Correlation Between the Two Manual and Cavity Preparation Skills

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Abstract

Background: Acquiring fine psychomotor skills is challenging for dental students.
Objectives: This study aimed to assess the correlation of cavity preparation skills with drawing skills and handwriting of dental students.
Methods: Ninety-two male and female dental students taking the preclinical course of restorative dentistry in Shahid Beheshti dental school participated in three tests of handwriting, drawing a smile and an amalgam class (CL) I cavity preparation and were scored using a specific scoring system. The correlation among the three skills was assessed using multivariate linear regression.
Results: Most dental students had cavity preparation, handwriting and drawing skills above the average. A significant correlation was found between drawing and tooth preparation skills (P < 0.05).
Conclusions: A statistically significant difference existed between drawing and cavity preparation skills in students; however, this correlation was not clinically considerable.

Keywords: Cavity Preparation, Dental Students, Drawing, Handwriting, Psychomotor Skills

1. Background

Many health care professions, particularly dentistry, require a high level of manual dexterity and psychomotor skills (1, 2). In dentistry, psychomotor skills are involved in many procedures that require eye-hand coordination and cognitive planning such as bending an orthodontic wire with a plier, carving a tooth out of wax, and cavity preparation (1).

Students taking the preclinical course of restorative dentistry are highly motivated and eager to learn dental operative skills, since it is an important step in reaching their professional goals (2). Recognizing students with poor psychomotor skills or below average learning rate at this stage or at the time of entrance exam can help to prevent their poor educational performance in the future, which can subsequently lead to their discouragement and futile efforts of instructors (3).

Therefore, many researchers suggest that manual dexterity and psychomotor skills tests should be added to the existing cognitive intellectual skills tests for dental candidates (1). Manual dexterity test as part of the entrance exam was first introduced in 1950 by chalk carving (1, 4) and it is still used with some modifications (1). Despite the positive results of some hand skills tests (5), others only recommend interviewing the candidates, because some stud-

ies did not find significant associations between these tests and the clinical performance of students (4, 6, 7). Different tests have been employed to assess manual dexterity such as wire bending (8), chalk carving (9), pencil and paper test (5), etc. However, no test has gained consensus as a standard criterion for the assessment of manual dexterity of dental students (10).

In Iran, dental students are accepted based on their grade point average (GPA), their score in the national entrance exam, and passing the national basic science exam; manual dexterity is not a requirement. On the other hand, based on previous studies, the motivations of most Iranian students for choosing dentistry as their future career are public service, high income and social position; manual dexterity and good hand skills are the least common motivations (11, 12). Therefore, the correlation between manual dexterity and dental practice skills needs to be evaluated in Iranian dental students.

2. Objectives

This study sought to assess the correlation of drawing skills and handwriting with cavity preparation skills in dental students taking the preclinical course of restorative dentistry.

3. Methods

This cross-sectional study was conducted on junior dental students who took the preclinical course of restorative dentistry in 2013 - 2014 after passing the basic science exam. The students learned how to hold a handpiece; also, amalgam and composite cavity preparation and restoration were taught to students and practiced by them on ivory plastic teeth and extracted natural teeth. Three months after the onset of the course, with no prior notice or instructions, the students were asked to take the following three tests:

3.1. Cavity Preparation Test

In an equipped dental laboratory, the students were requested to prepare an amalgam class (CL) I cavity on an ivory plastic mandibular right first molar tooth (#46) in a mandibular model (Nissin Typodont, Japan), using a new #330 carbide bur (Bur Carbide FG 330, SS White, United States) and high-speed handpiece within 10 minutes.

The assessment criteria used according to the American Board Certificate in Restorative Dentistry (5) are shown in Table 1 (1a). The students' performances were scored out of 10 by the restorative dentistry instructors.

3.2. Handwriting Test

In an equipped classroom, students were asked to write an answer (with their best handwriting) to the question why they chose dentistry as their future career on an A4 paper in four lines within five minutes using an HB2 pencil. The assessment criteria for the handwriting (5) are demonstrated in Table 1 (1b). The handwritings of students based on the set criteria were evaluated by experts in the University of Arts and were scored out of 10.

3.3. Drawing Test

In the same classroom, the students were requested to do their best in drawing a smile on an A4 paper as displayed on a monitor ahead of them within 30 minutes. The assessment criteria for the drawings (5) are shown in Table 1 (1c). The drawings of students based on the set criteria were evaluated by experts in the University of Arts and were scored out of 10.

In all three sections, expertise of students based on their obtained scores were categorized into five groups of poor (scores 0 to 1.9), below average (scores 2-3.5), average (scores 4 to 5.9), good (scores 6-7.9), and excellent (scores 8-10). The results of the study were evaluated using SPSS software version 18.0. Multiple linear regression was used to assess the correlation of cavity preparation skills with any of the handwriting or drawing skills, taking into account the confounding factor of gender (P < 0.05).

4. Results

The frequency distributions of the scores of all 92 students (56 females and 36 males) in the three skills are shown in Figures 1-3. The majority of students gained good and excellent scores in all three skills. Since no correlation existed between handwriting and drawing skills, each was entered into the linear regression model as an independent variable. The linear regression model showed a significant positive correlation between cavity preparation and drawing skills, taking into account the confounding effects of gender and handwriting skills (P = 0.049, beta = 0.32) (Table 2).
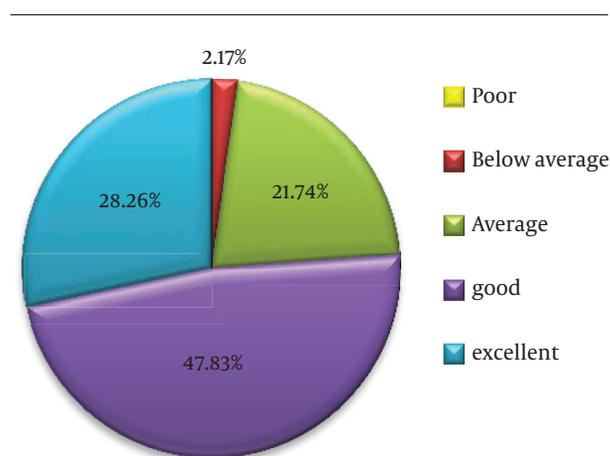

Figure 1. Frequency Distribution of Cavity Preparation Skills Categories
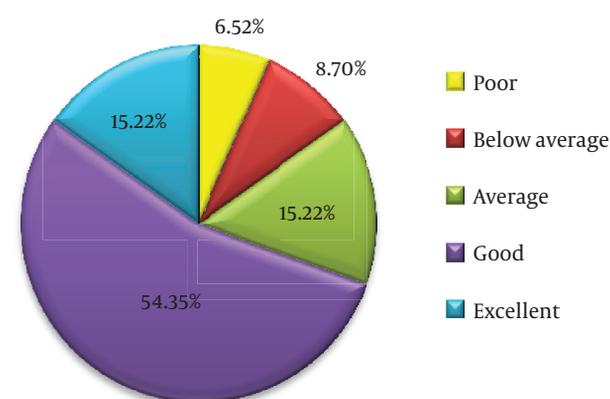

Figure 2. Frequency Distribution of Handwriting Skills Categories

In addition, students mentioned that they chose dentistry as their future career because of providing service to the community, its high income, and high social position.

Table 1. Assessment Criteria of the Three Tests of This Study

Test	Feature	Value, Points
1a. Cavity preparation test	Isthmus width: 1-1.5 mm	2
	Pulpal depth: 1.5-2 mm	2
	Buccal and Lingual walls convergence: parallel or lightly converged	1.5
	Mesial and distal walls divergence: lightly diverged	1
	Smoothness of walls, margins and line angles, regular, flat and round	2
	Marginal ridge thickness: 1.8-2 mm	1.5
1b. Handwriting test	Smoothness and continuity of the handwriting	2
	Continuity in the writing line without deviation	2
	Presenting the beauty aspects of Arabic writing	2
	Writing esthetics straight configuration on the same level of writing	2
	Size consistency and similarity between letters	2
1c. Drawing test	Clarity of borders with minor details	2
	Symmetry of drawing features	2
	Size of the student drawing comparing to the original picture	2
	Using the same pencil to differentiate saturation between the colors based on the saturation in the original picture	2
	Conversion of two dimensions rowing to three dimensions using shadow and other drawing skills	2

Table 2. Multiple Linear Regression Analysis Results[a,b]

Model	Standardized Coefficients	t	P Value
	Beta		
1 (Constant)		7.834	0.000
Painting skills	0.321	1.974	0.049
Writing skills	0.043	0.262	0.794
Gender	0.060	0.362	0.719

[a]Dependent variable: working skills.
[b]Independent variable: painting skills, writing skills, gender.

5. Discussion

University entrance exams are reliable predictors for the academic performance of junior (first year and second year) dental students (10). However, the entrance exams are not much useful for predicting the preclinical and clinical performances of students (10). Successful dental procedures in oral cavity require high levels of fine motor skills (13). Predicting the clinical performance of students is much more difficult than their academic performance and no standard test is available for this purpose (5, 14), because many uncontrollable variables such as stress, motivation, anxiety, interests and personality of students may affect the results (13, 15).

This study showed a significant association between drawing and cavity preparation skills; although, this correlation was not clinically considerable (P = 0.049, B = 0.32). Results of a study on French students revealed that although a significant correlation existed between dental hand skills and drawing and handwriting skills, evaluation of this correlation directly by the comparison of performance was found to be difficult, because there were many confounding factors that might have influenced the results (16).

It should be noted that the quality of the final work done by dentist depends on several factors namely education, experience and hand skills and focusing only on manual skills to predict the future performance of clinicians
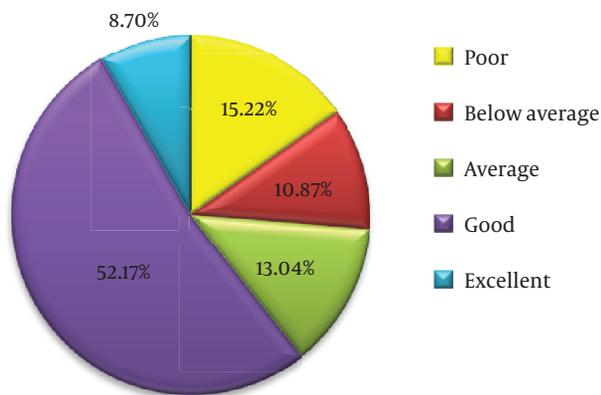
Figure 3. Frequency Distribution of Drawing Skills Categories

will result in failure (17). Repetition and practice can improve performance when it comes to motor skills (13, 18).

In a study by Al-Johary et al. in 2011, a strong correlation was observed between drawing skills and cavity preparation skills (5). However, it should be mentioned that their students were males only and were evaluated at one month after receiving cavity preparation instructions; whereas in our study, students were evaluated after three months of practicing and both male and female students were evaluated. However, it should also be taken into account that in Iran, drawing and handwriting skills are comprehensively taught to students in elementary school, middle school and high school and students can acquire expertise in this respect. Polyzois et al. in 2011 demonstrated that conventional preclinical instruction significantly improved manual skills of dental students and their baseline performances in the preclinical course and has a limited value for predicting their final performances (19).

On the other hand, it has been discussed that at baseline, most students have difficulties estimating the depth and distances affecting their manual skills and implementation of protocols in the preclinical instruction. These problems need to be recognized and eliminated (17).

Future studies with larger sample sizes and with inclusion of other manual skills are recommended to better elucidate possible correlations in this respect. Based on the results, the authors recommend a combination of academic and psychomotor assessments to qualify dental candidates (5, 15). The capabilities of students with some degrees of baseline skills will be well developed with education and practice. Assessment of psychomotor skills alone is not enough in dental admission test.

5.1. Conclusion

Within the limitations of this study, a statistically significant association was found between drawing skills and cavity preparation skills; although, this correlation was not clinically considerable.

Acknowledgments

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