CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

ORCA – Online Research @ Cardiff

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository:https://orca.cardiff.ac.uk/id/eprint/92519/

This is the author's version of a work that was submitted to / accepted for publication.

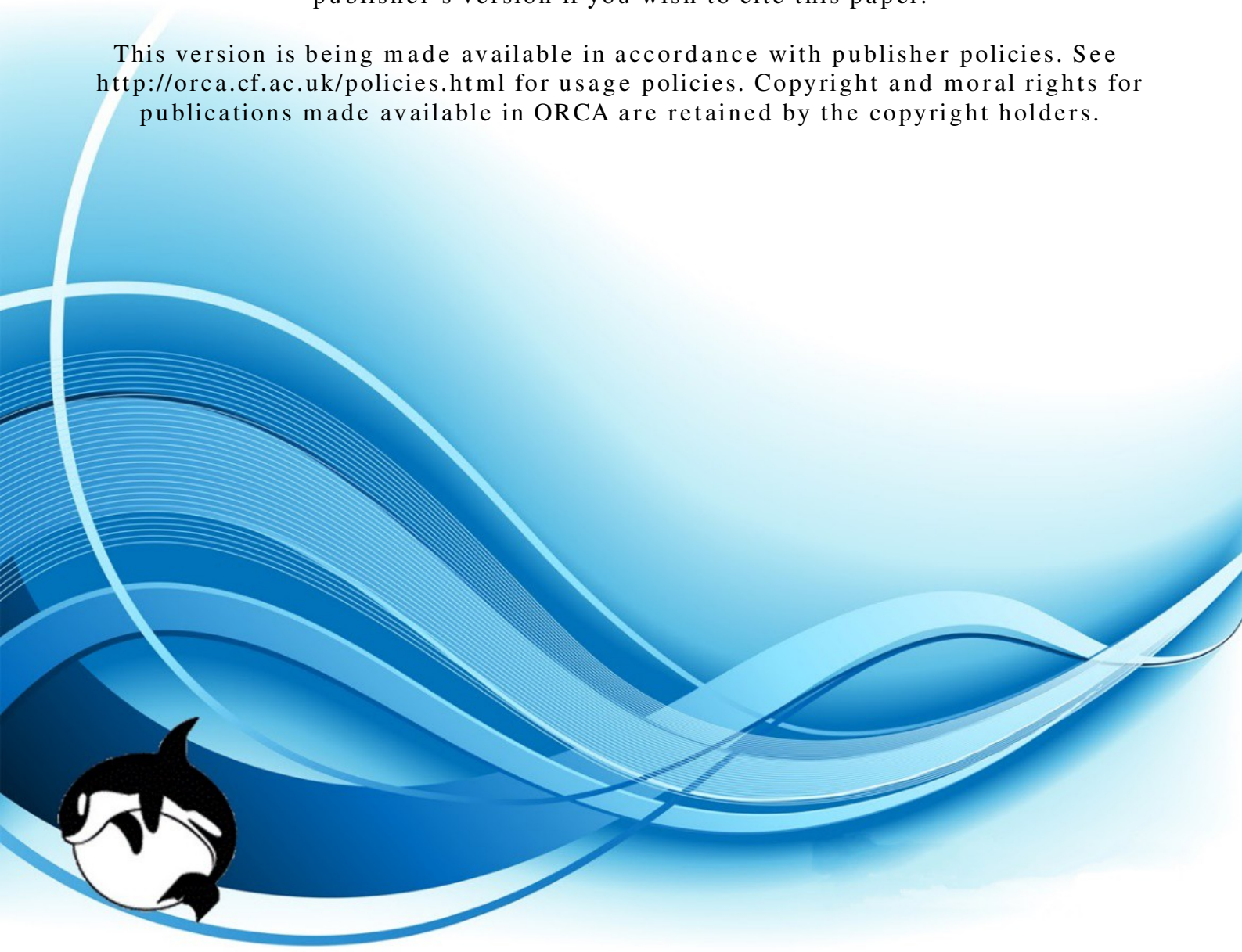
Citation for final published version:

Popat, Hashmat, Thomas, Katie and Farnell, Damian J. J. 2016. Management of orthodontic emergencies in primary care – self-reported confidence of general dental practitioners. British Dental Journal 221 , pp. 21-24. 10.1038/sj.bdj.2016.495

Publishers page: http://dx.doi.org/10.1038/sj.bdj.2016.495

Please note:
Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See http://orca.cf.ac.uk/policies.html for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



Management of orthodontic emergencies in primary care – self-reported confidence of general dental practitioners

Katie Thomas[1], BDS

Hashmat Popat[2], BDS, MFDS, MScD, MOrth, FDS (Orth), PhD

Damian JJ Farnell[2], BSc, PhD

[1] School of Dentistry, Cardiff University, Heath Park, Cardiff, CF14 4XY, UK

[2] Applied Clinical Research and Public Health, School of Dentistry, Cardiff University, Heath Park, Cardiff, CF14 4XY, UK

Corresponding author:

Hashmat Popat

Clinical Senior Lecturer/Consultant Orthodontist

Applied Clinical Research and Public Health

School of Dentistry

Cardiff University

CF14 4XY

UK

Email: popath@cardiff.ac.uk

Abstract

Objective: To determine general dental practitioners' (GDPs) confidence in managing orthodontic emergencies

Design: Cross-sectional study

Setting: Primary dental care

Subjects and methods: An online survey was distributed to all dental providers in Wales. The survey collected basic demographic information and it included descriptions of ten common orthodontic emergency scenarios.

Main outcome measure: Respondents' self-reported confidence were found in managing the orthodontic emergency scenarios on a 5-point Likert scale. Differences between the Likert responses and the demographic variables were investigated using Chi squared tests and multivariate ordinal regression.

Results: The median number of orthodontic emergencies encountered by respondents over the previous six months was 1. Overall, the self-reported confidence of respondents was high, and GDPs were found to be 'confident' in their management of 7 of the 10 scenarios presented to them. Furthermore, those GDPs who saw more orthodontic emergencies in the previous six months were more confident at the managing the presented scenarios. Other variables such as age, gender, geographic location of practice and number of years practising dentistry were not associated with self-reported confidence.

Conclusions: Despite encountering very few orthodontic emergencies in primary care, the self-reported confidence levels of GDPs in dealing with commonly arising orthodontic emergency situations are high.

Introduction

An orthodontic emergency can be described as a problem that arises from an orthodontic appliance, and an unscheduled appointment is required to resolve the issue[1]. A timely additional appointment should be arranged with a dental professional whenever a patient experiences such an issue. The main disadvantages of an orthodontic emergency are the pain or discomfort experienced by the patient and the inconvenience for the patient, and their parents also if the patient is a child, in attending the additional appointments due pre-existing school or work commitments. Consequently, repeated breakages prolong treatment time and they can lead to decreased patient motivation due to a loss of confidence in the appliance or the operator[1]. By providing appropriate timely management, inconvenience and distress can be minimised and the efficacy of the appliance can still being maintained[2].

Dental professionals in the UK are regulated by the General Dental Council (GDC). The learning outcomes outlined within the GDC's *Preparing for Practice* document[3] state that dental registrants should be competent at undertaking limited orthodontic appliance emergency procedures. Similarly, the Association for Dental Education in Europe (ADEE) specify that dental graduates should be competent at handling all forms of orthodontic emergencies including referral when necessary[4].

To satisfy both the GDC and ADEE learning outcomes related to orthodontic emergencies, practitioners should have had appropriate training as a dental student. Despite these regulations, previous studies have found that undergraduate confidence in managing orthodontic procedures are low[5]. Recent graduate

satisfaction of orthodontic training is also generally poor with more than 50% of graduates feeling unable to use a removable appliance to correct a simple malocclusion within their vocational training year[6, 7]. Additionally, dental foundation trainers rate the training of undergraduate students in orthodontics as inadequate when compared to other areas of dentistry[8]. General dental practitioners (GDPs) rate their self-perceived confidence at dealing with orthodontic emergencies at a relatively low level, where for example 40% of GDPs feel 'incompetent' at dealing with these situations[9]. Conversely, a more recent qualitative study of dental students' reflections found that confidence in dealing with orthodontic emergencies as undergraduates was relatively high, and almost two thirds of students feel confident at managing these situations in a training environment[10]. Given that most previous work in this area has been carried out in higher education institutions[5-7], a further study in general dental practice would allow greater exploration of the attitudes of dental professionals in the UK relating to orthodontic emergencies. Therefore, the aims of this study are to:

1. Identify the prevalence of orthodontic emergencies in the general dental practice setting
2. Explore general dental practitioners' confidence in managing common orthodontic emergencies
3. Identify factors that influence the confidence levels of general dental practitioners managing orthodontic emergencies

Methodology

Study design

This study was designed as a cross-sectional, self-reported survey. Ethical approval was granted by Cardiff University Dental School Ethics Committee (Ethics reference: 15/15).

Inclusion and Exclusion Criteria

The participants of the study included all primary care general dental practitioners registered as dental providers in Wales (*n*=226). There was no restriction on whether National Health Service (NHS) or private orthodontics was provided by the respondents although this was recorded. Orthodontic specialists and those individuals recognised as dentists with enhanced skills in orthodontics were excluded.

Questionnaire

An online survey was developed using the Bristol Online Survey Tool. The survey was divided into three separate sections relating to screening for inclusion/exclusion criteria, collection of basic demographic information (age, gender, practice location, number of years qualified, undergraduate/postgraduate training in orthodontic emergencies, and number of orthodontic emergencies seen in the previous 6 months) and presentation of orthodontic emergency scenarios. A structured literature review was used to identify ten common orthodontic emergencies[11-14] that were described within the questionnaire (Table 1). Respondents indicated their level of confidence in dealing with these situations, if they were encountered in general practice, on a 5-point Likert Scale (very confident, confident, neither confident nor unconfident, unconfident, very unconfident).

Table 1 Orthodontic emergency scenario legend with descriptions

Code	Orthodontic emergency description
GP	Generalised dental pain from all the lower teeth. A lower fixed appliance was placed 1 week ago.
DB	A debonded bracket from a lower right second premolar. The bracket is still attached to the archwire with an elastic module but is causing trauma to the buccal mucosa.
TW	A traumatic ulcer related to an over-extended piece of wire from an upper left first permanent molar.
FR	An upper removable appliance that has fractured a clasp on the upper right first permanent molar.
BF	A broken lower fixed retainer where the composite has become debonded from the lingual surface of one of the central incisors.
LR	A concern from a patient that their teeth may be moving because they have lost their removable retainer three days ago.
TB	Soreness related to a traumatic ulcer adjacent to a fixed appliance bracket on an upper right permanent canine.
LM	A lost elastic module which engaged the archwire to the fixed appliance bracket.
DW	An archwire that has been displaced out of the last standing molar attachment and is digging into the buccal mucosa.
PA	A localized periodontal abscess around a molar band.

Dissemination

The questionnaire was distributed to six clinical members of staff at the University Dental Hospital, Cardiff in order to gauge its validity. Feedback from the pilot study was provided by these members of staff and any further discussions were carried out on an individual basis. Minor modifications to items in the questionnaire were made accordingly. Welsh Local Health Boards disseminated the online questionnaire link to registered dental providers at the beginning of July 2015 and the questionnaire remained open until the end of September. Participants were sent reminder emails at 2 and 4 weeks following initial contact. Participant consent to be involved in the study was implicit on completion of the questionnaire.

Statistical Analysis

Data from the questionnaires were exported from the Bristol Online Survey Tool into SPSS (IBM SPSS Statistics, Version 22.0. Armonk, NY) for analysis. Descriptive statistics were used to investigate the confidence of general practitioners in managing the different scenarios. Spearman's correlation coefficients were used to investigate the associations between the different scenarios, and P-values for the standard test of the correlation coefficient (namely, if it is equal to zero) were carried found. Factors such as the number of years of practice of orthodontics and also the number of emergencies seen in the last six months were also analyses with respect to the different scenarios by using Spearman's correlation coefficients. Those factors that were nominal rather than ordinal or ratio in nature (i.e., orthodontics provided at workplace, gender, multi-surgery/single-surgery, region, undergraduate training, and post-graduate training) were analysed by descriptive statistics (means and quartiles) and also by appropriate non-parametric statistical tests (either Mann-Whitney tests for two groups or Kruskal-Wallis tests for more than two groups) due to non-normality of the data. Univariate ordinal logistic regression was carried out for (dependent variable) the GDPs self-reported confidence for each scenario as a function of the number of emergencies seen in the last six months (independent variable). This analysis was complemented by the use of multivariate ordinal regression out for (dependent variable) the GDPs self-reported confidence for each scenario in order to account for any confounding effects of the other independent variables. Odds ratios per unit increase (and associated 95% confidence intervals) in the number of emergencies seen in the last six months were found for all scenarios. Nominal factors were treated appropriately, and the number of years of practice of orthodontics and also the number of emergencies seen in the last six months were treated as covariates in ordinal logistic regression. Wald tests were used to determine the effects the independent variables. The parallel lines test of the

proportional odds assumption was met in most cases. Multivariate models increased strongly all measures of model fit, such as pseudo R-square values, compared to univariate models. All calculations were carried out using SPSS V20.

Results

In total, 103 responses from 226 subjects approached were obtained, of which 15 were excluded due to their previous orthodontic training either as a dentist with enhanced skills, special interest or an orthodontic specialist. Subsequently, the total number of responses used for data analysis was 88 achieving a response rate of 39%. The gender ratio of respondents was equal. A quarter of participants (24%) provided orthodontics at their practice, which was performed either by themselves or by another practitioner. Just over half of respondents (53%) practised in South East Wales, 33% in South West Wales and the remaining 13% in North Wales. The majority of respondents (89%) worked in a multi-surgery practice.

Approximately one third of respondents had been practising dentistry for up to 10 years (35%) and a further third from 11-20 years (35%). There were less respondents who had been qualified for longer between 21-30 years (14%) and greater than 30 years (16%).

Less than half of respondents (43%) had received training on orthodontic emergencies as an undergraduate. Of those that had received training as an undergraduate, theoretical training was the most common type (38%), followed by observation of orthodontic emergencies clinics (27%) and clinical patient exposure (25%). Only 8% of these participants had been taught using simulated clinical

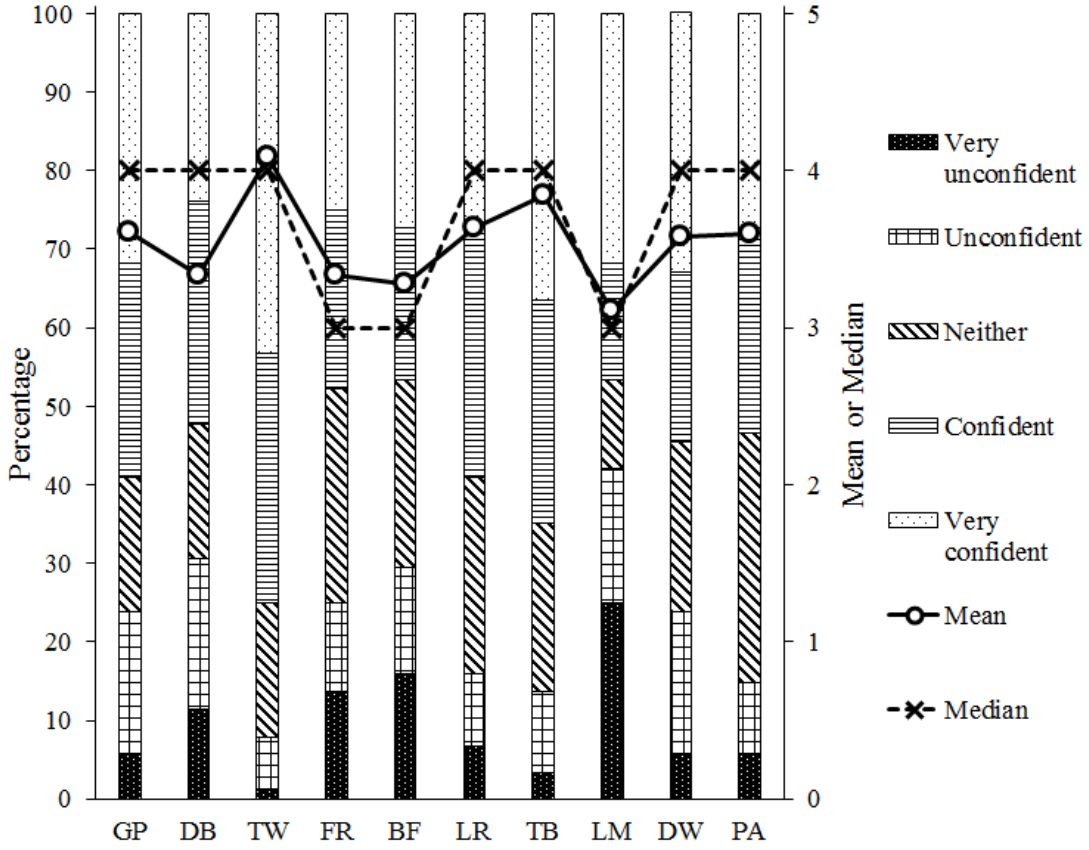
teaching, e.g., typodont, and even less (2%) had received training in the form of an online module. Two-thirds of those respondents who had graduated within the last 10 years received training in orthodontic emergencies (67%), whereas only a third of those who had been practising for over 10 years received any training (33%). Only 6% of respondents stated they had experienced postgraduate training in orthodontic emergencies.

The number of orthodontic emergencies encountered by GDPs over the previous six months was positively skewed (median = 0 and mean=1.19). Just over half of respondents (55%) reported no clinical contact with any form of orthodontic emergency over this time period. Only 9% of participants indicated they had encountered five or more orthodontic emergencies. The most frequent emergencies encountered were a debonded bracket (37%) followed by a protruding archwire (25%). The remaining emergencies included fractured archwires (7%), fractured removable appliances (7%), loose archwires (6%), broken retainers (6%), lost ligatures (4%), ulceration (4%) and post-operative pain following fixed appliance adjustment (4%).

Overall the self-perceived confidence level of participants when managing the orthodontic emergencies detailed in Table 1 was relatively high. Figure 1 presents the responses of all participants to these ten scenarios graphically. A median confidence level of 4 (= “confident”) was reported for seven out of ten of the scenarios (GP, DB, TW LR, TB, LR, DW, PA) indicating they respondents were generally in management (Figure 1). The median confidence level for the remaining three scenarios (FR, BF, LM) demonstrated a slightly lower value of 3 (= “neither

unconfident nor confident”), suggesting a neutral response in the management of these scenarios.

Figure 1 Stacked bar chart showing the percentage responses for confidence levels of respondents for each orthodontic emergency scenario. Means and medians across all respondents for each scenario are also plotted (with respect to a secondary axis on the right-hand side of the figure).



Spearman's correlation coefficients showed moderate to strong positive correlations (magnitude of coefficient of order approximately: 0.4 to 0.7) between the Likert responses for all of the different scenarios, as shown in Table 2. This result shows that those respondents that were not confident in one scenario were probably also not confident in other scenarios, whereas those that were confident in one scenario were probably also confident in other scenarios, and so on. Very weak (magnitude of coefficient of order approximately: 0.0 to 0.2) and generally positive correlations between the Likert responses the different scenarios and the "number of years in practice" are also seen in Table 2. However, all of these correlation coefficients were

not significant at the 5% level. By contrast, evidence of weak to moderately strong (magnitude of coefficient of order approximately: 0.2 to 0.4) positive associations between the Likert responses for all of the different scenarios and the “number of emergencies seen in the last six months” are seen in Table 2 also. These associations are significant at either the 5% and/or 1% levels. The correlation coefficient for the scenario TW (traumatic ulcer from protruding wire) is given by 0.39, which is significant at the 1% level. These associations are explored further in Figure 2 for the “number of emergencies seen in the last six months.” (Categories “4 emergencies” and “5 emergencies” or “more than 5 emergencies” are combined in a single category to avoid small sample-size problems). It can be seen from Figure 2 that there is a generally strong increase in self-perceived confidence levels with increasing “number of emergencies seen in the last six months.” Evidence exists in this figure for positive trends in all scenarios, although these trends are particularly apparent for scenarios DB (debonded bracket), LM (lost module), and TW (traumatic ulcer from protruding wire). For all scenarios, the largest increase occurs between the responses “No emergencies seen in the last six months” and “one emergency seen in the last six months,” suggesting that even some familiarity with the scenario led to increased confidence levels.

Factors such as orthodontics provided at workplace, gender, region of work, type of practice (single/multi-surgery), and previous undergraduate/postgraduate training and their relationship to confidence in managing orthodontic emergencies are examined in Table 3. Gender appeared to have little or inconsistent effects on confidence and they were no statistically significant differences in confidence based on these factors. Region of work seemed to have some effect, although this was not statistically significant, except for the scenario TB (traumatic ulcer from bracket).

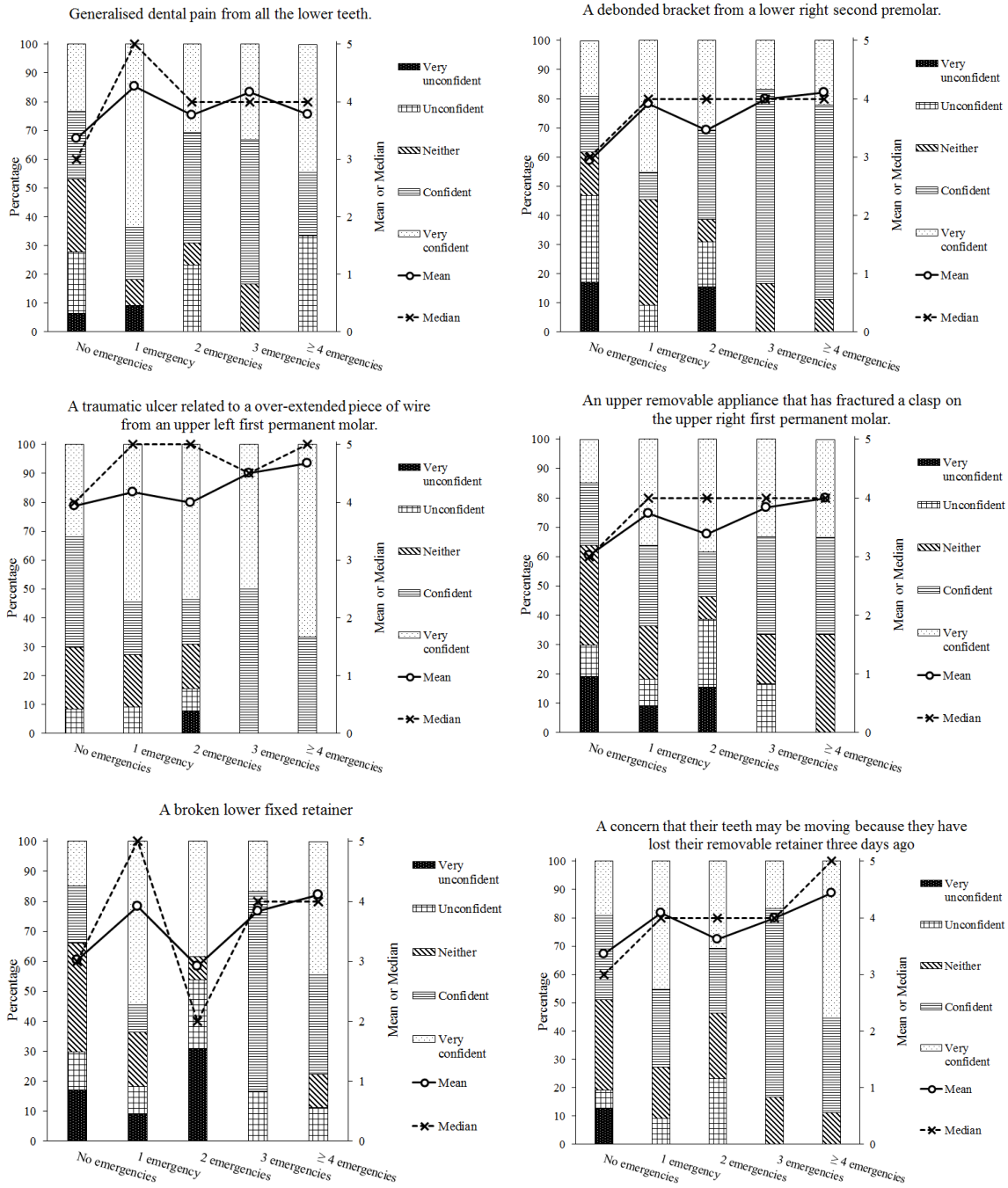
Orthodontic treatment being conducted at the workplace led to increased mean and median confidence levels, as shown in Table 3, although this factor was only statistically significant for three of the scenarios; generalised orthodontic pain ($p=0.020$), traumatic ulcer associated with a long archwire end ($p=0.014$) and lost removable retainers ($p=0.001$). Both undergraduate and postgraduate training in orthodontic emergencies led generally to increased mean and median confidence levels shown in Table 3, although these increases were generally not statistically significant. There is also some evidence in Table 3 that confidence was higher for all scenarios for those respondents that worked in a single surgery compared to a multi-surgery, although again these increases were not statistically significant.

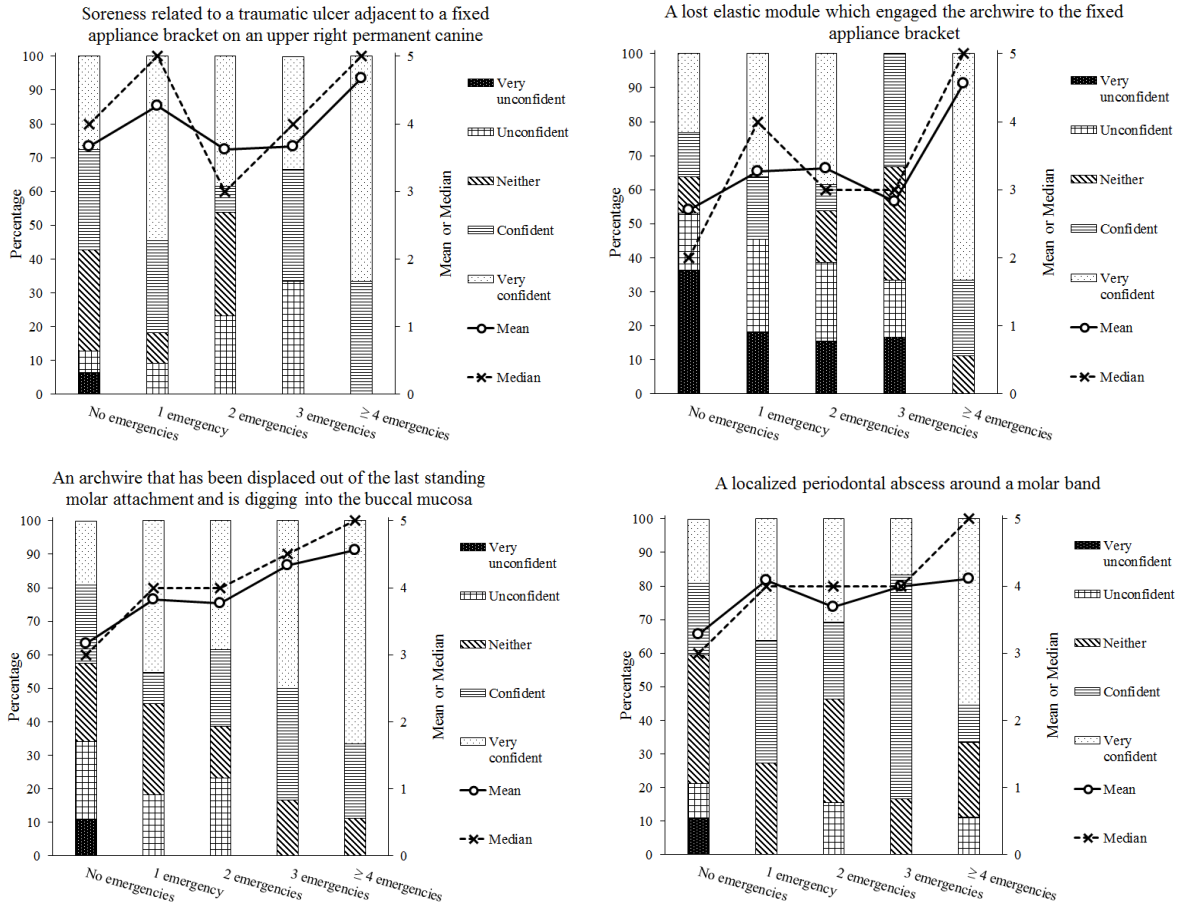
T**able 2** Spearman's correlation coefficients relating to different orthodontic emergency scenarios and the "Number of years qualified" and "How many orthodontic procedures have you seen in the last 6 months?"

*Statistically significant results at the 5% level show by the symbol * and statistically significant results at the 1% level by **.*

	GP	DB	TW	FR	BF	LR	TB	LM	DW	PA	Years qualified	Emergencies seen
GP	1	0.399**	0.466**	0.327**	0.582**	0.632**	0.540**	0.358**	0.451**	0.479**	0.124	0.204
DB	0.399**	1	0.581**	0.680**	0.479**	0.600**	0.533**	0.527**	0.614**	0.408**	0.016	0.319**
TW	0.466**	0.581**	1	0.501**	0.535**	0.636**	0.626**	0.516**	0.721**	0.459**	-0.182	0.250*
FR	0.327**	0.680**	0.501**	1	0.425**	0.566**	0.562**	0.572**	0.595**	0.300**	0.148	0.257*
BF	0.582**	0.479**	0.535**	0.425**	1	0.666**	0.593**	0.608**	0.587**	0.400**	0.072	0.247*
LR	0.632**	0.600**	0.636**	0.566**	0.666**	1	0.725**	0.558**	0.634**	0.480**	0.056	0.279**
TB	0.540**	0.533**	0.626**	0.562**	0.593**	0.725**	1	0.525**	0.603**	0.503**	0.028	0.198
LM	0.358**	0.527**	0.516**	0.572**	0.608**	0.558**	0.525**	1	0.696**	0.350**	0.028	0.308**
DW	0.451**	0.614**	0.721**	0.595**	0.587**	0.634**	0.603**	0.696**	1	0.506**	0.054	0.383**
PA	0.479**	0.408**	0.459**	0.300**	0.400**	0.480**	0.503**	0.350**	0.506**	1	0.170	0.266*
Years qualified	0.124	0.016	-0.182	0.148	0.072	0.056	0.028	0.028	0.054	0.170	1	0.036
Emergencies seen	0.204	0.319**	0.250*	0.257*	0.247*	0.279**	0.198	0.308**	0.383**	0.266*	0.036	1

Figure 2 Stacked bar chart showing the percentage responses for confidence levels of respondents for each orthodontic emergency scenario as a function of number of emergencies seen in the last six months. Means and medians across all respondents for each scenario are also plotted (with respect to a secondary axis on the right-hand side of the figure).





Based on the univariate analyses, the main variable showing an effect on the confidence level of GDPs managing the emergency scenarios was the number of emergencies seen in the last 6 months. Therefore, a multivariate ordinal logistic regression model was created with respondent demographics as independent variables. The 'number of orthodontic emergencies seen in the last 6 months' was used a covariate rather than a nominal factor. Table 4 shows that the effects of previous experience in orthodontic emergencies on confidence levels remained strong with nine of the ten scenarios statistically significant for the unadjusted (univariate) model. The unadjusted (univariate) odd ratios with 95% confidence intervals from the regression model showed that GDPs who had seen more orthodontic emergencies in the last 6 months were up to 1.6 times more likely per unit increase to be more confident at dealing with orthodontic emergencies when compared to those who had seen less or none (Table 4). When the odds ratios were

adjusted for confounding variables, the GDPs who saw more orthodontic emergencies in the last 6 months were most confident at dealing with debonded brackets (odds ratio per unit increase 1.334, 95% CI, 1.033 to 1.751), lost removable retainers (odds ratio per unit increase 1.344, 95% CI, 1.014 to 1.784), traumatic ulcers adjacent to brackets (odds ratio per unit increase 1.376, 95% CI 1.020 to 1.846), lost elastic modules (odds ratio per unit increase 1.504, 95% CI 1.125 to 2.010) and displaced archwires (odds ratio per unit increase 1.631, 95% CI 1.200 to 2.217).

Table 3. Mean and quartiles (Q_1, Q_2, Q_3) perceived confidence in dealing with the various emergency scenarios (1 = very unconfident; 2 = unconfident; 3 = neither confident nor unconfident; 4 = confident; 5 = very confident). Non-parametric tests were carried out to detect differences between the two groups and exact two-sided P-values are shown.

		Orthodontic Emergency Scenario									
		GP	DB	TW	FR	BF	LR	TB	LM	DW	PA
Orthodontics provided at workplace?	No (*N* = 67)	3.43 (2,4,5)	3.22 (2,3,4)	3.97 (3,4,5)	3.28 (2,3,4)	3.12 (2,3,4)	3.42 (3,4,4)	3.73 (3,4,5)	2.97 (1,3,5)	3.46 (2,3,5)	3.54 (3,3,5)
	Yes (*N* = 21)	4.19 (4,4,5)	3.71 (2½ ,4,5)	4.48 (4,5,5)	3.52 (3,4,5)	3.81 (3,5,5)	4.33 (4,5,5)	4.19 (3,5,5)	3.57 (2,4,5)	3.95 (3,4,5)	3.81 (3,4,5)
	P =	0.020*	0.147	0.014*	0.502	0.047	0.001*	0.112	0.115	0.137	0.221
Gender	Female (*N* = 44)	3.68 (3,4,5)	3.18 (2,3,4)	4.02 (3¼,4, 5)	3.14 (2¼,3, 4)	3.32 (2,3,4)	3.68 (3,4,5)	4.00 (3,4,5)	2.95 (1,3,4 ¾)	3.45 (3,3,5)	3.48 (3,4,4)
	Male (*N* = 44)	3.55 (2¼,4, 5)	3.50 (2,4,5)	4.16 (3¼,4, 5)	3.55 (2¼,4, 5)	3.25 (2,3,5)	3.59 (3,4,4 ¾)	3.68 (3,4,5)	3.27 (2,3,5)	3.70 (2¼,4, 5)	3.73 (3,4,5)
	P =	0.622	0.229	0.511	0.142	0.928	0.727	0.207	0.293	0.331	0.407
Region	NW (*N* = 11)	4.09 (3,4,5)	3.45 (2,3,5)	4.00 (3,4,5)	3.73 (3,3,5)	3.55 (3,4,5)	4.00 (3,4,5)	4.00 (3,4,5)	3.27 (2,3,5)	3.55 (3,3,5)	4.00 (3,4,5)
	EW (*N* = 46)	3.57 (2¾,4, 5)	3.22 (2,3½, 4)	4.11 (4,4,5)	3.24 (2¾,3, 4)	3.00 (2,3,4)	3.43 (3,4,4)	3.57 (3,4,5)	2.85 (1,3,4)	3.52 (2,4,5)	3.59 (3,4,5)
	WW (*N* = 29)	3.45 (2,4,5)	3.45 (2,4,5)	4.07 (3,5,5)	3.31 (2,3,5)	3.55 (2½,4, 5)	3.76 (3,4,5)	4.17 (4,5,5)	3.38 (1½,4, 5)	3.62 (2½,4, 5)	3.41 (3,3,4)
	P =	0.465	0.685	0.824	0.626	0.169	0.300	0.048*	0.294	0.942	0.364
Surgery Type	Multiple (*N* = 78)	3.53 (2,4,5)	3.32 (2,4,4)	4.09 (3¾,4, 5)	3.31 (2,3,4 ¼)	3.22 (2,3,5)	3.63 (3,4,5)	3.83 (3,4,5)	3.06 (1,3,5)	3.50 (2,4,5)	3.58 (3,4,5)
	Single (*N* = 10)	4.30 (3¾,4 ½,5	3.50 (2¾,3 ½,5)	4.10 (3,4½, 5)	3.60 (3,3½, 5)	3.80 (3,4,4 ¼)	3.70 (3,4,4 ¼)	3.90 (3,4,5)	3.50 (2,4,5)	4.20 (3,4½, 5)	3.80 (3,4,4 ¼)
	P =	0.080	0.708	0.897	0.553	0.287	0.961	0.999	0.474	0.114	0.709
Undergrad. Training	No (*N* = 49)	3.61 (3,4,5)	3.14 (2,3,4)	3.88 (3,4,5)	3.08 (2,3,4)	3.18 (2,3,5)	3.41 (3,4,4)	3.65 (3,4,5)	2.90 (1,3,4 ½)	3.41 (2,3,5)	3.63 (3,4,4 ½)
	Yes (*N* = 39)	3.62 (2,4,5)	3.59 (2,4,5)	4.36 (4,5,5)	3.67 (3,4,5)	3.41 (2,3,5)	3.92 (3,4,5)	4.08 (3,4,5)	3.38 (2,4,5)	3.79 (3,4,5)	3.56 (3,4,5)
	P =	0.841	0.131	0.009*	0.033	0.511	0.056	0.067	0.161	0.157	0.987
Postgraduate Training	No (*N* = 83)	3.63 (3,4,5)	3.33 (2,4,4)	4.07 (3,4,5)	3.29 (2,3,4)	3.23 (2,3,5)	3.60 (3,4,5)	3.81 (3,4,5)	3.05 (1,3,5)	3.53 (2,4,5)	3.59 (3,4,5)
	Yes (*N* = 5)	3.40 (2½,3, 4½)	3.60 (2,4,5)	4.40 (3½,5, 5)	4.20 (3½,4, 5)	4.20 (3½,4, 5)	4.20 (3½,4, 5)	4.40 (3½,5, 5)	4.20 (3,5,5)	4.40 (3½,5, 5)	3.80 (2½,4, 5)
	P =	0.632	0.622	0.527	0.159	0.164	0.338	0.277	0.129	0.158	0.711

Table 4 **Odds ratios per unit increase with 95% confidence intervals for GDPs confidence levels related to the number of orthodontic emergencies they had seen in last 6 months**

Orthodontic emergency scenario	Unadjusted (univariate)				Adjusted (multivariate)			
	Odds Ratio	95% CI: lower	95% CI: upper	*P* =	Odds Ratio	95% CI: lower	95% CI: upper	*P* =
GP	1.171	0.926	1.481	0.187	1.187	0.908	1.550	0.209
DB	1.334	1.050	1.694	0.018*	1.344	1.033	1.751	0.028*
TW	1.362	1.043	1.779	0.023*	1.315	0.967	1.790	0.081*
FR	1.288	1.016	1.632	0.036*	1.251	0.961	1.629	0.096*
BF	1.281	1.011	1.623	0.04*	1.285	0.984	1.680	0.066
LR	1.368	1.068	1.749	0.013*	1.344	1.014	1.784	0.04*
TB	1.301	1.013	1.670	0.039*	1.376	1.02	1.846	0.033*
LM	1.474	1.143	1.898	0.003*	1.504	1.125	2.010	0.006*
DW	1.597	1.214	2.100	0.001*	1.631	1.200	2.217	0.002*
PA	1.339*	1.050	1.707	0.019*	1.303	0.997	1.704	0.053

Discussion

This study has identified the prevalence of orthodontic emergencies in general dental practice and the confidence of GDPs in their management. Although orthodontic emergencies present infrequently to general dental practice, practitioners' confidence in managing these patients is relatively high. Despite undergraduate training in orthodontic emergencies being more common among recent graduates, (i.e., within the last ten years) there was no association with increased confidence levels when compared to respondents who had not received undergraduate training. All other demographic variables (gender, practice location, single/multi-surgery practice, and the number of years since dental qualification) showed no statistical relationship with confidence levels. The main significant relationship was found between the number of orthodontic emergencies encountered by practitioners in the preceding six months and confidence. As the orthodontic emergency scenarios described within the questionnaire were often seen by respondents in their practices. It is natural to assume that clinical experience/exposure to a particular problem might lead to the higher confidence levels reported by these practitioners. This theory is supported by the fact that the highest level of confidence was reported for managing a traumatic ulcer caused by a protruding archwire. This particular problem was the second-most commonly encountered orthodontic emergency by respondents over the previous six months.

A weaker relationship to the confidence level of respondents (statistically significant for three of the ten scenarios) related to orthodontic treatment was provided at the workplace, either by the participant themselves or by a fellow colleague. If an individual is routinely in contact with fixed or removable appliances then they should be increasingly confident at managing problems with these appliances. Alternatively,

if a colleague within the practice provides orthodontic treatment then the participant may feel more confident at managing an emergency as they are aware that they can seek advice from this individual and that they can subsequently provide the appropriate treatment with the suitable materials.

There is is very little evidence in the literature for the field of orthodontics that is relevant to our study, and the only published study on this subject was conducted some ten years ago[9]. The authors of this study reported that practitioners' perceived confidence when managing orthodontic emergencies in comparison to alternative orthodontic procedures was relatively low[9]. Although our study does provide new insight, a number of points need further discussion. In particular, homogenous responses to the emergency scenarios would have required a similar interpretation of 'management' between respondents. For example, management of a debonded bracket could range from comprehensive rebonding of new bracket, to a more conservative treatment of just covering the loose bracket with soft wax and referring the patient back to their treating clinician for definite treatment. The methodology used in our study allowed for explicit description of the orthodontic emergency scenarios but no further direct interaction with respondents. Therefore, how management was considered by respondents was unknown.

Another limitation of the study was the sample size. Overall, a response rate of 39% was achieved. Due to the small sample size, the power to detect significant differences may have low. Therefore, although statistical tests were performed on the collected data, a larger sample size would have facilitated more generalizable results. The present study could have been extended to GDPs in England and Scotland to increase the sample size. However, in Wales, only individuals registered

as orthodontic specialists and/or dentists with enhanced skills in orthodontics service NHS orthodontic contracts[15]. Therefore, those practitioners with significant orthodontic experience could be excluded and a homogenous group of GDPs was considered here. Elsewhere in the UK, GDPs with no formal orthodontic qualification may service NHS orthodontic contracts. From a respondent perspective therefore, previous orthodontic experience may have been difficult to standardise and confounded the study results if extended.

In summary, this study provides an insight into the number of orthodontic emergencies encountered in general dental practice. The low numbers of these patients seen by GDPs suggest that problems from orthodontic appliances are most likely dealt with by the treating clinician. Despite the limited clinical exposure and lack of undergraduate training in orthodontic emergencies for practitioners qualified for over ten years, self-reported confidence of orthodontic emergencies by GDPs was high. Literature also suggests that the number of short-term orthodontic treatments is rising in general dental practice[16]. As such, GDPs may be able to manage emergency procedures should they arise. Further studies with larger sample sizes may identify additional learning needs of GDPs in this subject area.

Conclusion

Although orthodontic emergency patients present infrequently in general dental practice, common emergency problems are likely to be dealt with confidently by practitioners. Those practitioners who see more orthodontic emergencies are more confident in their management.

References

1. Popat H, Rogers S, Knox J, Eckhardt C. Management of the casual orthodontic patient. *Orthodontic Update* 2010 **3**: 9-13
2. Dowsing P, Murray A, Sandler J. Emergencies in orthodontics. Part 1: Management of general orthodontic problems as well as common problems with fixed appliances 2015 *Dent Update* **42**:131-140
3. General Dental Council. Preparing for Practice. 2011. Online information available at: http://www.gdcuk.org/Newsandpublications/Publications/Publications/GDC%20Learning%20Outcomes.pdf (accessed Feb 2015)
4. Cowpe J, Plasschaert A, Harzer W, Vinkka-Puhakka H, Walmsley AD. Profile and competences for the graduating European dentist. *Eur J Dent Educ* 2010 **14**:193-202
5. Honey J, Lynch CD, Burke FM, Gilmour AS. Ready for practice? A study of confidence levels of final year dental students at Cardiff University and University College Cork. *Eur J Dent Educ* 2011 **15**: 98-103
6. Murray FJ, Blinkhorn AS. An assessment of the views held by recent graduates on their undergraduate course. *Eur J Dent Educ* 1999 **3**: 3-9
7. Levine, RS. Experience, skill and knowledge gained by newly qualified dentists during their first year of general practice. *Br Dent J* 1992 **172**: 97-102
8. Patel J, Fox K, Grieveson B, Youngson CC. Undergraduate training as preparation for vocational training in England: a survey of vocational dental practitioners' and their trainers' views. *Br Dent J* 2006 **201**: 9-15
9. Fleming PS, Dowling PA. A survey of undergraduate orthodontic training and orthodontic practices by general dental practitioners. *J Ir Dent Assoc* 2005 **51**: 68-72

10. Jones K, Popat H, Johnson IG. Dental students' experiences of treating orthodontic emergencies – a qualitative assessment of student reflections. *Eur J Dent Educ* 2015 [Online] Available at: http://onlinelibrary.wiley.com/doi/10.1111/eje.12155/full (accessed Nov 2015)
11. Travess H, Harradine, N. A re-audit of unscheduled attendances in the orthodontic department. *British Orthodontic Society Clinical Effectiveness Bulletin 2001* **14**: 9
12. Riley M, Rice P, Banks P. An audit of unscheduled attendance. *British Orthodontic Society Clinical Effectiveness Bulletin* 2008 **21**: 9
13. Irving F. An audit of unscheduled orthodontic appointments in Fife. *British Orthodontic Society Clinical Effectiveness Bulletin* 2011 **26**: 14-16
14. Dye S, Singh P. An audit of unscheduled appointments at Suffolk dental practice. *British Orthodontic Society Clinical Effectiveness Bulletin* 2012 **29**: 29-31
15. Richmond S, Karki A. Complexities associated with orthodontic services in the National Health Service. *Br Dent J* 2012 ***212***: E5-E5
16. Noar, JH, Sharma S, Roberts-Harry D, Qureshi T. A discerning approach to simple aesthetic orthodontics. *Br Dent J* 2015 **218**:157-166