
Peer reviewed version

Link to published version (if available):
10.1111/eje.12792

Link to publication record in Explore Bristol Research

PDF-document

This is the accepted author manuscript (AAM). The final published version (version of record) is available online via Wiley at https://doi.org/10.1111/eje.12792. Please refer to any applicable terms of use of the publisher.
Dental students’ self-reported confidence level in restorative crown and bridge procedures: a UK quantitative study

Abstract

Introduction: Graduating confident students who can flourish and develop in their future career is an important outcome of dental education. The aim of the study is to gain an insight into students' self-reported level of confidence in restorative crown and bridge procedures, highlighting which stage of the process students have highest and lowest confidence in, depending on the level of supervision required.

Materials and method: Fourth year- and final-year students (n= 85) were invited to complete a 71-item closed questionnaire specific to self-reported confidence based upon level of supervision required in stages of crown and bridge work. Clinical activity for each student from their portfolio system was collected. Non-parametric tests, specifically the Mann Whitney U Test was used to analyse the continuous non-normal data.

Results: A response rate of 65% was obtained. Final year students were more confident in crown and bridge procedures than fourth year students. Fourth year students were more confident in bridges, whilst final years were more confident with crowns. Majority of students expressed 'average confidence requiring minimal supervision' in crown and bridge procedure. An association between clinical activity, confidence and year of study was noted. Gender was not strongly associated with confidence. Stages in crown and bridge procedures were noted where students lacked confidence.

Conclusion: The study highlights areas in which students are most and least confident in crown and bridge procedures. A positive relationship between clinical activity in crown and bridge and student self-confidence has been noted for both years, though slightly higher in bridge procedures for fourth year students. We attribute this to the fact that fourth year students had
recently completed their bridge competency assessment. Upon graduating, final year students still require supervision and reported average confidence in certain aspects of crown and bridge procedures, namely occlusal, bevel and axial reduction.

Key words: dental students, crown, bridge, self-confidence, supervision, restorative

INTRODUCTION

A primary objective of dental education is the production of competent, skilled and professional dental practitioners to treat the oral health of the population. While national bodies such as the General Dental Council (UK) and Irish Dental Association (IRE) offer guidance on how this can be attained, the Association for Dental Education in Europe provides an overarching framework for how to assess newly graduated dentists. Using a competency model approach, it specifies four key domains or categories of educational attainment - professionalism, safe and effective clinical practice, patient-centred care, and the dentist in society. Clinical competence underpins all of these domains, including the specific learning outcome of being able to ‘provide direct, fixed and removable restorations, and occlusal splints’ (3.4.11).

In the UK, dental students must demonstrate competency across four main learning domains - clinical, communication, professionalism, management and leadership skills. Clinical dentistry is technically demanding, requiring fine manual dexterity in order to complete intricate procedures in a challenging environment. Restorative clinical activities include dental procedures such as indirect restorations, namely crown and bridge tooth preparation procedures. Each dental school in the UK has set requirements of clinical activities for undergraduate dental students to complete prior to graduating in accordance with registration guidance. Most dental undergraduates report their clinical activities on electronic portfolio systems, such as Health Care Learning Portfolio, Axium, LiftUpp and Clinical Assessment Feedback System (CAFS).
Dental students must graduate as ‘safe beginners’ prior to commencing their internship year, working under the supervision of a dedicated clinical supervisor.4 This will prepare graduates to work confidently and independently in practice.5

During undergraduate training, students undertake extensive technically demanding operative examinations to assess their clinical skills. Despite this, one study recorded that 80% of final year students report a lack of self-confidence in clinical skills, particularly complex crown and bridge procedures.6 Preparing a tooth for a crown or bridge requires high manual dexterity and involves a series of stages to complete, as well as using different materials, such as gold, tooth-coloured ceramic or porcelain fused to metal, with the latter being more aesthetically acceptable. Generally, students are more confident in simple operative procedures compared to endodontics and prosthodontics including indirect restorations such as crown and bridge procedure.5,7 These findings led the authors to consider - why might this be the case? Could this low level of student confidence around tooth crown procedure be due to the overall complex nature of these procedures, or are there specific parts of the procedure they find more challenging than others? What could reduce or help boost student confidence around crown and bridge procedures, as they prepare for graduation and independent practice? Is there a relationship between the amount of student clinical activity in crown and bridge work, specifically all ceramic and porcelain fused to metal procedures, and students' self-reported confidence in these procedures?

**AIMS AND OBJECTIVES OF STUDY**

The aim of the study is to gain an insight into students' self-reported level of confidence in restorative crown and bridge procedures, highlighting which stage of the process students have highest and lowest confidence in, based on the level of supervision they felt necessary.

The objectives were:
1. To identify factors that influence perceived self-confidence in crown and bridge procedures.
2. To note undergraduate dental students self-reported clinical confidence according to the level of clinical supervision students felt they required in crown and bridge procedures.
3. To identify a relationship, if any, between the amount of clinical activity and perceived self-confidence in crown and bridge procedures.
4. To determine whether gender and year of study have a bearing on perceived self-confidence in crown and bridge procedures.

MATERIALS AND METHODS

A closed questionnaire was designed to examine undergraduate dental students self-reported confidence levels when performing crown and bridge procedures. Ratings of student self-confidence was measured as a function/product of their reliance on clinical supervision. The questionnaire was piloted among a randomly selected group of ten fourth year and final year students and clinical supervisors to check for clarity, understanding and relevance.

The 71-item questionnaire was developed comprising three sections, see Appendix 1 for sample questions. Section 1 included student demographics such as gender and year of study. Section 2; involved 62 questions and recorded student self-reported confidence based upon level of supervision required when performing the following procedures on clinic: anterior all ceramic crowns (AACC), posterior porcelain fused to metal crowns (PPFMC), anterior all ceramic bridges (AACB) and posterior porcelain fused to metal bridges (PPFMB). A Likert scale from 1-5 was used to record confidence where one point was scored for “no confidence, requiring full supervision” two points for “little confidence requiring full supervision” three points for “some confidence, requiring full supervision”, four points for “average confidence, requiring minimal supervision” and finally five points for “full confidence, requiring no supervision”. Confidence was reported on the stages required to complete an AACC and PPFMC as well as a
fixed-fixed AACB and PPFMB. This included reporting confidence on significant aspects of tooth procedure such as taper, occlusal and axial reduction. 14 questions were asked regarding AACC and PPFMC stages, whilst a further question regarding path of insertion was asked on AACB and PPFMB. Section 3 allowed for provision of any further comments.

Ethical approval was granted by the Faculty of Health Sciences Student Research Committee at University of Bristol (Reference ID: 60708). All fourth year and final year students were contacted via email notifying them about the study (total population = 127). Two weeks after the email, paper versions of the questionnaire were distributed among the student groups following clinical sessions, tutorials, lectures and finals examinations during their final term of dental school. In total, 127 questionnaires were administered (Sample size =127). Respondents were initially denoted by their student number to enable the School’s educational technology developer to access students’ clinical portfolios. Once the matching with clinical records was completed, all data was anonmysied and given to the lead researcher (MA-K) for analysis.

**Data analysis**

Participants were assigned an anonymous code not linked to any personal identifier. Each student’s response therefore remained confidential.

The data was checked for errors and analysed utilising a statistical programme, SPSS15. Separate confidence values were obtained for each procedure: AACC, PPFM, AACB and PPFMB for both fourth year and final year dental students. Overall confidence (OC) was obtained by aggregating the results for all 62 questions regarding self-reported confidence for AACC, PPFMC, AACB and PPFMB. The students self-reported confidence and matched the number of clinical activities recorded on SPSS15. Descriptive statistics were employed to calculate the median and interquartile range (IQR). Non-parametric tests, specifically the Mann Whitney U Test was adopted to analyse the continuous non-normal data. The outcomes were
compared to the demographic variables. This was used specifically to compare confidence in AACC, PPFMC, AACB, PPFMB and OC between the categories of gender and year groups.

Spearman’s correlation coefficient was calculated to determine the intercorrelation between the five confidence variables for AACC, PPFMC, AACB, PPFMB and OC. The linear association between OC and clinical activity completed was also computed.

RESULTS

85 questionnaires were completed (65% response rate). 54% of which were fourth year and 46% final year students. 24% of respondents were males whilst 76% were females. All questionnaires were error free and considered for further analysis. No responses were provided by participants for section 3. As a result, only quantitative data from Sections 1 and 2 were collected and analysed. (See Appendix).

Demographics

85% of students were between the ages of 18 and 24 years, 93% were UK nationals, 11% held a previous university qualification and 2% were previously employed as healthcare professionals. These categories do not provide sufficient variation for analysis, unlike year of course and gender. These two latter categories were therefore analysed further and compared to self-reported confidence.

78% of fourth and final year dental students had completed either one or more all ceramic or porcelain fused to metal crowns. 59% of fourth year and 100% of final year students had completed a single crown on a patient. Only 24% of students had completed a single bridge during their studies, either being a fixed-fixed, resin retained or cantilever bridge. 18% of these students were in their final year and 6% were fourth year students.

Self-reported confidence between fourth-and final-year dental students
Strong association was noted between year and confidence (Table 1). Final year dental students highlighted an increased OC in crown and bridgework to fourth year counterparts (p<0.0001). Final year students presented with increased confidence in AACC and PPFMC (median 63.0), whilst fourth year students presented with increased confidence in AACB and PPFMB (median 55.0).

**Perceived self-confidence between male and female students**

Male respondents reported higher OC compared to female respondents (median ranges from 60.0-65.5, whilst the median for females ranged from 56.0 - 57.0). See Table 1. While there was not a strong association between gender and confidence, as highlighted by the p values (Table 2), which was (p=0.037) it is statistically significant.

**Perceived self-confidence for crown and bridge procedures based upon level of supervision required**

Fourth and final-year students scored the highest confidence in PPFMC procedures (see Table 3). 49% of students reported ‘average’ confidence with minimal supervision for all stages except for occlusal, bevel and axial reduction. Student’s report ‘some’ confidence and require full supervision for these three reductions. 47% scored ‘average’ confidence with minimal supervision for both AACC and PPFMB procedures. For AACB procedures, 47% reported ‘average’ confidence requiring minimal supervision. The majority of students reported ‘some’ confidence, requiring full supervision for path of insertion and identifying bridge facts. The lowest confidence levels were reported for PPFMB (33%), followed by AACB (32%) and both AACC and PPFMC (23%).

**Perceived self-confidence and relationship to clinical activity**

The number of crowns and bridges performed by each fourth and final year dental students ranged from 0-16 at the time of the study (0-9 for Yr 4, 1-16 for Yr 5 students). A total of 528
crowns and 127 bridges were completed by fourth and final year dental students at the time of the study. These numbers reflected satisfactory work (acceptable quality) whereby students were found to be competent in skills performing crown and bridge, and have been signed-off by a trained, calibrated supervisor. Each student completed on average 1-2 crowns and bridges by the time they completed fourth year, while each student in final year had completed on average 8 crowns and bridges. There is a positive correlation between self-reported confidence and total clinical activity in both crown and bridge work reported in this research (p<0.042). There is a strong association between Year and clinical activity (p<0.0001) for all procedures except AACB (p= 0.001) (Table 2). Students that had completed an increased total of crowns and bridges, equally reported increased OC in these disciplines. Students however, that had not yet completed a single bridge in year 5, still presented with higher OC (p<0.0001, Table 2) than fourth year students, regardless of whether they had or hadn’t completed a bridge.

DISCUSSION

This study confirms that student confidence with crown and bridge work, measured as an indication of need for clinical supervision, is positively correlated with clinical activity.

The self-reported confidence associated with crown and bridge work was found to be positively correlated with year of study and gender ⁵,⁸ and males presented with greater overall confidence (OC) than females in crown and bridge procedure (Table 2). A gender gap in self-reported confidence has been found in two UK studies where recently graduated female dentists were found to rely more on their educational/clinical supervisors compared to their male counterparts. ⁸, ⁹

This study affirms the importance of developing manual dexterity to enhance confidence in aspiring dentists. The best way to ensure this could be through practice on phantom heads in the skills lab and regular patient flow for exposure to crown and bridge work. Other methods
have been reported to improve the teaching of crown and bridge preparations including the use of 3D multi-layered printed teeth with included preparations\textsuperscript{10,11} the use of CEREC prepCheck (Dentsply Sirona, York, Pennsylvania, USA) for the control of a preparations\textsuperscript{12,13} and a more advanced method utilising virtual 3D models\textsuperscript{14,15}. However, two factors appear to threaten the UK undergraduate clinical experience. First, a study found that posterior crowns are more commonly placed than anterior crowns.\textsuperscript{9} As a result, students may have a reduced pool of patients that require anterior crown provision. Second, the number of students enrolled in dental universities has increased significantly in recent years, while the number of senior clinical academics has reduced, with the potential to compromise teaching quality.\textsuperscript{16} In addition to these factors, the current COVID-19 pandemic has left students suffering from generalised anxiety surrounding contracting the virus from direct contact with the public, patients, staff and peers. This additional strain to the undergraduate dental experience will no doubt reduce self-confidence if clinical exposure is reduced.\textsuperscript{17,18} World-wide lockdowns have had a negative impact on patient flow, with many unwilling to attend dental appointments due to fear of contracting the virus. This may have led to current undergraduates having less opportunities to work with actual patients and maybe relying more on phantom head practice.

This study found that the more clinical activity undertaken, the more confident dental students became with their operative skills. Despite a focus on the number of procedures required for graduation, a recent study has found that the “numerical requirement approach alone should not be used to make valid judgements over the competency of a dental student to undertake direct restorations”,\textsuperscript{19} and that appropriate quality of technical skills is required. Measures of clinical activity do not necessarily provide a measure of competency. Students reported high levels of confidence with limited supervision does not mean the student is fully competent. From this research, it is unlikely graduates are competent if they have not competed a single bridge at undergraduate level.\textsuperscript{20,21}
To date, no publication has clarified uniform requirements for the level of clinical activity expected from newly qualified graduates. Clearly, more guidance needs to be drafted by the regulatory bodies regarding when and how much crown and bridge work needs to be completed by undergraduates. Establishing this type of consensus would ensure that there is consistency with minimum level of competency expected from undergraduates, regarding crown and bridge work across the UK.

A recent study shows that students with high levels of clinical experience were more prepared and more confident than those with lesser amounts of clinical experience. Final year students completed more crowns and bridges (8 on average), than their fourth-year counterparts (1-2 on average) on clinic. Students have reported feeling more prepared and confident in higher years, but limited research is available for comparison between fourth year and final year undergraduates. This study highlights students in final year who have increased confidence. Final year students express increased OC in all disciplines of crown and bridge procedure. This increased OC compared to fourth year could be associated with their overall enhanced manual dexterity developed over the one-year period. Final year students also become full-time operators at outreach programmes simulating general practice. These programmes contribute towards increased clinical activity and have been shown to be fundamental towards increased self-confidence. This study, however, has shown low clinical activity within the same year contributes towards reduced OC. Attention should be paid to students who present with reduced activity on their clinical portfolio, prioritising patient cases to this cohort in aim to increase their confidence to a similar level as peers.

For crown procedure: occlusal, bevel and axial reduction in PPFMC were areas where students reported some confidence and required full supervision. This could be due to the difficulty of checking the occlusion. Students may be concerned about under or over preparing the crown and therefore leading to an ill-fitting crown. With regards to bridge procedure, ‘path of insertion’
and ‘identifying bridge faults’ were areas the majority of students required full supervision for in AACB. Reasons for this could be attributed to the position of anterior teeth in the arch form. Furthermore, dental students may feel anxious when preparing a tooth within the aesthetic zone, afraid of making inaccuracies.

This research confirms that crown and bridge work registers as a challenging task, as students are still in need of supervision even at graduation. Dental Schools are in a dilemma about when to introduce bridges procedures. Such advanced clinical procedures are typically introduced later in dental studies, however, that is dependent on the assumption that students have built up their manual dexterity skills on procedures introduced earlier in the degree, such as fillings and non surgical periodontal procedures. Nevertheless, the fact that performing crown and bridge work is kept to later years of dental programmes also means that students have reduced self-confidence with this type of clinical activity, ‘wishing to learn more’ about them. In this study, a total of 528 crown and bridge procedures were completed by final year dental students, and only 127 by fourth years. Despite only 6% of fourth year students completing a bridge on clinic, they presented with more confidence in bridges compared to crowns, unlike final year students, who were more confident in crowns than bridges. Fourth year students had shortly completed their bridge preparation practical exam on phantom heads before the survey was administered. Miller’s pyramid concept, states that in order to be able to perform in a particular procedure, to “know how” to do something and “show how” to do it through competency is not the same as “doing” the procedure. Perhaps students are graduating with the correct knowledge but struggling with application of the clinical skill and require more time to practice and build confidence.

Undertaking a crown and bridge procedure is categorised as an aerosol generated procedure (AGP), indicating that enhanced personal professional equipment (PPE) and further time is required for the treatment to be carried out under the current pandemic circumstances. Because
of this, there is difficulty for staff to undertake direct supervision of multiple AGP procedures. As a result of the coronavirus spread, students are restricted by the number of patients they can see, reducing clinical exposure. Alternative methods of teaching to ensure students gain the maximum experience possible should be explored, for example, virtual reality/augmented reality environments, computerised virtual reality simulators, combined conventional phantom heads and other forms of technology.

FUTURE RESEARCH

Further work is needed nationally and internationally to investigate any relationship between perceived self-confidence and actual clinical competence. Longitudinal data of student performance could also be obtained during their undergraduate clinical experience and following graduation during the first year internship.

LIMITATIONS

We accept that this study has limitations. The questionnaire was distributed in a paper-based format and there are known limitations with this research approach. These include: a low response rate as well as data handling/inputting errors. To mitigate against this risk of low response rate, the lead author of the study was known to the student cohort and so distributed the questionnaire at a time that was convenient for the students. This led to a response rate of 65%. To eliminate errors at the data inputting stage, data was rechecked to check for inaccuracy. Second, it is important to note that results are only generalisable to this student cohort and the clinical experience and education they experienced.

CONCLUSIONS

The study highlighted areas in which students are most and least confident in for crown and bridge procedures. A positive relationship between clinical activity in crown and bridge and student self-confidence has been noted for both years, though slightly higher in bridge
procedures for fourth year students. We attribute this to the fact fourth year students had recently completed their bridge competency assessment. Upon graduating, final year students still require supervision and reported average confidence in certain aspects of crown and bridge procedures, namely occlusal, bevel and axial reduction. It is therefore important that students maximise patient contact as an undergraduate to increase clinical experience.

**Conflict of interest:**

There were no financial or professional interests that affected the study

**References**


