

RESEARCH AND EDUCATION

Electronic laboratory quality assurance program: A method of enhancing the prosthodontic curriculum and addressing accreditation standards

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The current generation of dental students has been using technology throughout their education, allowing them easy, immediate access to information. Although the use of technology in dental schools varies greatly, current dental students expect and often demand learning platforms that are readily accessible from a variety of electronic-based resources.¹ The challenge of implementing any technology into a learning environment is multifaceted. Issues such as web design, delivery methods, relevant material, and the ability of the faculty to contribute and update content in these dynamic environments are some of the challenges facing dental education.¹⁻³ Some of the advantages of electronic-based teaching (e-learning or blended learning) include the expansion of learning beyond that of printed materials; customized learning; interactivity; and the incorporation of graphics and multimedia to enhance e-learning platforms. Moreover, the availability and proliferation of handheld devices, such as smartphones, allows timely delivery of teaching materials and feedback so that students can conveniently access content.

ABSTRACT

Statement of problem. An electronic quality assurance (eQA) program was developed to replace a paper-based system and to address standards introduced by the Commission on Dental Accreditation (CODA) and to improve educational outcomes. This eQA program provides feedback to predoctoral dental students on prosthodontic laboratory steps at New York University College of Dentistry.

Purpose. The purpose of this study was to compare the eQA program of performing laboratory quality assurance with the former paper-based format.

Material and methods. Fourth-year predoctoral dental students (n=334) who experienced both the paper-based and the electronic version of the quality assurance program were surveyed about their experiences. Additionally, data extracted from the eQA program were analyzed to identify areas of weakness in the curriculum.

Results. The study findings revealed that 73.8% of the students preferred the eQA program to the paper-based version. The average number of treatments that did not pass quality assurance standards was 119.5 per month. This indicated a 6.34% laboratory failure rate. Further analysis of these data revealed that 62.1% of the errors were related to fixed prosthodontic treatment, 27.9% to partial removable dental prostheses, and 10% to complete removable dental prostheses in the first 18 months of program implementation.

Conclusions. The eQA program was favored by dental students who have experienced both electronic and paper-based versions of the system. Error type analysis can yield the ability to create customized faculty standardization sessions and refine the didactic and clinical teaching of the predoctoral students. This program was also able to link patient care activity with the student's laboratory activities, thus addressing the latest requirements of the CODA regarding the competence of graduates in evaluating laboratory work related to their patient care. (J Prosthet Dent 2015;■:■-■)

Until 2010, the New York University College of Dentistry (NYUCD) laboratory quality assurance (QA) program was based on a paper form that listed possible errors, oversights, or deficiencies related to patient treatments submitted to external laboratories for prosthodontic procedures. Calibrated prosthodontic QA faculty reviewed the submissions and assessed their

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Clinical Implications

The electronic quality assurance program may provide valuable teaching opportunities in a format that appeals to the current generation of learners in an efficient and precise manner. Additionally, because of the strict control of laboratory quality, the program improves the quality of prosthodontic care for the patients.

adequacy and completeness before they were sent to the laboratory. If a submission lacked any item, was deemed insufficient, or had execution errors, the issue was identified, marked on the paper form, and a handwritten “corrective action” was recommended by the QA faculty to the student ([Supplemental Fig. 1](#)). The disadvantage of this method was that the supervising faculty was often not included in this chain of communication from the QA faculty to the student. Further, even though errors could be identified as those of execution (indicating inadequate or poor quality work) or omission (indicating a simple oversight that is correctable by additional material or information submission), the department had no way of tracking error types, recording error frequency, or identifying deficient students other than by manual tabulation. This paper-based approach to reviewing laboratory submissions was performed to enhance student education and to ensure a high standard of patient care. However, the method was considered less than ideal. The electronic quality assurance (eQA) program at NYUCD aimed to improve students’ understanding of laboratory procedures, track error types and frequency, and provide areas of deficiency for faculty calibration. The data gathered from the eQA program were analyzed to provide specific areas of weakness in the patient’s clinical care and provided important information to enhance the curriculum. Additionally, the program tracks deficient faculty and provided targeted faculty standardization modules specifically addressing areas of weakness in different groups of faculty. The program also addresses the Commission of Dental Accreditation (CODA) standard regarding students’ ability to understand and assess laboratory procedures. This was done in 2 ways: the formative report identified total laboratory “errors” by student providers; and the summative report identified and ensured student competency and lack of errors in patient treatments.

Background

Before 1990, the predoctoral curriculum at most dental schools in the United States required that the dental student complete almost all phases of laboratory procedures related to the fabrication of a prosthesis,

including investing, casting, processing, and ceramic application, among others.^{4,5} In 1975, Harrison and Stephens⁶ found that although 67% of dental schools required that students perform the majority of laboratory procedures for their patients, the school favored delegation of this work to dental technicians in order to allow the student to accomplish more clinical treatments. In a commentary in 1981, MacEntee⁷ urged educators to consider reducing the burden of the laboratory work required by students due to time constraints in the crowded prosthodontics curriculum. This was especially poignant in light of the finding that only 5% of private practice prosthodontists devoted time to the performance of laboratory procedures. When compared with the 1975 findings,⁶ a 1984 study by Comer et al⁸ reported that the percentage had dropped to only 55% of schools requiring students to do most laboratory procedures related to patient prosthodontic care.

In 1984, Aquilino and Taylor⁹ and Taylor et al¹⁰⁻¹² surveyed prosthodontic department chairs and dental laboratory technicians and found a great discrepancy between what is taught in dental school and what is done by practitioners shortly after graduation. The implication was that the level of rigor relative to the performance of laboratory procedures in dental school was not applicable to the private practice setting and that the majority of laboratory procedures were delegated to the laboratory technician once clinicians had left school. In 1995, Leary et al¹³ described a curriculum where fourth-year dental students no longer performed a majority of the laboratory work but instead delegated the work to laboratory technicians. In essence, the students directed rather than performed the requisite laboratory work.

A turning point in dental education relative to the performance of laboratory work by dental students came in 1995, when the Institute of Medicine was charged with assessing the content of the typical dental school curriculum. The goal of this assessment was to improve the curriculum via recommendations by an objective and independent source. The Institute of Medicine found curriculum overcrowding to be the major obstacle in dental education. Their recommendation for addressing this issue was to modernize courses and to eliminate redundant content. Additionally, they recommended decreasing the amount of time spent on “low priority labwork.”¹⁴⁻¹⁶

In 1996, Nimmo and Knight⁴ described the shift in dental education to a competency-based curriculum with an emphasis on assessment of the dental laboratory procedures, rather than on the rigorous performance of the procedures themselves.¹⁵ According to the American Dental Education Association, a competency is defined as “a complex behavior or ability essential for the general dentist to begin independent, unsupervised dental practice.”¹⁷ The competency encompasses the ability to

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