Dental Students' Knowledge, Attitude, and Confidence toward Evidence-based Dentistry: A 5-year Retrospective Study

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Abstract

Aim: The purpose was to assess dental students' knowledge, attitude, and confidence toward evidence-based dentistry in five graduating Doctor of Dental Surgery (DDS) classes.

Materials and methods: All dental students (class of 2019, 2020, 2021, 2022, and 2023) enrolled in the D3 research design course were required to take a pre-Knowledge, Attitude, and Confidence in Evidence-based Dentistry (KACE) survey. On completion of the 11-week course, a post-KACE survey was distributed to compare the differences in the three domains of evidence-based dentistry (EBD). For the knowledge domain, the responses from the 10 questions were converted to either correct (1) or wrong (0) so that the compiled scores could range from 0 to 10. The attitudes and confidence domains used a five-point Likert scale. The compiled attitude score was a sum of the responses from 10 questions yielding a range from 10 to 50. For confidence, the compiled score ranged from 6 to 30.

Results: The mean knowledge scores of all classes together before and after training were 2.7 and 4.4, respectively. Overall, there was a statistically significant difference between pre- and post-knowledge indicating an improvement in knowledge associated with the training ($p < 0.001$). The mean attitudes of all classes together before and after the training were 35.3 and 37.2, respectively. Overall, there was a statistically significant improvement in attitude ($p < 0.001$). The values of mean confidence of all classes together before and after the training were 15.3 and 19.5, respectively. Overall, there was a statistically significant improvement in confidence ($p < 0.001$).

Conclusions: A dental curriculum emphasizing Evidence-based practice (EBD) resulted in increased knowledge acquisition, improved attitude, and confidence toward EBD of dental students.

Clinical significance: Educational initiatives emphasizing evidence-based dentistry increase students' knowledge acquisition, improved attitude, and confidence toward EBD that may also translate to active implementation of EBD in their future practices.

Keywords: Coronavirus disease-2019 pandemic, Curriculum, Dental students, Evidence-based dentistry.

The Journal of Contemporary Dental Practice (2022): 10.5005/jp-journals-10024-3418

Introduction

Evidence-based practice allows the practitioner to carefully integrate clinically relevant scientific evidence and relate it to the patient's oral needs.[1] Despite the fact that a high percentage of dentists are aware of EBD and are willing to implement EBD into their daily practices. Recent systematic reviews revealed that only a few dentists seemed to really understand EBD principles, methods, and practices.[2,3] Furthermore, more years of expertise and practice correlated with lower levels of knowledge and nonadherence to standards of care,[4] indicating that still many dentists tend to mainly rely on what they have learned during their training or personal experience.[5] Recognizing the gap in applying EBD in patient care,[6] there has been a significant trend in dental education to increase students' exposure to the concepts and practices of EBD along with enhancing students' ability to think critically to form their own opinions of the current dental literature. Creating a comprehensive EBD curriculum and culture at the Loma Linda University School of Dentistry (LLUSD) required collection of data of students' knowledge, attitude, and confidence toward EBD and how selected courses affected different EBD components.

At the LLUSD, students are taught to use an evidence-based approach to patient care throughout the 4-year curriculum. Special emphasis on EBD is given during the 11-week research design and applied statistics course taught during the summer quarter in the D3 year. Students are exposed to the basic concepts and principles of conducting and evaluating research in dental and biomedical sciences and further develop required skillsets to recognize clinical problems, search and review the literature, interpret results, and draw appropriate conclusions based on the best evidence. The course is designed to enhance critical thinking skills and lay the foundation for the dental professionals' commitment to life-long learning in addition to meeting Commission on Dental Accreditation standards.[7]

Several instruments have been used to assess acquisition of EBP skills. However, many were targeted toward medicine, which did not allow for proper interpretation of results within the

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dental environment setting. The KACE survey was developed as an assessment that uses 35 questions to assess four dimensions of EBD: (1) knowledge of EBD concepts, (2) attitudes toward EBD, (3) methods used in accessing information, and (4) confidence in critically appraising scientific evidence.[4] Throughout the survey, discrimination between different training and experience, responsiveness to education, internal consistency. and test–retest reliability were maintained. The validity of the KACE survey as an assessment instrument was considered vital in detecting possible trends in the application of EBD in the curriculum at the LLUSD.

Although confounding variables are undesirable in research, the start of quarantine due to the coronavirus disease-2019 (COVID-19) pandemic in late March 2020 forced the change of curriculum for all educational institutions. The LLUSD curated a schedule for online classes and implemented mandatory attendance. However, with the inability to require students to turn on cameras, their actual attendance and attention were out of the faculty's control. The research design and statistics classes were given to the Dental third year (D3) students (DDS'22) in 2020, with a change in delivery from in-person to synchronous online format. Considering some unforeseen changes, the purpose of the study was to evaluate dental students' knowledge, attitude, and confidence toward evidence-based dentistry over 5 years. By using the validated KACE survey, we aimed to assess if there was improvement after completing a research and statistics class in the third year of dental school and if there was a trend over five different DDS classes (DDS class of 2019 through 2023). We hypothesized first that there would be no difference in knowledge, attitude, and confidence among the different classes. Second, there would be no difference in pre- and post-test scores in the three domains. Third, there would be no change in attitude and confidence within the graduating classes.

MATERIALS AND METHODS

An Institutional Review Board (IRB) application was filed to confirm exempt status for this study (IRB #5210428). All dental students (class of 2019, 2020, 2021, 2022, and 2023) enrolled in the D3 research design course were required to take a pre-KACE survey as an assignment of the class that was distributed via online Qualtrics software (Qualtrics, Provo, Utah, USA) on the first day of class. On completion of the 11-week course, a post-KACE survey was distributed via the same online Qualtrics platform to compare the differences in the three domains of EBD. The DDS class of 2019 (DDS'19) took the research design class in 2017 when they were D3 students, while the DDS'23 took the class in 2021. Thus, all data were retrospective in nature when the study was initiated. The research design course was

delivered as an in-person class except for the DDS'22 that received all classes via synchronous Zoom platform due to the COVID-19 pandemic. Data sheets downloaded from Qualtrics were double-checked and only students that completed both pre- and post-surveys were included in the analysis. For the knowledge domain, the responses from the 10 questions were converted to either correct (1) or wrong (0) so that the compiled scores could range from 0 to 10. Blank responses were scored as incorrect and assigned a weight of zero. The attitudes and confidence domains used a five-point Likert scale. For attitudes, the scale range for each item was 1 = Strongly disagree to 5 = Strongly agree. The compiled attitude score was a sum of the responses from 10 questions yielding a range from 10 to 50. For six questions on confidence, the scale range for each item was 1 = Not at All Confident to 5 = Very confident so that the compiled score ranged from 6 to 30. One-Way Analysis of Variance test (ANOVA) was used to evaluate knowledge, attitude, and confidence among the five different DDS classes, and a paired t-test was used to evaluate the change within each group in the three domains. Descriptive statistics were calculated by graduating classes. P-values < 0.05 were considered statistically significant. All data were analyzed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS

Each class comprised 100 students and out of 500 dental students 478 completed both pre- and post-KACE surveys over 5 years. The response rates for each class were as follows: DDS'19: 96%, DDS'20: 100%, DDS'21: 94%, DDS'22: 95%, and DDS'23:93%. The comparison of dental students' knowledge, attitude, and confidence by graduating class at pre- and post-training is summarized in Table 1.

Knowledge

The mean knowledge scores of all classes together before and after training were 2.7 and 4.4, respectively. Overall, there was a statistically significant difference between pre- and post-knowledge indicating an improvement of knowledge associated with the training ($p < 0.001$). There was a statistically significant difference among the five classes before and after the training ($p < 0.001$). For each class, there was a statistically significant improvement in knowledge scores at post-training ($p < 0.001$). The knowledge score at post-test by type of questions and by graduating class is summarized in Table 2.

Despite the training, all classes demonstrated weaknesses in analyzing study results [Question 6 (Q6)] and determining the proper study design (Q8).

Table 1: Comparison of dental students by graduating class on the KACE components pre- and post-training

	Pre-knowledge (mean ± SD)	Post-knowledge (mean ± SD)	Pre-attitude (mean ± SD)	Post-attitude (mean ± SD)	Pre-confidence (mean ± SD)	Post-confidence (mean ± SD)
DDS'19 (N = 96)	2.7 ± 1.5[a]	3.6 ± 1.7[b]	34.8 ± 4.3[a]	36.4 ± 6.5[b]	14.8 ± 5.1[a]	18.4 ± 3.7[b]
DDS'20 (N = 100)	3.4 ± 1.6[a]	4.0 ± 2.1[b]	35.0 ± 4.2[a]	36.1 ± 6.7[a]	15.7 ± 4.4[a]	19.3 ± 4.5[b]
DDS'21 (N = 94)	2.3 ± 1.8[a]	4.9 ± 1.5[b]	35.3 ± 4.7[a]	37.7 ± 6.2[b]	15.1 ± 4.6[a]	20.0 ± 4.3[b]
DDS'22* (N = 95)	2.5 ± 1.4[a]	5.1 ± 1.5[b]	35.6 ± 5.5[a]	38.4 ± 5.2[b]	15.2 ± 5.0[a]	19.7 ± 4.3[b]
DDS'23 (N = 93)	2.7 ± 1.4[a]	4.4 ± 1.4[b]	35.9 ± 4.8[a]	37.3 ± 7.8[a]	15.8 ± 4.8[a]	19.8 ± 4.2[b]
Total (N = 478)	2.7 ± 1.4[a]	4.4 ± 1.5[b]	35.3 ± 4.8[a]	37.2 ± 6.6[b]	15.3 ± 4.8[a]	19.5 ± 4.2[b]
p-value**	<0.001	<0.001	0.499	0.092	0.565	0.072

*COVID-19 synchronous online class. **ANOVA testing comparing the difference among the five graduating classes within the same column. Same lowercase letters within the same row indicate no significant difference between pre- and post-training based on paired t-test ($p > 0.05$)

Table 2: Knowledge score at post-test by type of questions and by graduating class

Type of question	Compiled score of correct responses at post-test				
	DDS'19	DDS'20	DDS'21	DDS'22*	DDS'23
Q1. Level of Evidence	3.2	2.9	4.6	6.0	3.8
Q2. Level of Evidence	2.0	2.7	4.3	4.5	3.7
Q3. Literature Search Strategy	5.5	6.2	6.3	5.7	6.2
Q4. Analyzing Study Results	4.2	4.0	4.4	4.7	4.1
Q5. Identifying PICO Questions	4.6	5.8	6.9	6.1	6.0
Q6. Analyzing Study Results	3.1	0.0	2.7	3.0	3.6
Q7. Identifying Research Study Design	6.4	6.0	5.5	7.2	5.1
Q8. Study Design	0.8	3.0	3.9	3.4	2.4
Q9. Sensitivity and Specificity	3.8	6.4	7.2	6.6	6.0
Q10. Prevalence and Incidence	2.4	3.2	3.3	3.7	3.0
Knowledge average	3.6	4.0	4.9	5.1	4.4

*COVID-19 synchronous online class

Attitude

The values of mean attitude of all classes together before and after the training were 35.3 and 37.2, respectively (Table 1). Overall, there was a statistically significant improvement in attitude ($p < 0.001$). When assessing attitude improvement by graduating class, DDS' 19, DDS' 21, and DDS' 22 showed statistically significant improvement ($p = 0.045$, $p = 0.003$, $p < 0.001$) while DDS'20 and DDS'23 showed no statistically significant difference ($p = 0.168$ and $p = 0.142$).

Confidence

The values of mean confidence of all classes together before and after the training were 15.3 and 19.5, respectively (Table 1). Overall, there was a statistically significant improvement in confidence ($p < 0.001$). When assessing confidence improvement by graduating class, all classes showed statistically significant improvement ($p < 0.001$, in all instances).

Overall, a dental curriculum emphasizing EBD resulted in increased knowledge acquisition, improved attitude, and confidence toward EBD of dental students.

DISCUSSION

One of the vital goals in dental education is to make students competent in critical thinking and develop their opinion of the current dental literature.[8] Hence, a number of dental schools in the United States have implemented strategies to embed evidence-based dentistry content throughout the 4-year curriculum. At the LLUSD, the importance of fostering an EBD culture started with an intensive 2-day evidence-based dentistry faculty workshop in June 2012. Instructors from the American Dental Association (ADA) Center for EBD were invited to the school to cover the primary

aspects of evidence-based dental practice, including implementing best evidence in clinical practice and teaching; asking precise, structured clinical questions; finding the best evidence via laptop computer; rapid critical reading and appraisal; using evidence-based clinical guidelines and recommendations and systematic reviews; understanding clinical trial design for therapy, diagnosis, and qualitative assessment; and using odds ratios, risk reduction, relative risk, and numbers needed to treat to implement EBD in practice and teaching. The workshop not only aimed to increase faculty's EBD knowledge but was also intended to positively influence the attitude and confidence toward practicing EBD in teaching in the clinic and classroom. Upon completion of the workshop that was available to all faculty, some faculty were further selected to spearhead a newly established EBD taskforce to develop strategies to implement EBD in the entire curriculum, design an EBD curriculum map, and develop competencies and assessments.

The results of this study reflect the implementation of strategies that have been put forth by the taskforce in creating substantial data on changes in knowledge, attitude, and confidence toward EBD of dental students at LLUSD. Based on the results, we rejected the first null hypothesis that there would be no difference in knowledge at pre- and post-training among the five classes. There was a difference in knowledge score with DDS'20 having the highest score before the research design and statistics classes and the DDS'22 showing the highest score on completion of both classes. However, it is important to note that all graduating classes showed improved knowledge after taking the classes. This is in accordance with other studies where participants demonstrated an increase in knowledge after an EBD training course as measured by the KACE survey instrument.[4,9,10] We accepted our second hypothesis that there would be no difference in attitude and confidence among the graduating classes. The overall mean attitude scores of 35 prior to the training were higher than reported means of 23.6 and 26.6 of students from other dental schools.[4,10] This may indicate that the EBD culture fostered at the LLUSD had already impacted the students' attitude in a positive way. It is noteworthy that a positive perspective can impact behavior, as one is likely to achieve better in an area that provides enjoyment and views as useful.[11] This concept is also supported by studies in other disciplines demonstrating that an attitude index may be used as a positive predictor for better behavior.[12] Developing positive attitudes toward EBD are vital learning outcomes since they may influence the graduates' implementation of EBD in their future dental practices. The overall mean confidence score of 15.3 was comparable to the mean confidence of another study.[4] It was also in accordance with a multi-institutional, cross-sectional study that reported low levels of confidence in dental students' critical appraisal skills.[6] We rejected our third hypothesis that there would be no change in attitude and confidence within the graduating classes. For all graduating classes the attitude and confidence increased, except for DDS' 20 and DDS' 23 that did not demonstrate a change in attitude.

To the best of the authors' knowledge, this is the first study that evaluated the trend of dental students' knowledge, attitude, and confidence toward EBD over a 5-year period. Another strength of the study was the opportunity to assess the impact of a change in content delivery method from in-person to synchronous online lectures during the not anticipated COVID-19 period for one specific graduating class—DDS'22. There were no differences for the DDS'22 for attitude and confidence but the knowledge score

post-training was the highest among the five classes. This may support the positive outcome of online learning reported by other studies in the mastery of core knowledge in dental education.[13–15] Most importantly, the study results identified areas to improve in delivering EBD content so that students can improve in knowledge acquisition and further enhance confidence toward EBD. Proper emphasis on EBD in education is crucial as it was shown that dental school EBD training was associated with the use of peer-reviewed journals in future clinical practice that was consistent between dental specialists and non-specialists.[16] Limitations of this study include the following. First, the inability of following up and assessing the change of the different EBD domains of a cohort class over time from freshmen to the senior year. Second, the study did not relate knowledge, attitude, and confidence level to the actual implementation in patient care on the clinic. Future studies are warranted to address the limitations and further the understanding about the effects of EBD training in dental education and its impact in the integration of EBD in dental practices.

CONCLUSION

A comprehensive EBD curriculum in dental education is vital to increase students' exposure to the concepts and practices of EBD along with enhancing students' ability to think critically and become life-long learners. Within the limitations of the study, we conclude that a dental curriculum emphasizing EBD resulted in increased knowledge acquisition, improved attitude, and confidence toward EBD of dental students.

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