

Uptake of best practice recommendations in the management of patients with diabetes and periodontitis: a cross-sectional survey of dental clinicians

S. M. Bissett,^{*1} J. Presseau,² T. Rapley³ and P. M. Preshaw⁴

Key points

Shows that dental clinicians usually inform patients with diabetes and periodontitis about the links between the two diseases, and consider the impact of periodontitis treatment on glycaemic control.

Demonstrates that dental clinicians tend not to contact the doctor about the patient's diabetes, and when they do, they mostly prefer to communicate through the patient as opposed to contacting the doctor directly.

Reveals a potential mismatch between the best practice recommendation to contact the patient's doctor and the communication practices of dental clinicians.

Introduction Published guidance documents describe best practice recommendations for management of patients with diabetes and periodontitis. However, little is known about their uptake by dental professionals. **Aims** To explore current practice and behavioural correlates for three behaviours in the management of patients with diabetes and periodontitis: 'informing' patients about the links; 'considering' the impact of periodontitis treatment on glycaemic control; and 'contacting' the patient's doctor. **Methods** Participants (N = 328) recruited via two UK professional dental societies completed online questionnaires assessing their 'informing', 'considering' and 'contacting' activities, utilising constructs from behavioural and implementation theories (social cognitive theory and normalisation process theory). **Results** There was good reported uptake of 'informing' and 'considering', with clinicians performing these behaviours in more than eight of their last ten patients. However, there was poor uptake of 'contacting'. Periodontal specialists had significantly higher scores for 'contacting' (3.44±4.16 of last ten patients) than dental hygienist/therapists (0.57±1.37, $p < 0.001$), who mainly relied on dentists to contact the doctor. Respondents indicated negative experiences of 'contacting', preferring to communicate via the patient than contact the doctor directly. **Conclusion** Contacting the doctor can be problematic and dental clinicians generally chose not to do this, indicating a mismatch between this best practice recommendation and preferences of dental clinicians.

Introduction

People with poorly controlled diabetes have a three-fold increased risk of developing periodontitis, which, in turn, can negatively impact glycaemic control.¹ Furthermore, treatment of periodontitis can result in improved glycated haemoglobin (HbA1c) levels, the reduction being similar to that expected from second

line diabetes medication.^{2,3} Previous qualitative research exploring the management of periodontitis within the context of diabetes suggests that whereas these facts may be well known to dental professionals, people with diabetes and medical professionals are frequently unaware.⁴

In 2013, the findings of a workshop held by the European Federation of Periodontology (EFP) and American Academy of Periodontology (AAP) on the links between periodontal diseases and general health were published, together with a manifesto on this topic.⁵ The evidence-based papers that were published called for closer collaboration between dental and medical clinicians to improve patient care, with a clear emphasis on informing and educating patients about the links between periodontitis and diabetes. For example, they recommended that patients newly diagnosed with diabetes should receive a periodontal examination, and

that patients who do not currently have diabetes but present in the dental clinic with risk factors for diabetes and signs of periodontitis should be informed about their risk for having diabetes, assessed using a chairside HbA1c test, and/or referred to a physician for appropriate diagnostic testing.⁶ In the UK, guidance documents on this topic include the British Society of Periodontology (BSP) Good Practitioner's Guide, which suggests contacting the patient's doctor to obtain recent HbA1c test results to help the dental team better understand the diabetes risk to periodontal health.⁷ Similarly, the UK Department of Health recommended that the dental team write to the patient's doctor for information on the patient's diabetes status (particularly HbA1c levels), and produced a template letter for dental clinicians to use in this regard.⁸ To date, little is known about the uptake of these recommendations by dental professionals.

¹Centre for Oral Health Research & Institute of Cellular Medicine, Newcastle University, Newcastle upon Tyne, UK; ²Centre for Implementation Research, Ottawa Hospital Research Institute, Ottawa, Canada; ³Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne, UK; ⁴National University Centre for Oral Health, National University of Singapore, Singapore
*Correspondence to: Susan Bissett
Email: s.m.bissett@newcastle.ac.uk

Refereed Paper.

Accepted 16 July 2018

Published online 18 January 2019

DOI: 10.1038/sj.bdj.2019.48

Aims

We aimed to investigate the reported practices of dental clinicians in relation to management of patients with periodontitis and diabetes to ascertain whether published best practice recommendations⁶⁻⁸ were being followed and to assess the factors which predict behaviour. We focused on three recommended clinical behaviours:

1. 'Informing' patients with diabetes about the links between diabetes and periodontitis
2. 'Considering' the impact of periodontitis treatment on the patient's glycaemic control, as opposed to treating periodontitis in isolation from the diabetes
3. 'Contacting' the doctor with regard to the management of patients who have periodontitis and poorly controlled diabetes.

Materials and methods

Design

The study used a cross-sectional design, involving online questionnaires (Qualtrics) to collect clinicians' self-reported performance and views on the three clinical behaviours. The questionnaire was piloted before use with dental clinicians. In accordance with the UK Medical Research Council guidance for developing and evaluating complex interventions,⁹ we used theory to explore dental professionals' behaviours in the management of patients with periodontitis and diabetes, specifically a combination of Social Cognitive Theory (SCT)^{10,11} and Normalisation Process Theory (NPT) (Table 1).¹²

SCT is a theory of motivation and action that describes key modifiable cognitions that can help to explain and improve the quality of care.¹³⁻¹⁵ SCT posits that the care that clinicians provide is a function of their belief in their ability to do so (self-efficacy), their beliefs about the consequences of the care they provide (outcome expectations), their intention to do so (proximal goals) and the external social and structural factors that act as barriers and enablers (socio-structural determinants). NPT is an implementation theory used to identify, conceptualise and evaluate the factors that promote or inhibit the introduction, implementation and embedding of processes (such as patient management) into normal care.^{16,17} For researchers who wish to utilise NPT, the NoMAD instrument^{12,18} was developed as a tool to quantitatively assess implementation determinants, and is composed of four core constructs: coherence, cognitive participation,

collective action, reflexive monitoring and 16 sub-constructs or items. The authors suggested customisation of the NoMAD tool by selecting sub-constructs as appropriate according to the study context (Table 1).

The questionnaire assessed the following parameters:

Self-reported past behaviour

The questionnaire measured past behaviour in terms of the last ten patients with diabetes seen for whom the clinicians reported performing any of the three recommended clinical behaviours ('informing', 'considering', 'contacting'). Response options ranged from zero to ten patients (that is, the behaviour was performed on 'x' of their last ten patients with diabetes), with this approach chosen as a means to simplify the estimation of the behaviour by the participant. The wording and operationalisation of this measure was consistent with other studies of clinicians' provision of diabetes-related healthcare.¹⁹

SCT constructs

For each of the three recommended clinical behaviours, proximal goals was assessed on

a ten-point scale of direct estimation of how many of their next ten patients with diabetes they intended to engage in each behaviour. Self-efficacy and outcome expectations were also assessed for each behaviour, using a five-point Likert scale with response options: '1-strongly disagree', '2-disagree', '3-neither agree or disagree', '4-agree', and '5-strongly agree'. Items assessing SCT constructs were worded in a manner consistent with past research.¹⁹

NPT constructs

In customising the NoMAD tool, five NPT sub-constructs were measured: differentiation; communal specification; individual specification; internalisation; legitimisation,¹² and these were measured using a five-point Likert scale (same scale as above). Multiple item questions were informed by previous qualitative exploration of the determinants involved in carrying out behaviours in the context of diabetes and periodontitis.⁴

Finally, a free-text box enabled respondents to provide any further comments for qualitative analysis.

Table 1 Definitions of Social Cognitive Theory (SCT) and Normalisation Process Theory (NPT) constructs utilised in this research^{10-12,18}

Social Cognitive Theory (SCT): a theory of motivation and action that is used to predict clinicians' cognitions that may improve quality of care. SCT comprises three constructs:	
Self-efficacy	The belief in one's ability to succeed in specific situations or accomplish a task
Outcome expectations	One's expectations about the consequences of performing an action or behaviour
Proximal goals	One's intention (ie motivation) that regulates future effort and action with respect to a particular behaviour
Normalisation Process Theory (NPT): a framework that is used to evaluate the factors that promote or inhibit implementation of processes (such as specific aspects of patient management) into routine care. NPT comprises four core constructs:	
Coherence	How clinicians make sense of the behaviour or intervention, eg what it involves and why?
Cognitive participation	How clinicians get involved and stay committed, eg can they see how they contribute?
Collective action	How clinicians make it work in practice, eg what do they need to make it happen?
Reflexive monitoring	How clinicians assess whether it is worth the effort, eg does it result in benefits to patient care?
NPT also includes up to 16 sub-constructs, and those that are relevant to the particular clinical scenario should be selected. We selected five NPT sub-constructs in this research, and the participants were asked to respond to these in the questionnaire:	
Differentiation	I can see how the (behaviour) differs from usual ways of working
Communal specification	Staff in this organisation have a shared understanding of the purpose of this (behaviour)
Individual specification	I understand how the (behaviour) affects the nature of my own work
Internalisation	I can see the potential value of the (behaviour) for my work
Legitimation	I believe that participating in the (behaviour) is a legitimate part of my role

Study population

Participants invited to complete the questionnaire included dental clinical academics, periodontal specialists, general dental practitioners (GDPs) and dental hygienist/therapists (DHTs) working in academia, primary and secondary care services. They were recruited via two professional societies: the British Society of Periodontology (BSP) and British Society of Dental Hygiene and Therapy (BSDHT). These societies were selected to optimise recruitment as it was considered likely that their members would be interested in the subject area. Based on systematic reviews of predictive healthcare professional behaviour regression modelling, a sample size target of $N = 150$ completed questionnaires was set.^{20,21}

A link to the questionnaire was e-mailed to each member of the two societies (combined membership of approximately 4,000: BSP ~1,000 and BSDHT ~3,000). The recruitment period ran from January to May 2016 with repeat mailings to encourage participation. No attempts were made to achieve targets with respect to numbers of responses from specific groups of clinicians as this was not considered feasible within the study design. Completion and submission of the questionnaire was incentivised via a prize draw to win one of ten £100 Amazon gift cards. The questionnaires were

completed anonymously, however, in order to issue prizes, the respondents were invited to provide their General Dental Council (GDC) registration number to be entered into the prize draw.

Statistical analysis

Statistical analysis was conducted using SPSS v23.0 for Windows. Descriptive analyses (means and standard deviations) were calculated to summarise sample characteristics and NPT data. Constructs that were multi-item were tested for internal consistency in order to combine results to a single mean score.^{22,23} To explore variation in responses according to professional role, Kruskal Wallis tests were used to identify significant differences between three professional groups (periodontal specialists, GDPs, and DHTs), with Mann Whitney tests for post-hoc comparisons with adjustment of the critical value of p as appropriate. SCT correlates of behaviour were assessed using binary univariate and multivariate logistic regression to identify construct predictors for each of the behaviours.

Ethical approval

A favourable ethical opinion was obtained from North West-Greater Manchester West Research Ethics Committee (16/NW/0030).

Results

In total, 346 questionnaires were returned: 103 from BSP members (~10% response rate); and 243 from BSDHT members (~8% response rate). Partially completed questionnaires were deleted list-wise to achieve a final sample of 328: 42 periodontal specialists, 13 GDPs, and 273 DHTs (including individuals who were members of BSDHT or BSP). The majority of the participants were female (84%).

Sample sociodemographic and clinical practice descriptive statistics (Table 2) show that DHTs reported seeing, on average, approximately twice the number of patients with diabetes per month (21) compared to specialists (10). GDPs reported spending the least amount of time practising periodontology (though the questionnaire did not ascertain precisely which types of periodontal treatments they were providing), however this was still a large percentage of their time (43%). For those respondents working in primary care, a small amount of periodontal treatment was reported to be provided under NHS contracts (16%), with the majority being treated privately (57%) or by some other non-NHS payment scheme (27%).

Behaviour 1: Informing patients with diabetes about the links between diabetes and periodontitis

The questionnaire identified that dental clinicians reported 'informing' more than nine out of their last ten patients with diabetes about the links between diabetes and periodontitis. These scores were consistent with high scores for outcome expectations, proximal goals, internalisation and legitimation (Table 3). Significant differences were seen, however, between the responses of the specialists and DHTs for self-efficacy (3.75 ± 1.24 and 3.32 ± 1.07) ($p = 0.01$), differentiation (1.87 ± 1.00 and 2.44 ± 1.23) ($p = 0.01$); and specification, both communal (4.10 ± 1.10 and 3.68 ± 1.13) ($p = 0.01$) and individual (4.21 ± 1.06 and 3.86 ± 1.05) ($p = 0.01$).

The SCT predictors for 'informing' accounted for a medium amount of variance (Cox & Snell R^2 0.14; Nagelkerke R^2 0.24), with outcome expectations ($B = 2.44$, $p < 0.001$) and proximal goals ($B = 5.01$, $p < 0.001$) as significant predictors of informing (Table 4). Self-efficacy was not statistically significant ($B = 1.32$, $p = 0.13$) when it was included in a model that controlled for demographic factors and included other SCT constructs.

The qualitative responses regarding 'informing' patients about the links between

Table 2 Sample characteristics of study population (N = 328)

Sex (N, %)	Female	274 (84.3%)
	Male	54 (15.7%)
Age cohort (N, %)	<30 years	41 (12.5%)
	30-40 years	85 (25.9%)
	40-50 years	89 (27.1%)
	50-60 years	94 (28.7%)
	>60 years	19 (5.8%)
Sample recruitment (N, %)	BSP	90 (27.4%)
	BSDHT	238 (72.6%)
Years since first registered with GDC		19.78 ± 11.82
N patients with diabetes seen per month	Specialists (N = 42)	10.16 ± 9.83
	GDPs (N = 13)	14.62 ± 12.43
	DHTs (N = 273)	21.29 ± 23.74
% of clinical time spent in practise of periodontology:	Specialists (N = 42)	$66.83\% \pm 33.42\%$
	GDPs (N = 13)	$43.08\% \pm 25.29\%$
	DHTs (N = 273)	$71.12\% \pm 28.35\%$

Data for continuous variables presented as mean \pm standard deviation. BSP, British Society of Periodontology; BSDHT, British Society of Dental Hygiene and Therapy; GDPs, general dental practitioners; DHTs, dental hygienists and therapists.

Table 3 Descriptive statistics of the three behaviours for SCT and NPT

Behaviour	Professional role	Past behaviour	Self-efficacy	Outcome expectations	Proximal goals	Differentiation	Communal specification	Individual specification	Internalisation	Legitimation
Informing	Sp. (N = 42)	9.83±0.54	3.75±1.24	4.54±0.55	9.95±0.31	1.87±1.00	4.10±1.10	4.21±1.06	4.82±0.39	4.90±0.31
	GDP (N = 13)	9.31±2.21	3.96±0.84	4.19±0.60	10.00±0.00	2.62±1.39	3.62±1.04	4.15±1.07	4.62±0.51	4.85±0.38
	DHT (N = 273)	9.34±1.87	3.32±1.07	4.40±0.65	9.90±0.62	2.44±1.23	3.68±1.13	3.86±1.05	4.65±0.52	4.74±0.48
	p	0.60	0.01 (Sp. vs DHT 0.01)	0.15	0.77	0.01 (Sp. vs DHT 0.01)	0.02 (Sp. vs DHT 0.01)	0.02 (Sp. vs DHT 0.01)	0.10	0.07
Considering	Sp. (N = 42)	8.56±2.80	3.88±1.18	4.32±0.79	9.66±1.49	2.23±1.20	3.82±1.14	4.21±0.98	4.46±0.85	4.54±0.82
	GDP (N = 13)	8.46±2.82	4.07±0.69	4.42±0.45	9.62±1.39	2.54±1.20	3.23±1.17	4.15±0.80	4.62±0.51	4.77±0.44
	DHT (N = 273)	8.21±2.93	3.57±1.03	4.33±0.72	9.71±1.42	2.93±1.25	3.65±1.12	3.94±1.04	4.47±0.64	4.61±0.59
	p	0.55	0.04	0.99	0.86	<0.001 (Sp. vs DHT <0.001)	0.13	0.22	0.72	0.67
Contacting	Sp. (N = 42)	3.44±4.16	3.65±1.16	3.73±0.99	5.46±4.30	2.97±1.25	3.46±0.94	3.97±0.84	4.08±0.96	4.03±0.87
	GDP (N = 13)	0.75±1.06	3.01±0.75	3.19±1.11	5.85±3.91	3.46±0.97	2.69±1.03	3.69±0.86	4.08±0.64	3.77±0.73
	DHT (N = 273)	0.57±1.37	2.83±0.89	3.28±0.99	4.49±4.28	4.00±0.99	3.01±1.16	3.64±0.86	3.88±0.87	3.61±0.96
	p	<0.001 (Sp. vs DHT <0.001)	<0.001 (Sp. vs DHT <0.001)	0.44	0.14	<0.001 (Sp. vs DHT <0.001)	0.01 (Sp. vs DHT 0.01)	0.05 (Sp. vs DHT 0.01)	0.25	0.03 (Sp. vs DHT 0.01)

Past behaviour and proximal goals were ten-point scales, ie for how many of the last ten patients did the clinician perform the behaviour ('past behaviour'), and for how many of their next ten patients does the clinician plan to perform the behaviour ('proximal goals'); the other measures were five-point Likert scales: 1 – strongly disagree, 2 – disagree, 3 – neither agree or disagree, 4 – agree and 5 – strongly agree.

Data presented as mean ± standard deviation.

p = test of differences between professional groups determined using Kruskal-Wallis (with post-hoc Mann Whitney tests and adjustment of critical value of p). GDP, general dental practitioners; DHT, dental hygienists and therapists; Sp, specialists; SCT, social cognitive theory; NPT, normalisation process theory.

diabetes and periodontitis were consistent with the quantitative findings, suggesting that all professional groups are performing this behaviour with almost all of their patients with diabetes. Some professionals noted:

'Patients who aren't diagnosed with diabetes should also be informed of the link between diabetes and periodontitis. I inform all patients with periodontitis' (specialist periodontist).

As periodontitis is a risk factor for diabetes, they inform all of their patients with periodontitis about the links.

Behaviour 2: Considering the impact of periodontitis treatment on glycaemic control

All dental professional groups reported high uptake (self-reported past behaviour) of 'considering' the impact of periodontitis treatment on diabetes control, with mean scores showing that the clinicians considered this element of care for more than eight of their last ten patients with diabetes. These scores were consistent across SCT constructs with high scores

for outcome expectations, proximal goals, internalisation and legitimation (Table 3); and, although not as high, the scores for self-efficacy and specification, both communal and individual, were positive. There were, however, significant differences seen between the responses of the specialists and DHTs for differentiation (2.23±1.20 and 2.93±1.25) (p <0.001).

The SCT predictors for 'considering' accounted for a medium amount of variance (Cox & Snell R² 0.11; Nagelkerke R² 0.15), with all three SCT constructs as statistically significant predictors (Table 4). Outcome expectations (B = 1.79, p <0.001) was the strongest predictor, followed by self-efficacy (B = 1.44, p <0.01).

The qualitative responses for 'considering' the impact of periodontitis treatment on glycaemic control showed that some DHTs reported checking the patient's glycaemic control infrequently:

'I have always considered the impact of diabetes on periodontitis and treatment. But never the impact of periodontal treatment on diabetes control' (DHT).

Instead, they focused on updating the patient's medical/medication history at successive appointments.

Behaviour 3: Contacting the patient's doctor with regard to their poorly controlled diabetes

All three dental professional groups reported low uptake of 'contacting' the patient's doctor with regard to patients' periodontitis and poorly controlled diabetes, with a score of 3.44±4.16 for the specialists, which was (nonsignificantly) higher than that of GDPs (0.75±1.06), and significantly higher than that of DHTs (0.57±1.37) (p <0.001). These results were consistent across SCT constructs, with low responses for proximal goals, and mid-scale responses for outcome expectations (Table 3). Mean scores for self-efficacy were similar for specialists (3.65±1.16) and GDPs (3.01±0.75), but significantly different between specialists and DHTs (2.83±0.89) (p <0.001). Significant differences between specialists and DHTs were also identified in the responses to

Table 4 Multivariate logistic regression model predicting past informing, considering and contacting (N = 328)

Behaviours	Covariates and SCT predictors	B	SE	p	95% CI B coefficient	
					Lower	Upper
Informing*	Self-efficacy	1.32	0.18	0.13	0.93	1.87
	Outcome expectations	2.44	0.27	<0.001	1.45	4.11
	Proximal goals	5.01	0.56	<0.001	1.66	15.13
Considering**	Self-efficacy	1.44	0.13	<0.01	1.12	1.84
	Outcome expectations	1.79	0.18	<0.001	1.26	2.55
	Proximal goals	1.26	0.11	<0.05	1.01	1.57
Contacting†	Self-efficacy	1.25	0.17	0.21	0.89	1.75
	Outcome expectations	1.72	0.18	<0.001	1.21	2.44
	Proximal goals	1.14	0.04	<0.001	1.06	1.24

B, exponential of β (odds ratio); SE, standard error; CI confidence interval
 *Cox & Snell R² 0.14, Nagelkerke R² 0.24
 **Cox & Snell R² 0.11, Nagelkerke R² 0.15
 †Cox & Snell R² 0.20, Nagelkerke R² 0.29

NPT items, apart from internalisation which nonetheless revealed positive responses across all professional groups.

The SCT predictors for 'contacting' accounted for a medium amount of variance (Cox & Snell R² 0.20; and Nagelkerke R² 0.29), with both outcome expectations (B = 1.72, p <0.001) and proximal goals (B = 1.14, p <0.001) as statistically significant predictors (Table 4). Self-efficacy was not statistically significant when it was included in a model that controlled for demographic factors and included other SCT constructs.

The qualitative responses to 'contacting' the patient's doctor with regard to patients' poorly controlled diabetes were mainly negative, which was consistent with the quantitative findings (that indicated very low uptake of the behaviour). There were comments from all professional groups regarding the difficulty of getting a response from a letter to a patient's doctor; and many had experienced negative encounters with doctors. Several DHTs stated that their practice preferred the referring dentist to contact the patient's doctor, with the exception of those DHTs seeing patients under direct access arrangements.

'I personally would not inform the doctor when a patient has these problems as the dentist would do it, being head of the dental team. However, if I were seeing a patient under direct access then it would be my responsibility' (DHT).

Many respondents preferred to communicate through the patient, for instance by asking a patient with periodontitis to go to the doctor in the case of suspecting undiagnosed diabetes;

or with regard to glycaemic control, even with concerns regarding the accuracy of patient report:

'I often suggest seeing [the] GP if [the] periodontal treatment response is poor when I am not expecting it to be – for a diabetes check – to rule it out. If I felt that it was needed then I would be happy to contact the GP regardless of time etc – I would want to provide the best I could for my patient' (DHT).

Discussion

Given the increasing strength of evidence linking periodontitis and diabetes, and the known benefits of periodontitis treatment on diabetes control, it is unsurprising that many scientific and professional organisations have published recommendations for clinical practice, and that these evolve over time. Indeed, most recently, the consensus report of a joint workshop held by the EFP and the International Diabetes Federation has been published.²⁴ This included updates on epidemiological studies of the effect of periodontitis on diabetes,²⁵ the pathogenic mechanisms linking the two diseases,²⁶ and the impact of periodontal therapy on glycaemic control.³ Importantly, this workshop was inter-professional and the papers were published simultaneously in both a dental journal (*Journal of Clinical Periodontology*) and a medical journal (*Diabetes Research and Clinical Practice*) to help to improve awareness of this topic among dental and medical clinicians. The consensus report included guidelines

for medical professionals (such as informing patients with diabetes about their risk for periodontitis and investigating the presence of periodontal disease as an integral component of diabetes care), guidelines for patients, and guidelines for dental professionals (including asking patients about their most recent HbA1c results, as well as suggesting that patients who do not currently have a diagnosis of diabetes but present in the dental practice with diabetes risk factors should be informed about their risk for having diabetes, and referred to a doctor).²⁴

In this cross-sectional survey, we investigated the quantitative and qualitative self-reports of periodontal specialists, GDPs and DHTs for three extant best practice clinical behaviours in the context of diabetes and periodontitis care published at the time of our research.⁶⁻⁸ These included 'informing' patients about the links between periodontitis and diabetes, 'considering' the impact of periodontitis treatment on the patient's glycaemic control (rather than treating periodontitis in isolation from the diabetes), and 'contacting' the patient's doctor with regard to their periodontitis and poorly controlled diabetes. The research did not aim to suggest what different professional groups should be doing in relation to these topic areas, but rather aimed to identify current practice as reported by clinicians themselves, and to identify modifiable correlates while positioning these in the context of published guidance. To the best of our knowledge, this is the first time that these two theories (SCT and NPT) have been utilised together.

The findings suggest that overall, if a patient with periodontitis and poorly controlled diabetes goes to a dental professional, it is likely that they will be 'informed' about the links between the diseases. There was high reported uptake of this behaviour by all three professional groups, with participants reporting informing more than nine out of their last 10 patients with diabetes about the links. Patients who have periodontitis but not diabetes may also sometimes be informed about the links, particularly if undiagnosed diabetes is suspected, as was suggested by some specialists. There were significant differences between responses of specialists and DHTs for self-efficacy, communal and individual specification, and legitimacy for 'informing', indicating that not all dental clinicians have the same understanding of how 'informing' affects their work or consider it normal practice.

Most clinicians reported that they generally 'consider' the impact of periodontitis treatment

on the patient's glycaemic control, with participants in all three professional groups reporting that they considered the impact of periodontitis treatment in more than eight out of their last ten patients with diabetes and periodontitis. This suggests that evidence confirming the beneficial impact of periodontitis treatment on glycaemic control^{2,3} is known to dental professionals, though it should also be noted that some clinicians (notably DHTs) further reported that whereas they acknowledge the effect that diabetes has on periodontitis, they do not always tend to consider the effect of periodontitis treatment on diabetes.

The findings for 'contacting' the patient's doctor with respect to patients' periodontitis and poorly controlled diabetes showed consistently low levels of reported past behaviour across all professional groups, and this behaviour would appear more likely to be carried out by a specialist than a DHT or GDP. However, specialists' motivation (proximal goals) appears to be low for contacting the patient's doctor in the future, similar to those of DHTs and GDPs, despite the published best practice recommendations.

The qualitative findings showed that many clinicians prefer to communicate through the patient rather than directly contacting the patient's doctor, despite questions of reliability. The reasons for this were varied: they were not aware of the recommendations; a perception that it empowers the patient; patient preference; difficulties in getting a response from the doctor, either by letter or by telephone; and reports of previous negative experiences of interactions with doctors or diabetes nurse specialists. Divisions between dental and medical professionals have been shown in previous research⁴ and it is not uncommon for clinicians to be unaware of guidelines and instead operate by 'mindlines', which are collectively reinforced, internalised guidelines informed mainly by their own experiences and those of colleagues, and their interactions with each other, patients and opinion leaders.²⁷

The specialists had significantly higher self-efficacy scores than DHTs for 'contacting', which was consistent with some DHTs' comments that it wasn't expected of them to contact the patient's doctor. The responses of the specialists were also significantly different to those of DHTs for the NPT sub-constructs of differentiation, specification and legitimisation, which was consistent with the qualitative findings that suggested some DHTs do not see this as part of their job role, perhaps due to

practice policies which rely on the referring or principal dentist to contact the doctor. Nonetheless, the DHT responses for internalisation or seeing the potential value of contacting were relatively high and some commented that they would consider a peer review session or practice meeting to review the policy, especially with regard to direct access.²⁸ SCT and NPT responses suggest that should an educational intervention or training to increase the uptake of this behaviour be considered worthwhile, the intervention should focus on outcome expectations, proximal goals and communal specification. Such an intervention could particularly benefit DHTs who see a higher number of patients with diabetes compared to other dental clinicians; and although not a significant predictor, perhaps self-efficacy would help with motivation, particularly for DHTs.

Study limitations

Self-report completion of the questionnaires was a direct way of gathering data; however, self-reporting one's behaviour is inherently affected by recall bias and social desirability bias.²⁹ We recruited participants via the membership of two professional societies affiliated with periodontology to optimise the response rate of interested participants; however, the population ratio of professional groups was heavily swayed towards DHTs (83%). Given the design of the study, which required interested individuals to respond to the invitation to complete the questionnaire, it was not feasible to set targets for responses from specific clinician groups. The imbalance in response rates between the three groups coupled with the low response from GDPs were limitations that can be appreciated particularly when considering the sub-group analyses. GDPs reported spending an average of 43% of their time practising periodontology, which may reflect the specialist interest in the responding GDPs. This recruitment strategy meant that the opinions of GDPs who are not as interested in periodontology were under-represented in this sample. Furthermore, it is not known specifically what was meant by the GDPs in their reporting of spending 43% of their time practising periodontology, that is, whether this referred to treatment of periodontitis, which would be highly relevant in the context of managing patients with diabetes, or whether this also includes treatment of gingivitis and prevention (for example, by delivery of oral hygiene instruction). As the questionnaire was cross-sectional, the dependent variable

in the logistic regression analysis was self-reported past behaviour, used as a proxy for future behaviour.¹⁴ Longitudinal designs using self-report and including objective measures of clinical behaviour would be relevant for future research.

Conclusion

The self-reported responses for 'informing' about the links and 'considering' the impact of periodontitis treatment on glycaemic control show that there is good uptake of these behaviours by dental professionals. This suggests that best practice guidance documents and scientific evidence on the links between diabetes and periodontitis and the beneficial impact of periodontitis treatment on glycaemic control are known to dental professionals who are acting in accordance with recommendations. However, we have identified that dental professionals 'contacting' the patient's doctor with regard to patients' periodontitis and poorly controlled diabetes is not reported as happening to any great extent, with specialists only reporting this behaviour in a minority of their patients with diabetes, and GDPs and DHTs reporting this behaviour in less than one of their last ten patients. Furthermore, the low uptake of this behaviour and preference to communicate through the patient (despite reliability issues) seem to raise a question regarding the relevance of this best practice recommendation that is featured in several guidance documents. These findings were consistent across all three professional groups and despite difficulty with (and previous negative experiences of) contacting the doctor, dental clinicians would endeavour to do so if they felt it necessary, but they chose not to, which reveals a potential mismatch between this best practice recommendation and the communication preferences of these front-line dental clinicians. If adherence to these recommendations is felt to be important to the overall aim of improving communication between medical and dental professionals to optimise patient care, then interventions to improve uptake could include aiming to increase outcome expectations and proximal goals/motivation. Furthermore, before recommending particular behaviours in published guidance documents, we consider that policy-makers and scientific/professional organisations should develop recommendations and test the feasibility of their implementation in close concert with the patient and professional groups concerned.

Acknowledgements

Susan Bissett is funded by a UK National Institute for Health Research Doctoral Research Fellowship (DRF-2014-07-023) and an Oral & Dental Research Trust DCP award (2013) funded the survey. This paper presents independent research and the views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health. The authors would like to thank the British Society of Periodontology and British Society of Dental Hygiene & Therapy for allowing distribution of the survey.

- Preshaw P M, Alba A L, Herrera D *et al*. Periodontitis and diabetes: a two-way relationship. *Diabetologia* 2012; **55**: 21–31.
- Simpson T C, Weldon J C, Worthington H V *et al*. Treatment of periodontal disease for glycaemic control in people with diabetes mellitus. *Cochrane Database Syst Rev* 2015: CD004714.
- Madianos P, Koromantzos P. An update of the evidence on the potential impact of periodontal therapy on diabetes outcomes. *J Clin Periodontol* 2018; **45**: 188–195.
- Bissett S M, Stone K M, Rapley T, Preshaw P M. An exploratory qualitative interview study about collaboration between medicine and dentistry in relation to diabetes management. *BMJ Open* 2013; **3**: e002192.
- European Federation of Periodontology. *EFP Manifesto*. Available at <https://www.efp.org/efp-manifesto/index.html>. (accessed June 2018).
- Chapple I L C, Genco R. Diabetes and periodontal diseases: consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. *J Clin Periodontol* 2013; **40**: S106–S112.
- British Society of Periodontology. *BSP Basic Periodontal Examination (BPE)*. Available at http://www.bsperio.org.uk/publications/downloads/94_154250_bpe-2016-pov5-final-002.pdf (accessed June 2018).
- Public Health England. *Delivering better oral health: an evidence-based toolkit for prevention*. 3rd ed. London: Public Health England, 2017.
- Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *Int J Nurs Stud* 2013; **50**: 587–592.
- Bandura A. *Social foundations of thought and action: a social cognitive theory*. New Jersey, USA: Englewood Cliffs, 1986.
- Bandura A. Self-efficacy: toward a unifying theory of behavioural change. *Psychol Rev* 1977; **84**: 191–215.
- May C, Rapley T, Mair F *et al*. Normalization Process Theory On-line Users' Manual, Toolkit and NoMAD instrument. 2015. Available at <http://www.normalizationprocess.org> (accessed June 2018).
- Godin G, Naccache H, Morel S, Ebacher M F. Determinants of nurses' adherence to Universal Precautions for venipunctures. *Am J Infect Control* 2000; **28**: 359–364.
- Presseau J, Johnston M, Francis J *et al*. Theory-based predictors of multiple clinician behaviours in the management of diabetes. *J Behav Med* 2014; **37**: 607–620.
- Stacey F G, James E L, Chapman K, Courneya K S, Lubans D R. A systematic review and meta-analysis of social cognitive theory-based physical activity and/or nutrition behaviour change interventions for cancer survivors. *J Cancer Surviv* 2015; **9**: 305–338.
- May C, Finch T, Mair F *et al*. Understanding the implementation of complex interventions in health care: the normalization process model. *BMC Health Serv Res* 2007; **7**: 148.
- May C, Finch T. Implementation, embedding, and integration: an outline of Normalization Process Theory. *Sociology* 2009; **43**: 535–554.
- Finch T L, Girling M, May C R *et al*. Nomad: Implementation measure based on Normalization Process Theory. [Measurement instrument]. 2015. Available at <http://www.normalizationprocess.org> (accessed June 2018).
- Eccles M, Hrisos S, Francis J *et al*. Instrument development, data collection, and characteristics of practices, staff, and measures in the Improving Quality of Care in Diabetes (iQuaD) Study. *Implement Sci* 2011; **6**: 61.
- Rashidian A, Miles J, Russell D, Russell I. Sample size for regression analyses of theory of planned behaviour studies: Case of prescribing in general practice. *Br J Health Psych* 2006; **11**: 581–593.
- Godin G, Bélanger-Gravel A, Eccles M, Grimshaw J. Healthcare professionals' intentions and behaviours: A systematic review of studies based on social cognitive theories. *Implement Sci* 2008; **3**: 36.
- Cohen J. A power primer. *Psychol Bull* 1992; **112**: 155–159.
- Cronbach L J. Coefficient alpha and the internal structure of tests. *Psychometrika* 1951; **16**: 297–334.
- Sanz M, Ceriello A, Buysschaert M *et al*. Scientific evidence on the links between periodontal diseases and diabetes: Consensus report and guidelines of the joint workshop on periodontal diseases and diabetes by the International Diabetes Federation and the European Federation of Periodontology. *J Clin Periodontol* 2018; **45**: 138–149.
- Graziani F, Gennai S, Solini A, Petrini M. A systematic review and meta-analysis of epidemiologic observational evidence on the effect of periodontitis on diabetes. An update of the EFP-AAP review. *J Clin Periodontol* 2018; **45**: 167–187.
- Polak D, Shapira L. An update on the evidence for pathogenic mechanisms that may link periodontitis and diabetes. *J Clin Periodontol* 2018; **45**: 150–166.
- Gabbay J, le May A. Evidence based guidelines or collectively constructed 'mindlines'? Ethnographic study of knowledge management in primary care. *BMJ* 2004; **329**: 1013.
- General Dental Council. *Direct Access*. 2017. Available at <https://www.gdc-uk.org/professionals/standards/direct-access> (accessed June 2018).
- Furnham A. Response bias, social desirability and dissimulation. *Pers Individ Differ* 1986; **7**: 385–400.