The experience of dentists who gained enhanced skills in endodontics within a novel pilot training programme

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In brief

- Gives primary care dentists' views of post graduate training.
- Outlines dentists' views on barriers to providing root canal treatment in primary care.
- States implications for future training initiatives.

Objective To explore the experiences of primary care dentists following training to enhance endodontic skills and their views on the implications for the NHS. **Design** Qualitative study using anonymised free text questionnaires. **Setting** Primary care general dental services within the National Health Service (NHS) in London, United Kingdom. **Subjects and methods** Eight primary care dentists who completed this training were asked about factors affecting participant experience of the course, perceived impact on themselves, their organisation, their patients and barriers/facilitators to providing endodontic treatment in NHS primary care. Data were transferred verbatim to a spreadsheet and thematically analysed. **Intervention** 24-month part-time educational and service initiative to provide endodontics within the NHS, using a combination of training in simulation lab and treatment of patients in primary care. **Results** Positive impacts were identified at individual (gains in knowledge, skills, confidence, personal development), patient (more teeth saved, quality of care improved) and system levels (access, value for money). Suggested developments for future courses included more case discussions, teaching of practical skills earlier in the course and refinement of the triaging processes. Barriers to using the acquired skills in providing endodontic treatment in primary care within the NHS were perceived to be resources (remuneration, time, skills) and accountability. Facilitators included appropriately remunerated contracts, necessary equipment and time. **Conclusion** This novel pilot training programme in endodontics combining general practice experience with education/training, hands-on experience and a portfolio was perceived by participants as beneficial for extending skills and service innovation in primary dental care. The findings provide insight into primary dental care practitioners' experience with education/training and have implications for future educational initiatives in support of systems innovation within the NHS.

Introduction

At present within the United Kingdom (UK) postgraduate dental education and training, most notably specialist training, is delivered by NHS service providers and universities, supported by The Royal Colleges, and overseen by Health Education England (and its counterparts in the other 3 UK countries) in line with the General Dental Council requirements.[1–4]

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Refereed Paper. Accepted 6 December 2016
DOI: 10.1038/sj.bdj.2017.172
©British Dental Journal 2017; 222: 269-275

Non-specialist training can vary from distance learning courses mainly using printed educational materials, part-time courses with or without hands-on components; to apprenticeship style work-based learning. There is a variety of unregulated postgraduate (short and long) courses in which dentists can enrol, to improve their clinical and knowledge skills. Endodontics is a difficult technical or 'craft' skill to master and there is evidence that many dentists are currently discouraged from the discipline due to clinical complexity, poor funding and medico-legal risk.[5,6] Endodontics forms part of speciality training in restorative dentistry, and specialists often remain within secondary care environments after training. Training is also undertaken as a self-funded mono-speciality training pathway in endodontics, and many of these specialists are likely to work within the private sector after training.

In 2009, the former London Deanery (now part of Health Education England), responsible for professional development of dentists, established a training programme in line with national guidance on dentists with a special interest (DwSI). The aim was to address access to and quality of endodontic treatment in National Health Service (NHS) primary care[7–9] and to build expertise within primary care and enable dentists who were generalists to develop enhanced skills in a distinct field while still continuing to work as a generalist for part of their time. The participants entered the programme through a process involving nomination by their local NHS organisation (Primary Care Trust or PCT) and selected through interview by a panel consisting of London Deanery commissioners, course teachers, and PCT representatives including a consultant in dental public health.

The model of education aimed at taking a group of London NHS GDPs to an enhanced level of clinical endodontic skills, within primary care. Training involved didactic seminars, simulation tasks, self-directed study and workplace-based assessments within the participants' own practice environment, as well as treatment of a large number (1,600) of patients within a general practice setting.[10] The NHS patients treated during the programme were used to build skills and deeper learning with the aid of a reflective clinical practice. The course providers were available to give clinical advice and help, including with patient triaging. It was hoped that this 24-month training structure would allow dentists who complete the course to safely operate as enhanced practitioners in endodontics.

This two-year part-time training programme in endodontics, developed in accordance with the evidence base, involved educational reading material, interactive seminars, problem based learning, technical skills training using simulators and clinical experience, as well as reflective learning.[11–18] The formal education and training was delivered one day per month at the London Deanery Educational Centre. The learning outcomes for this course were similar to those advocated by the Department of Health and Faculty of Dental Surgery[7–9] and similar to the emerging Guide for Commissioning Dental Specialties.[19] Participants were provided with additional equipment by their PCT and were required to deliver a limited level of endodontics in their dental practice under contract, thus delivering a service to patients in London across seven boroughs.[10]

Participant views and feedback are essential to development and improvement and the initiative overall was perceived as a welcome response to challenges within the NHS and welcomed by a range of players,[5,10] including general dental practitioners (GDPs). Male (N = 5) and female (N = 4) participants were enrolled in the programme. The majority of participants worked in general dental practice (N = 7), with a minority in the community dental service (N = 2). Only one participant did not complete the two-year course and left at the end of year-one, as a result of the end of year assessment outcomes. Their skills have been assessed during- and post-training using a specifically designed instrument for endodontics.[20]

This study aimed to explore the views and experiences of participants enrolled in the pilot training programme for increasing endodontic skills using a combination of training in a simulation lab and treatment of cases within general dental practice, with a view to identifying factors that influence participant experience of training and future service provision. This was considered important learning from the pilot as future population oral health needs are likely to require dentists to undertake additional training to enable provision of more complex patient care.

Method

NHS research ethics approval was sought and granted (ref: 10/H0718/69). Research governance approval was granted from all seven NHS primary care trusts involved (Barking and Dagenham PCT Ref No. 2298; Ealing and Hounslow PCT, Greenwich PCT Ref No. RDGre573; Hammersmith and Fulham PCT, Newham PCT, Kingston PCT and Wandsworth PCT via St George's Healthcare Ref No: 2010/401K,W; Kings College London, Ref No. KCH11006). All participants of the course were invited to participate and it was highlighted that anonymity would be strictly maintained and informed consent was provided.

Participant views were captured by way of a questionnaire. Questionnaires are a practical method of collecting information about a large number of people within a fairly short period of time, which in turn is a relatively cost effective method of data collection.[21,22] One of their main advantages is that the researcher can seek the views of designated participants with limited affect to its validity or reliability. While, some have found no superiority between self-administered questionnaires and interviewer administered questionnaires,[23] the advantage of the former is that it provides greater distance when the researcher has been involved in the education process. Therefore, the main reasons for use of written, self-completed questionnaires was to avoid bias of the researcher influencing the answers and to gain responses in the same time frame. Maintaining anonymity allowed the participants to be honest about their experiences and suggestions for improvement. The questionnaires were collected before the participants received their final grades to minimise bias. This complemented focus groups and in-depth interviews which were conducted as part of the wider research for this initiative,[5,10] and focused on exploring participant views on their experience of training, the perceived impact of the pilot training programme on themselves, their organisation and their patients, the effect of the NHS arrangements on the experience of providing an endodontic service within NHS primary care and possible barriers/facilitators to providing endodontic treatment in NHS primary care in turn. The questions were open ended with room to elaborate on the answers.

Course participants were emailed with the questionnaire at the end of the second, and final, year of their part-time training. They were invited to complete the questionnaire anonymously and either drop the questionnaire in a sealed unmarked envelope on the feedback day (April 2011) or return it by post to the researcher.[24] It was advised that the questionnaire should be completed using a computer to facilitate anonymity. Demographics were not included to protect anonymity. All responses were transferred to an Excel spreadsheet (Microsoft Office 2010, Microsoft, Redmond, WA, USA) for analysis.

This qualitative data were analysed using framework analysis[25] involving a thematic approach. Framework analysis allowed for systematic and visible stages to the data analysis process: familiarisation; identification of a provisional thematic framework; indexing; charting; and mapping and interpretation. In the initial familiarisation stage responses were read and re-read, and key emerging themes and ideas listed, framed by areas of the topic guide or objectives of the study. A provisional thematic framework, identifying key issues, concepts and themes was used, so that the data could be examined and referenced into themes through coding. In the data indexing process, the index of the thematic framework was applied to the transcripts. During the charting process the data were in relation to the objectives of the research, and the thematic framework expanded in light of the application of the data. During the mapping and interpretation stage, the data were synthesised to detect and define concepts that allow mapping of the range and nature of experiences, as well as finding patterns and associations with participant experience.

Results

Respondents

All eight participants finishing the course responded to the survey. One participant did not complete the course and was excluded. Responses were received for almost all questions; those omitted (four questions in total from two respondents) related to ideas for improving the course and the endodontic services within general dental practice.

There was diversity in respondents' prior endodontic experience. This ranged from those having had no prior formal training since their undergraduate programme (N = 2), to those who reported gaining significant experience in general practice (N = 3), to others who had attended continuing professional development courses (N = 2), and even gained a diploma in endodontics (N = 1). Their motivation for enrolling in this course included encouragement, payment for this course and provision of paid study leave.

Course content and delivery

Respondents' overall experience of the course was reported as positive. Themes that emerged related to its organisation, the provision of appropriate prior reading material and the culture of the learning environment created (Table 1). Organisation of the course included the associated NHS arrangements and the system of triaging of patients to be treated as part of the learning experience. The course was considered inspirational and enjoyable, fostering a supportive, helpful and inclusive learning environment. Developments suggested involved greater levels of contact with teachers at the outset, more sessions under supervision, short and targeted training, greater discussion of cases and shorter seminars with greater emphasis on gaining practical skills. Participants observed the different learning styles of the group and perceived the need for and benefit of students receiving more individualised feedback and support.

'*I think more contact time at the start would have been better, also doing more on root preparation and apical gauging and techniques at the start would have increased our clinical standard more quickly*' (P2Q2).

'*A little bit more one to one support initially in some of the practical sessions*' (P3Q6).

'*Maybe short focused seminars would be more productive*' (P3Q4).

'*To improve have some patient sessions under supervision* [sic]' (P5Q4).

'*More discussion on the completed cases in practice. Where we went wrong and what could have been improved. We did discuss cases but now and then, [it] was never compulsory*' (P5Q6).

'*My colleagues and I consisted of 9 individuals with widely different levels of training experience and skills in dentistry. We also have varying personalities and personal commitments […] fortunately most of the teachers on the course understood this and were very encouraging. Perhaps a little more individual feedback would have been useful throughout the course*' (P6Q6).

The course was delivered in tandem with the NHS provision of general dental services with NHS time and funding allocated for enhancing skills in endodontics for these practitioners. This was recognised and appreciated as an integral part of training.

'*Without such an arrangement it would be impossible to dedicate the time necessary to develop the skills learned at the course and it would be extremely unlikely for an NHS dental practice to absorb the extra cost it does involve.*' (P1Q10)

Impact on participants, their patients and their organisation

The perceived effect of the course on participants themselves included gaining confidence, experience, understanding and change in practice as well as improvement in skills and knowledge. Reported changes in practice were not limited to endodontics (Table 2). There was support and appreciation for time and resources allocated to improving skills in primary care. There were no perceived negative impacts of the course; there were, however, challenging suggestions for improving the course delivery as previously illustrated. For some the impact on themselves was very significant:

'*This has been a career changing experience for me. I have exited this course with a new outlook on dentistry and I am much happier with my skills and understanding as a whole*' (P7 additional comments section at end of questionnaire).

The perceived impact of the course on the participants' organisation (NHS dental practice) were better or predictable clinical outcomes, access to NHS endodontic treatment, improved care, improved outcomes, value for money and empathy. Positive feedback from patients was described in relation to the service, thoroughness of care, time spent and explanations of the treatment. The course was perceived as relevant to general dental practice:

'*The most relevant course I could ever attend. In my PCT patients have benefited within 6 months of the start of the course*' (P6Q7).

Table 1 Themes that emerged from the participant views of the course and the NHS arrangements supporting the course

Themes	Examples
Organisation	'Excelled in providing a balance between theoretical and practical teaching for a busy GDP' (P8Q2)
	'It was a perfect course for a dentist who did not want to or could not go to full-time training due to family reasons. It was perfect combination of formal training and general practice experience' (P2Q5)
	'The course teachers were very supportive in providing the appropriate reading materials and literature before the study days. This proved invaluable throughout the course' (P6Q5)
	'The programme was very well organised' (P1Q3).
Learning culture	'Very well organised. Culture created by course tutors was very good – professional yet friendly and inclusive' (P4Q3)
	'It was hard work but enjoyable' (P3Q2)
	'The support from the teachers was excellent' (P1Q5)
Developmental	'A little bit more one to one support initially in some of the practical sessions to address individual problems' (P3Q6)
	'More discussion (needed) on the completed cases in practice. Where we went wrong and what could have been improved' (P5Q6)
	'I believe that the rotary instruments and warm vertical/backfill technique should have been introduced in earlier modules' (P1Q4)
	'I think more contact time at the start would have been better, also doing more on root preparation and apical gauging and techniques at the start would have increased our clinical standard more quickly' (P2Q2)
	'Maybe short focused seminars would be more productive' (P3Q4)

Table 2 Examples of the participant perceptions of the impact of the course on themselves, their patients and their organisation

Perceived impact of the course on themselves	Perceived impact of the course on their patients and on their organisation
'…Ignited an interest in dentistry and has spurred me to improve myself and continue to educate myself. I am now seeking an evidence based approach to all aspects of my dental treatment' (P7Q2)	'So many teeth have been saved' (P6Q7)
'The course in DwSI in endodontics took me to a totally different level of dentistry. It changed the way I practiced in general. It did mainly inspire me to use an evidence-based approach to most things I do' (P1Q2)	'The in-depth knowledge and skill acquired during the course has enabled me to provide an improved standard of care to my patients' (P3Q2)
'…Decision-making, treatment planning and technical skills have improved' (P5Q8)	'It is the best value for money, as most of the cases treated by us [did] not [therefore] require specialist treatment' (P1Q14)
'…I can carry out more complex endodontics with greater confidence. It has also given me a deeper knowledge and understanding of many aspects of restorative dentistry' (P6Q2)	'Patients have got such a good standard of root canal treatment for the same NHS charges or for free, which they would not have dreamt of getting' (P5Q7)
'Understanding, diagnosis, consistency of results' (P2Q9)	'Absolutely, the biggest surprise in this course was the fact that most aspects of the course could be practiced in general dentistry' (P1Q7)
'Definitely without a doubt the basic principles are the same but a completely new approach to achieving these principles' (P3Q8)	
'My technical procedure is totally different to what I was doing before' (P5Q9)	

The perceived positive aspects of NHS arrangements included resources, triaging and referral systems. The perceived negative factors were lack of organisation, remuneration, understanding of treatment and clarity of arrangements.

'*An understanding that it is a labour intensive treatment* […] *That unless they have long term funding for enough patients to be treated by a DwSI, the training expense may prove to be not very financially viable to the NHS*' (P8Q12).

'*Clear agreement and commitments to arrangement by both PCT and DwSI*' (P7Q12).

The transition of these skills into primary care and implementation of change was viewed to be dependent mainly on remuneration and production of appropriate care pathways. Local agreements and national policy on remuneration in primary dental care were perceived as important issues to be addressed. There was widespread appreciation for the PCTs who supported the initiative, however better organisation and communication were highlighted as areas for improvement. There was obvious intention to use the skills learned to provide improved care and high quality endodontics within the NHS; however, there was uncertainty and concerns as to whether the service would be commissioned in the future. Participants voiced concerns that the resources used to provide this pilot programme would be wasted, by all stakeholders in the initiative, if the service was to be discontinued. The participants did not state that they would be looking to provide this service in the private sector:

'*My PCT having invested in me for 2 years is now suggesting they have limited finances to support me after April 2011. This makes very little financial sense*' (P6Q12).

'*Despite seeing the benefits of the programme to the patients and the service, the PCTs commitment to me after April 2011 is unknown as yet*' (P6Q11).

Wider views included the importance of value for money and quality of care deserved by NHS patients and recommended better undergraduate training in endodontics. Many suggestions for commissioners included increased understanding of moderate complexity endodontic care services (time and single use equipment required), improved triaging services, written clarification, agreements and commitments to financial arrangements between commissioners and providers. The local factors affecting change in practice may be related to participants adopting techniques.

The perceived barriers to providing endodontics generally in primary care within the NHS were described as remuneration, time, skills/training, cost of providing the service or 'motivation' / 'incentive', accountability and quality assessment.

'*For the "average" NHS practitioner: funding, lack of accountability that is, motivation and incentives*' (P4Q15).

'*The funding to root canal treatment is the biggest barrier. The young dentists are not at all motivated as they are not paid or very for it [sic]. Disposable files are expensive and that does not help the practice principal. This is inculcating a culture in general practice that doing root canal is a waste of time and money*' (P5Q15).

'*For a general dentist, skill, magnification, undergraduate training, material cost, equipment available at the practice, use of rubber dam, remuneration*' (P2Q15).

Overall participants stated training and remuneration as important to facilitating the delivery of high quality endodontic treatment in NHS practice (Fig. 1). Having this programme may have overcome some of the barriers such as 'resources (such as time equipment etc), skills and knowledge' (P3Q15); however did not address other barriers such as 'Incentive, motivation' (P4Q16) and 'Better undergraduate training' (P8Q16).

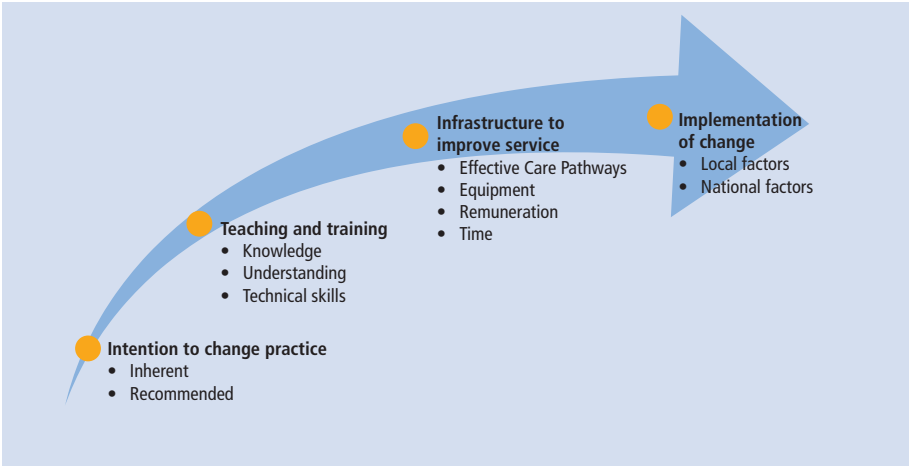
Discussion

These findings contribute to the literature by providing valuable insight into the views and experiences of dentists who undertook a novel educational initiative to enhance their skills in endodontics on the pilot programme. The participants perceived this course not only to have given them skills, knowledge and confidence but as also having led them to better predictable clinical outcomes, improved care, value for money and access to NHS endodontic treatment. There is limited literature on endodontics within the NHS as much of the surveys have been around new graduates and their experience of undergraduate training or vocational training.[26–29] The responses of the participants were related to three broad areas: the course design, the impact of training and the wider NHS. Each will be addressed in turn, starting with the course design.

First, the different suggestions for the re-design of the teaching days in the course reflected experience and individual requirements, which may relate to learning styles and engagement with the course and course tutors. There were preferences to different styles of teaching and there were differences in participant views of the areas where more

help was needed, as expected of participants from varying experience and backgrounds. Strategic learners may identify what they need to learn before beginning, and to some extent this group may have approached the course in this way.[29] The factors affecting the learner's experiences of learning and training should be considered when future training programmes are created; however, the approach used here was well received and this may have been related to the range of styles of teaching used. The factors highlighted in this study have been supported by other educational publications.[30–32] It is known that printed educational materials, didactic teaching alone and audit/feedback have limited influence of professional practice.[33–35] Simulated learning of technical skills can be as effective in dentistry as bench-top learning.[36–38] Bench-top learning is practicing in simulated lab/phantom heads using extracted teeth or artificial teeth or endodontic training blocks, and simulated learning during the course in the current study included training using endodontic training blocks. The perception in dentistry is that supervised clinical training, whereby patients are treated under the direct supervision of more experienced trainers, is the most effective and therefore the most common approach around the world. This limits capacity and requires the cooperation of suitably consented patients, as well as being expensive and intensive on human resources of both the trainers and trainees.[39] The new trend is for ongoing reflective learning, where the individual examines an experience leading to a change in conceptual perspective, often using a portfolio.[11,13,40] These techniques of teaching were embedded within the course and the participant's perceived outcome was that knowledge, understanding, and technical skill improved within this course. Although, the participants stated that more sessions under supervision would have been useful, there is no evidence to suggest that training under supervision provides better education for dental post-graduates than the model of training assessed in this study. In this training initiative patients were treated from the very beginning, while course-training days were a month apart, during which time numerous patients would have been referred to these dentists to provide endodontic treatment. Therefore, the need to front load the course with the practical skills is echoed in the experience of the participants. There is learning here for ensuring robust triaging for appropriate cases for various stages of the course and the consideration of extended periods of clinical skills training before referral of patients begins.

Fig. 1 Potential barriers to and facilitators of change in practice as identified by the participants of the course



The second reported impact was that the participants stated that wider change in practice occurred resulting in benefits to the participants and their patients, possibly due to the range of teaching methods used suiting different learning styles. The intention to change practice may be inherent in those who are always seeking to improve and would influence deeper learning.[41] While the participants of this course were nominated for further training by their PCT as they already provided sufficient endodontic services for the PCT, however were unable to provide treatment of moderate complexity and these skills were not readily available elsewhere, the participants were chosen through a competitive interview process; therefore inherent desire to improve or gain validation may have been a factor. From the transcripts, participants spoke of actively seeking post-graduate training in endodontics before embarking on this course. Previous interest in endodontics and lenience towards providing endodontic services in general practice was stated. Almost all participants cited changes in practice following the course.

The views of the key stakeholders (which included trainees within the course) gathered using structured interviews were resonated in the current study, and details not captured elsewhere were discovered in the current study in relation to the course itself.[5,6,10] The barriers to providing endodontic treatment within the NHS system highlighted in this study are in keeping with the data gathered from structured interviews and previous surveys.[5,42] The findings also provide evidence that education and experience-based training can address the issues raised by general dental practitioners about their perceived level of skills. Interestingly, in addition to their own experiences, the participants identified wider NHS issues during this survey.

Thirdly, regarding the wider NHS environment, the end of the educational initiative coincided with a radical change in the NHS commissioning environment, resulting in loss of corporate memory and strategic direction for the new enhanced skills practitioner. The changes of the Health and Social Care Act (2012)[43] were the source of uncertainty regarding the future commissioning of dental services, and were highlighted in the views of the participants of this course, and brings to attention the importance of the stability of funding and structure of healthcare systems.[6,10,44]

This evaluation had a number of strengths and limitations that must be considered. First, there is a limitation in using a single questionnaire to assess the education and training initiative, which is reliant on recall and summative ability of the participant. In order to allow greater exploration, these findings can inform future evaluations involving structured interviews,[45] over the course of a training programme. These findings are relevant as they can inform a future quantitative questionnaire instrument for use with larger schemes at intervals during the training. Future research could additionally involve the use of detailed reflective learning diaries with focused areas of exploration such as motivations and benefits of training. However, the findings have congruence with the responses of semi-structured interviews of key players on the overall initiative as reported by Al-Haboubi *et al.* (2014)[6]

and endorsed by general dental practitioners.[5] Second, it must be recognised that the participants in such a programme are self-selecting and not necessarily representative of wider practitioners, which may be an inherent issue with pilot initiatives. However, people should ideally only pursue such developments if they have a strong interest in the field.

There was a call for coordinated patient care pathways and time for training of the workforce within new commissioning arrangements.[46] The creation of dentists with enhanced skills (also described as Level II practitioners, providing treatment of moderate difficulty) was identified as an important part of the delivery of a twenty-first century NHS dental service to patients following a change to commissioning of restorative dentistry and endodontics across England.[46–50] Dentists with appropriate skills to carry out treatment of moderate difficulty would therefore need to be trained; the training would not be provided at an undergraduate level and would need to be provided as post-graduate training.[51,52] In the short to medium term, the workforce will need additional training while still providing a service to their patients. This study suggests that participants of such a training programme valued the NHS arrangements that allowed them to enhance skills, while still maintaining an income and treating their patients. These findings inform a systems approach to the provision of specialised care involving hands-on education for practitioners in endodontics, while also enabling them to continue to provide primary dental care, and should support the restorative guide when published.[47]

In summary, this novel pilot training programme in endodontics combining general practice experience with education/training, hands-on experience and a portfolio was perceived by participants as beneficial for extending skills and service innovation in primary dental care. The findings provide insight into primary dental care practitioners' experience with education/training and have implications for future educational initiatives in support of systems innovation and patient care within the NHS.

Acknowledgements

We would like to acknowledge the dentists with enhanced skills who participated in the training and the study, without whom this research would not have been possible.

Conflicts of interest

SE taught on the DES course described above. PB was the educational lead for the London DES in Endodontics Programme, taught on the DES course and was responsible for patient triage for three of the DES participants. JEG was part of the Senior Dental Leadership Team in the Department of Health and a Dental Public Health representative in the working group for setting up DES in endodontics.

1. Specialist Advisory Committee (SAC) in Restorative Dentistry. Curriculum for Speciality Training In Restorative Dentistry (approved by the GDC). 2009. Available online at URL incorrect. Please insert correct URL (accessed February 2017).
2. Specialist Advisory Committee (SAC) in Restorative Dentistry. Curriculum for specialist training in endodontics. 2010. Available online at http://www.gdc-uk.org/dentalprofessionals/specialistlist/documents/endodonticscurriculum.pdf (accessed August 2016).
3. Health Education England. Workforce Plan for England Proposed Education and Training Commissions for 2014/15. Available online at https://www.hee.nhs.uk/sites/default/files/documents/Workforce-plan%202014-15.pdf (accessed August 2016).
4. Health Education England. Framework 15 Health Education England Strategic Framework 2014 2029. Available online at https://www.hee.nhs.uk/sites/default/files/documents/HEE%20Strategic%20Framework%20%202015%20Refresh%20Final%20document.pdf (accessed July 2016).
5. Ghotane S G, Al-Haboubi M, Kendall N, Robertson C, Gallagher J E. Dentists with enhanced skills (Special Interest) in Endodontics: gatekeepers views in London. *BMC Oral Health*. 2015; **15:** 110.
6. Al-Haboubi M, Newton P, Gallagher J E. Meeting Patient and Professional Needs: Views of Stakeholders on a Training Initiative for DwSIs in Endodontics in London. *Prim Dent J* 2016; **5:** 54–65.
7. Department of Health & Faculty of General Dental Practitioners (UK). Implementing a Scheme for Dentists with Special Interests (DwSIs). 2004. Available online at http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4083120.pdf (accessed February 2017).
8. Department of Health, Faculty of GDPUK. Guidelines for the appointment of Dentists with Special Interests (DwSIs) in Endodontics. London: Department of Health & Faculty of GDPUK. 2006. Available online at http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4133752.pdf (accessed February 2017).
9. Department of Health, Faculty of GDPUK. Primary Care Contracting. Dentists with a Special Interests: a step by step guide to setting up a DwSI service – London. 2006. Available online at http://www.pcc-cic.org.uk/sites/default/files/articles/attachments/step_by_step_guidance_dwsis.pdf (accessed February 2017).
10. Al-Haboubi M, Eliyas S, Briggs P F A, Jones E, Rayan R R, Gallagher J E. Dentists with extended skills: the challenge of innovation. *Br Dent J* 2014; **217:** DOI:10.1038/sj.bdj.2014.652.
11. Boyd E M, Fales A W. Reflective Learning. *J Humanistic Psych*. 1983; **23:** 99–117.
12. Cartney P, Rouse A. The emotional impact of learning in small groups: highlighting the impact on student progression and retention. *Teach High Educ* 2006; **11:** 79–91.
13. Dannefer E F, Henson L C. The Portfolio Approach to Competency-Based Assessment at the Cleveland Clinic Lerner College of Medicine. *Acad Med* 2007; **82:** 493–502.
14. Mathers N J, Challis M C, Howe A C, Field N J. Portfolios in continuing medical education effective and efficient? *Med Educ* 1999; **33:** 521–530.
15. Murad MH. Coto-Yglesias F. Varkey P. Prokop LJ. Murad AL. The effectiveness of self-directed learning in health professions education: a systematic review. [Review]. *Med Educ* 2010; **44:** 1057–1068.
16. Neumann R, Parry S, Becher T. Teaching and Learning in their Disciplinary Contexts: a conceptual analysis. *Stud Higher Educ* 2002; **27:** 405–417.
17. Paget T. Reflective practice and clinical outcomes: practitioners' views on how reflective practice has influenced their clinical practice. *J Clin Nurs* 2001; **10:** 204–214.
18. Weston C M, Sciamanna C N, Nash D B. Evaluating online continuing medical education seminars; evidence for improving clinical practice. *Am J Med Qual* 2008; **23:** 475–483.
19. NHS England Guides for Commissioning Dental Specialities and their implementation webpage. Available online at https://www.england.nhs.uk/commissioning/primary-care-comm/dental/dental-specialities/ (accessed February 2017).
20. Eliyas S, Briggs P F A, Harris I R, Newton J T, Gallagher J E. Development of quality measurement instruments for root canal treatment. *Int Endodont J* 2016; DOI:10.1111/iej.12679
21. Kline P. *Personality: The psychometric view*. London: Routledge, 1993.
22. Paulhus D L, Vazire S. The self-report method. *In* Robins R W, Fraley R C, Krueger R F (Eds) *Handbook of research methods in personality psychology.* pp. 224–239. London: The Guilford Press, 2007.
23. McColl E, Jacoby A, Thomas L *et al.* Design and use of questionnaires: a review of best practice applicable to surveys of health service staff and patients. *Health Tech Assess* 2001; **5:** 1–256.
24. Dillman D A, Smyth J D, Christian L M. *Internet, mail and mixed-mode surveys: the tailored design method. 3rd Edition*. Hoboken, NJ: John Wiley & Sons, 2009.
25. Ritchie J, Lewis J. *Qualitative Research Practice: A guide for social science students and researchers*. London: Sage, 2003.
26. Murray F J, Blinkhorn A S, Bulman J. An assessment of the views held by recent graduates on their undergraduate course. *Eur J Dent Educ.* 1999; **3:** 3–9.
27. Bartlett D W, Coward P Y, Wilson R, Goodsman D, Darby J. Experiences and perceptions of vocational training reported by the 1999 cohort of vocational dental practitioners and their trainers in England and Wales. *Br Dent J*. 2001; **191:** 265–270.
28. Patel J, Fox K, Grieveson B, Youngson C C. Undergraduate training as preparation for vocational training in England: a survey of vocational dental practitioners' and their trainers' views. *Br Dent J* 2006; **Suppl:** 9–15.
29. Entwistle N J, Ramsden P. *Understanding Student Learning*. London: Croom Helm, 1983.
30. Dolmans D H J M, Wolfhagen I H A P, Heineman E, Scherpbier A J J A. Factors Adversely Affecting Student Learning in the Clinical Learning Environment: A Student Perspective Education for Health. *Educ Health (Abingdon)* 2008; **20:** 32.
31. Lord B, McCall L, Wray N. Factors affecting the education of pre-employment paramedic students during the clinical practicum. *Aust J Paramed*. 2012; **7:** 3.
32. Bos E, Alinaghizadeh H, Saarikoski M, Kaila P. Factors associated with student learning processes in primary health care units: a questionnaire study. *Nurse Educ Today* 2015; **35:** 170–175.
33. Freemantle N, Harvey E L, Wolf F, Grimshaw J M, Grilli R, Bero L A. Printed educational materials: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev* 2000; CD000172.
34. Jamtvedt G, Young J M, Kristoffersen DT, O'Brien M A, Oxman A D. Does telling people what they have been doing change what they do? A systematic review of the effects of audit and feedback. *Qual Safe Health Care*. 2006; **15:** 433–436.
35. O'Brien M A, Freemantle N, Oxman A D, Wolf F, Davis D A, Herrin J. Continuing education meetings and workshops: effects of professional practice and health care outcomes. *Cochrane Database Syst Rev* 2007; CD003030.
36. Clancy J M, Lindquist T J, Palik J F, Johnson LA. A comparison of student performance in a simulation clinic and a traditional laboratory environment: tree year results. *J Dent Educ.* 2002; **66:** 1331–1337.
37. Jasinevicius T R, Landers M, Nelson S, Urbankova A. An evaluation of two dental simulation systems: virtual reality *versus* contemporary noncomputerassisted. *J Dent Educ*. 2004; **68:** 1151–1162.
38. LeBlanc V R, Urbankova A, Hadavi F, Lichtenthal RM. A preliminary study in using virtual reality to train the dental students. *J Dent Educ*. 2004; **68:** 378–383.
39. DePaola D P, Slavkin H C. Reforming dental health professions education: a white paper. *J Dent Educ.* 2004; **68:** 1139–1150.

40. Buckley S, Coleman J, Davison I *et al.* The educational effects of portfolios on undergraduate student learning: A Best Evidence Medical Education (BEME) systematic review. BEME Guide No. 11. *Med Teach* 2009; **31:** 282–298.
41. Biggs J, Tang C. *Teaching for quality learning at university, 3 edition*. Berkshire, UK: Oxford University Press, 2007.
42. Gallagher J E, Patel R, Wilson N H F. The emerging dental workforce: long-term career expectations and influences. A quantitative study of final year dental students' views on their long-term career from one London Dental School. *BMC Oral Health* 2009; **9:** 35.
43. UK Government. Health and Social Care Act 2012 (Chapter 7). The Secretary of State for Health, ed. 2012. Available online at http://www.legislation.gov.uk/ukpga/2012/7/pdfs/ukpga_20120007_en.pdf (last accessed August 2016).
44. Gallagher J E, Clarke W, Eaton K A, Wilson N H F. Dentistry – a professional contained career in healthcare. A qualitative study of Vocational Dental Practitioners' professional expectations. *BMC Oral Health* 2007; **7:** 16.
45. Mullens J E, Kasprzyk D. Using qualitative methods to validate quantitative survey instruments. Available online at http://www.amstat.org/ASA/Membership/Sections-and-Interest-Groups.aspx (accessed August 2016).
46. Steele J. NHS dental services in England: An independent review led by Professor Jimmy Steele. 2009. Available online at http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_101180.pdf (accessed July 2016).
47. NHS England. Introductory Guide for Commissioning Dental Specialties. 2015. Available online at https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2015/09/intro-guide-comms-dent-specl.pdf (accessed May 2016).
48. NHS England. Guide for Commissioning Oral Surgery and Oral Medicine Specialties 2015. Available online at https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2015/09/guid-comms-oral.pdf (Accessed May 2016).
49. NHS England. Guide for Commissioning Orthodontics. 2015. Available online at https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2015/09/guid-comms-orthodontics.pdf (accessed May 2016).
50. NHS England. Guides for commissioning dental specialties – Special Care Dentistry. 2015. Available online at https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2015/09/guid-comms-specl-care-dentstry.pdf (accessed May 2016).
51. NHS England. Five Year Forward View. 2014. Available online at https://www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf (accessed June 2016).
52. Gallagher J E, Wilson N H F. The future dental workforce? *Br Dent J.* 2009; **206:** 195–199.