



Is Soap Carving in Dental Anatomy Predictive for Clinical Dental Students' Performance in Operative Dentistry?

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Abstract

Objectives: Manual skills form only a part of the capabilities required for a future dentist. Nevertheless, they are very important components that should be tested. The aim of this study is to investigate if a correlation exists between dental students' grades in the preclinical courses and their clinical performance.

Methods: Preclinical/clinical grades were collected for first, fourth, and fifth year students who graduated from the Faculty of Dentistry at the University of Jordan, Amman, Kingdom of Hashemite Jordan, in 2014, and 2015. Two courses (Dental Anatomy and Conservative Dentistry) were selected. Correlations comparing the practical grades of Dental Anatomy course for first year students, and the practical grades of Conservative Dentistry course for the same students in fourth and fifth years.

Results: Statistically significant positive correlation was found between the soap carving grades of first-year dental students and their practical grades in Operative Dentistry course during fourth and fifth years. Also, statistically significant moderate to strong positive correlation was found between the grades of fourth-year practical Operative Dentistry and the grades of fifth-year practical Operative Dentistry.

Conclusion: The clinical performance of dental students in their practical courses in fourth and fifth years can be predicted from their soap carving grades at their first year in Dental School.

Keywords: Carving; Dexterity; Practical; Motor; Preclinical

Introduction

Dentistry is a multitasked profession which mandates knowledge in medicine and science, competence in art and dexterity skills, personal qualities and social intelligence. Intellectual abilities and cognitive components are fundamental elements for a successful dentist, but should not be the tool for prediction of academic performance and professional success [1]. In Dentistry, the acquisition of psychomotor skills is an essential pre-requisite for a successful professional [2,3]. Although those manual skills form only a part of the capabilities required for a future dentist, they are very important components that should be tested [4].

Traditionally, dental school admissions decisions are based upon an evaluation of a student's high school cumulative grade point average (GPA) and dental admission test (DAT) scores [5,6]. Admission decision is based on knowledge of math, science, and language, with no test on aptitude or manual skills is done for such applicants [6]. Pre-dental school cumulative GPAs and DAT scores have consistently shown insignificant or negative correlation with students' preclinical performance during preclinical courses [7-10]. However, research demonstrated that the relationship between GPA and academic performance has been found to be stronger in the earlier years of the educational program [11]. Moreover, GPA does not predict how well the students will perform during their dental education program [3,12]. While admission to dental schools requires a very high academic achievement in high school, there are number of dental students that have difficulty completing the curriculum successfully even before reaching the clinical years [13-15]. Mostly attributed to their dexterity aptitude and the inability to meet the minimum clinical requirements [16]. Dental school admissions' criteria based on assessing academic success are largely successful in determining the best candidates for the didactic abilities and intellectual potentials through the dental education program [17-20]. On the other hand, those criteria neglect other domains such as the variability of aptitude and manual competency among students [21]. They do not evaluate the potential of an applicant to succeed clinically [1]. Hence, admission procedures should include assessment of both

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cognitive and non-cognitive characteristics of dental school applicants [12]. The need to incorporate more than just cognitive factors has led to a growing interest in exploring possible supplemental predictors of academic performance, particularly those outside the cognitive domain [22]. It is thought that predictive admission procedures can reduce dropout rates, improve average academic performance, and selectively exclude applicants who are unlikely to be successful as practitioners [23]. In spite of the various publications that stated that manual dexterity has predictive value as a screening instrument for selecting dental school students [6,23-25]. It is debatable whether manual skills and dental aptitude are valid parameters for selecting dental students or predictive measures linked to professional success [26].

The aim of this study was to determine if a correlation exists between students' practical grades in Dental Anatomy for first year and their practical grades during their clinical course in Operative Dentistry for fourth and fifth years. Moreover, the current study aimed to investigate if soap carving for first year dental students can predict the practical performance of these dental students in their clinical courses for fourth and fifth years.

Null hypothesis

There is no correlation between first year dental students' soap carving grades and their clinical grades in Operative Dentistry course for fourth and fifth years.

Methods and Materials

According to the ethics policy of the University of Jordan, ethics approval form to collect the needed data was signed and approved from the School of Dentistry and the Academic Research Committee of the University of Jordan. Available practical preclinical/clinical grades were collected for students who graduated from the School of Dentistry, University of Jordan, in 2014 and 2015. Soap carving grades for first year dental students were collected from Dental Anatomy course. Clinical grades for the same students in fourth and fifth years were collected from their Operative Dentistry courses. The sample size is of 160 students, 37 males (23%) and 123 females (77%).

Statistical analysis

Statistical analysis was performed using SPSS for Windows release 16.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were generated. The grades in the three groups were standardized using the z-score formula ($z\text{-value} = (\text{original score} - \text{group mean}) / \text{group SD}$) to account for variation in the mean and the standard deviation between the groups prior to conducting correlation and regression analyses. Pearson's rho test was used to examine differences between groups. Linear regression analyses were conducted to derive grade prediction formulas for the fourth and fifth year groups. To label the strength of the association, for absolute values of rho, 0-0.19 was regarded as very weak, 0.2-0.39 as weak, 0.40-0.59 as moderate, 0.6-0.79 as strong and 0.8-1 as very strong correlation. Results were considered significant if P-values were less than 0.05.

Results

Statistically significant positive correlation (Pearson's correlation coefficient: 0.281, $p = .0001$) was found between the soap carving grades of first-year dental students and their grades in fourth-year practical Operative Dentistry. In addition, statistically significant positive correlation (Pearson's correlation coefficient: 0.276, $p = .0001$) was found between the soap carving grades of first-year dental

students and their grades in fifth-year practical Operative Dentistry. Also, statistically significant moderate to strong positive correlation (Pearson's correlation coefficient: 0.596, $p = .0001$) was found between the grades of fourth-year practical Operative Dentistry and the grades of fifth-year practical Operative Dentistry. A linear regression established that the grade of soap carving at the first year could statistically significantly predict the grade of practical Operative Dentistry at the fourth year, $F(1, 98) = 13.53$, $p = .0001$ and the grade of soap carving accounted for 7.3% of the explained variability in the grade of fourth-year practical Operative Dentistry. The regression equation was:

Predicted grade of fourth-year practical Operative Dentistry = $42.08 + 0.281x$ (the grade of first-year soap carving).

In addition, a linear regression established that the grade of first-year soap carving could statistically significantly predict the grade of fifth-year practical Operative Dentistry, $F(1, 98) = 13.04$, $p = .0001$ and the grade of soap carving explained 7.0% of the variability in the grade of fifth-year practical Operative Dentistry. The regression equation was:

Predicted grade of the fifth-year practical Operative Dentistry = $42.35 + 0.276x$ (the grade of first-year soap carving).

Also, a linear regression established that the grade of fourth-year practical Operative Dentistry could statistically significantly predict the grade of fifth-year practical Operative Dentistry, $F(1, 98) = 87.16$, $p = .0001$ and the grade of fourth-year practical Operative Dentistry explained 35.1% of variation in the grade of fifth-year practical Operative Dentistry. The regression equation was:

Predicted grade of fifth-year practical Operative Dentistry = $23.61 + 0.596x$ (the grade of fourth-year practical Operative Dentistry).

Discussion

The aim of the present study was to investigate whether there is a correlation between the practical grades of first-year dental students' Dental Anatomy course and their practical performance during their clinical course in Operative Dentistry in fourth and fifth years. The results of our study showed that dental students' soap carving grades correlated positively (weak correlations) with their clinical grades in Operative Dentistry. Moreover, practical grades of fourth year students in Operative Dentistry correlated (moderate to strong correlations) positively with their practical grades in fifth year for the same course. Students in the Dental School at University of Jordan are required to carve teeth on soap blocks as part of their Dental Anatomy course curriculum during first year. They are then introduced to several preclinical practical courses in their third year, where they perform several different operative procedures on typodont-mounted manikins. In their fourth and fifth years they perform these operative procedures on patients in their clinical Operative Dentistry course. However, each year the number of applicants for dental schools in Jordan exceeds the number of places available. Therefore, decision algorithms based on the predicted chance of success at dental school are necessary and important, for both students and dental schools [23]. Methods for assessment of psychomotor skills, such as perceptual motor ability, chalk carving, paper and pencil, waxing tests, or O'Conner tweezers and embedded figures tests have been used to correlate manual dexterity with success in dental schools [26-29]. Controversial results, questionable validity, cost, time, and difficulty of administration led to regression of such tests [21].

However, several studies stated positive correlations between those various testing methods and dental school performance in preclinical technique courses [6]. To develop the qualification processes, it is imperative that dental schools are able to predict both the prospective academic performance and the clinical competencies of their students [16].

In our current study the students' grades of soap carving which is performed during first-year could significantly predict their practical grades in Operative Dentistry course in fourth and fifth year. However, the correlation is weak between first year and fourth and fifth years. On the other hand, it is moderate to strong between fourth and fifth years. The data obtained in the present study confirm Giuliani et al. conclusion; basic manual dexterity is not essential in the selection of dental students, because these skills can be improved through incremental learning and extra practice [26]. The prediction of first year soap carving grades did not account for more than 7% of the variance of the clinical performance in fourth and fifth years. These results are in agreement with other studies that stated that manual dexterity tests and chalk carving explain 5-7% of variance [30]. Moreover, the grade of fourth-year practical Operative Dentistry explained 35.1% of variation in the grade of fifth-year practical Operative Dentistry. Again these results confirm that manual dexterity plays a role and is trainable in the course of dental education, which is in agreement with Lundergan and Lyon study [31]. The latter study suggested that the complex nature of modern dental practice requires a broad range of skills that digital dexterity contributes only a small increment [31]. The weak correlation in our study indicates that achievement of students in practical dental courses could be partly influenced by their grades in theoretical courses and that their achievement in clinical courses could be partly predicted by their grades in preclinical practical courses. However, other confounding factors such as genuine artistic skills of students, factors related to supervisors of clinical sessions, patients' factors, and degree of student to cope with stress of practical or clinical sessions are additional factors that should be considered. Furthermore, the results of this study did not show significant sex differences in the relationship between the academic grades and practical performances. The results of the present study rejected the null hypothesis; were there is significant positive correlation between first year dental students' soap carving grades and their clinical grades in Operative Dentistry course for fourth and fifth years.

Conclusion

The present study demonstrated significant but weak positive correlation between first year dental students' soap carving grades and their clinical grades in Operative Dentistry course for fourth and fifth years. These results suggest that fine manual skills are teachable and can be acquired. On the other hand, admission procedures for dental schools could include theoretical and practical components to evaluate the manual aptitude for the applicants. Moreover, other confounding factors related to the student, patient, and instructor have to be considered when studying correlations between students' preclinical and clinical grades, as those variables may help in explaining the variance of the students' practical grades.

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