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Is There a Correlation Between Students' Performance in Dental Anatomy and Performance in Operative Dentistry?

¿Existe una Correlación entre el Rendimiento de los Estudiante de Anatomía Dental y el Rendimiento en Odontología Operativa?

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SUMMARY: 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. 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, Jordan, in 2016, and 2017. Two courses (Dental Anatomy and Operative Dentistry) were selected. Corre-lations comparing the practical grades of Dental Anatomy course for first year students, and the practical grades of Operative Dentistry course for the same students in fourth and fifth years. 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 strong positive correlation was found between the grades of fourth-year practical Operative Dentistry and the grades of fifth-year practical Operative Dentistry. 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.

KEY WORDS: Operative Dentistry; Soap carving; Dental Anatomy; Manual skills; Practical.

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 (Sullivan *et al*., 2014). In Dentistry, the acquisition of psychomotor skills is an essential pre-requisite for a successful professional (Tedesco, 1995; Afify *et al*., 2013). 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 (Luck *et al*., 2000).

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 (Suddick *et al*., 1983; Boyle & Santelli, 1986; Kao *et al*., 1990). Mostly attributed to their dexterity aptitude and the inability to meet the minimum clinical requirements (Gansky *et al*., 2004).

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 (Downey *et al*., 2002; Bauchmoyer *et al*., 2004; Ward *et al*., 2010; Austin, 2011). On the other hand, those criteria neglect other domains such as the variability of aptitude and manual competency among students (Urbankova *et al*., 2013). The need to incor-porate 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 (Schmitt *et al*., 2009).

It is thought that predictive admission procedures can reduce dropout rates, improve average academic performance, and selectively ex-clude applicants who are unlikely to

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be successful as practitioners (Beier *et al*., 2010). In spite of the various publications that stated that manual dexterity has predictive value as a screening instrument for selecting dental school students (Spratley, 1992; Oudshoorn, 2003; Beier *et al*.), it is debatable whether manual skills and dental aptitude are valid parameters for selecting dental students or predictive measures linked to professional success (Giuliani *et al*., 2007).

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.

MATERIAL AND METHOD

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 2016 and 2017. 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.

Students who failed to graduate with their colleagues at the same year or who failed to pass neither the Dental Anatomy course nor the Operative Dentistry course were excluded from the study. The sample size is of 188 students, 49 males (26 %) and 139 females (74 %).

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-value = (original score – group mean) / 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: 0.312, 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: 0.305, 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 strong positive correlation (Pearson's correlation coefficient: 0.634, p = .0001) was found between the grades of fourth-year practical Operative Dentistry and the grades of fifth-year practical Operative Dentistry as shown in (Table I).

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) = 14.61, p = .0001 and the grade of soap carving accounted for 9.7 % 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 = 40.52 + 0.312 x (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) = 13.98, p = .0001 and the grade of soap carving explained 9.3 % 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 = 40.86 + 0.305 x (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) = 89.39, p = .0001

Table I. Pearson's correlation coefficient values between carving performance and practical operative dentistry performance.

	Carving grades/first year	Practical operative grades/ fourth year	Practical operative grades/ fifth year
Carving grades first year	1		
Practical operative grades fourth year	.312*	1	
Practical operative grades fifth year	.305*	.634*	1

*Correlation is statistically significant at the .001 level (2-tailed)

and the grade of fourth-year practical Operative Dentistry explained 40.2 % of variation in the grade of fifth-year practical Operative Dentistry. The regression equation was:

Predicted grade of fifth-year practical Operative Dentistry = 20.42 + 0.634 x (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 (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 (Beier *et al*.). 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 (Kirby, 1979; Suddick *et al*., 1982; Giuliani *et al*.; Kothe *et al*., 2014). Controversial results, questionable validity, cost, time, and difficulty of administration led to regression of such tests (Urbankova *et al*.). However, several studies stated positive correlations between those various testing methods and dental school performance in preclinical technique courses (Al-Johany *et al*., 2011). 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 (Gansky *et al*.).

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 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.

The prediction of first year soap carving grades did not account for more than 10 % 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 texts and chalk carving explain 5-7 % of variance (Smithers *et al*., 2004). Moreover, the grade of fourth-year practical Operative Dentistry explained about 40 % 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 & Lyon (2007). 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 Lundergan & Lyon.

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 signifi-cant 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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RESUMEN: Las habilidades manuales forman solo una parte de las capacidades requeridas para un futuro dentista. Sin embargo, son componentes muy importantes que deben ser probados. El objetivo de este estudio fue investigar si existe una correlación entre las calificaciones de los estudiantes de odontología en los cursos preclínicos y su desempeño clínico. Los grados preclínicos / clínicos se obtuvieron para los estudiantes de primero, cuarto y quinto año, graduados de la Facultad de Odontología, de la Universidad de Jordania, Amman, Jordania, en 2016 y 2017. Se seleccionaron dos cursos (Anatomía Dental y Odontología Operativa). Correlaciones que comparan los grados prácticos del curso de Anatomía Dental para estudiantes de primer año y las notas de calificación prácticas del curso de Odontología Operativa para los mismos estudiantes en cuarto y quinto año. Se encontró una correlación positiva estadísticamente significativa, entre las notas de tallado de jabón de los estudiantes de primer año de odontología y sus notas de calificación prácticas en el curso de Odontología Operativa durante el cuarto y quinto años. Además, se encontró una fuerte correlación positiva estadísticamente significativa entre las notas de calificación en Odontología Operativa práctica de cuarto año y los grados de Odontología Operativa práctica de quinto año. El rendimiento clínico de los estudiantes de odontología en sus cursos prácticos en cuarto y quinto año se puede predecir a partir de las calificaciones en tallado de jabón durante su primer año en la Escuela de Odontología.

PALABRAS CLAVE: Odontología operativa; Tallado de jabón; Anatomía dental; Habilidades manuales; Práctico.

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