date, no study has looked at smoking behaviour and attitudes to health and guit smoking in patients with periodontal disease. Our results show that there are some significant differences between the attitudes and self-reported periodontal needs of patients referred to our periodontal department especially when considering their smoking status. This is also the first study to apply the TTM to a sample of smokers with periodontal disease to look at their smoking behaviour. We also established that there is a need to provide smoking cessation help within the department as almost half the patient stating that they wanted quit help alongside their periodontal treatment.

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# **Clinical Relevance**

Scientific rationale for the study: Smoking is one of the key risk factors for periodontitis, and quitting smoking improves treatment outcomes. However, there is a paucity of data about smoking behaviour and attitudes to health and quit smoking in periodontal patients. *Principal findings:* Smokers noticed more tooth mobility but less gingival bleeding, and may be considering an attempt to quit smoking. About half of the respondents requested to have smoking cessation as part of their periodontal treatment.

Practical implications: Many periodontal patients who smoke want to quit, and the nature of periodontal treatment provides an opportunity in which we can deliver targeted smoking cessation treatment in combination with traditional therapy. This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.