



Radiographic Proximal Caries Detection and Multiple Intelligences

Emad A. Khan^{1*}

¹Oral Diagnostic Sciences, Faculty of Dentistry, King Abdulaziz University, P.O.Box 80209, Saudi Arabia.

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Introduction: The accuracy of radiographic caries detection is a multifactorial diagnostic task. One of the important factors are the Inter-observer variability. One of the suggested procedures to estimate the variations is the Multiple Intelligence (MI) theory of Howard Gardner.

Aim: The current research aims to study the relation among radiographic proximal caries detection accuracy and MI for dental undergraduate and new graduates (trainees)

Patients and Methods: Twenty dental students who have just terminated caries detection training and 19 interns were employed. The sample composed of seventeen men and twenty two women. Caries detection precision was estimated as the region under Receiver Operating Characteristic (ROC) curve (Az) scores, and MI scores were estimated by using a modified, bilingual MIS self-recorded questionnaire. MS Excel software was applied to calculate means, percentages and correlation.

Results: There was little and mild positive correlation among Az and Spatial/Visual (0.29) and Intrapersonal (0.31) domains of MI respectively. The current correlation was mild for students (0.38) and (0.40), and it was lowered for interns (0.28) and (0.26) respectively.

Conclusions: There is positive weak relationship between Az and the domains of Spatial/Visual and Intrapersonal of MI. This relationship might be diminished by education and training.

Keywords: Caries; radiographic; proximal; multiple intelligence (MI).

1. INTRODUCTION

Inter-observer variation has been appeared as the significant agent for the accuracy of radiographic proximal caries detection, which is a multifactorial diagnostic task. One of the suggested procedures to estimate the variations is the Multiple Intelligence (MI) theory of Howard Gardner [1].

MI theory (or hypothesis or concept) has been proposed to explain differences between people with the same intelligence quotient (IQ) or even less IQ and better performance in different tasks and objectives. Intelligence as defined by Gardner is the ability to solve problems, or to create products, that are valued within one or more cultural settings. Based on this definition, he proposed 7 intelligences (Table 1). Other intelligences domains (like Naturalist, Spiritual/Existential and Moral) have been added later by him and others as a result of the continued debate and interpretation of the concept.

MI has been extensively studied in relation to academic achievement and specifically for university students [2-4]. MI has also been studied in relation to dental skills and competencies. Ahmad et al. [5] has studied MI in relation to amalgam class II, composite, crown and bridge, endodontic, problem-based learning and the last written test of undergraduate dental students.

Table 1. Howard Gardners model of the seven multiple intelligences

Intelligence	Capability and Perception
Linguistic	Using words in reading, writing and speaking
Logical/ Mathematical	Logical thinking and mathematical problem-solving
Musical	Using music, sound and rhythm
Bodily/Kinesthetic	Using physical body
Spatial/Visual	Navigation and visualization
Interpersonal	Social skills and intuition about others
Intrapersonal	Accurate self-understanding

To our knowledge, the relation of MI to radiological proximal caries detection has not been studied in the English literature. This research aims to test the correlation between

radiological proximal caries detection accuracy and MI outcomes for dental undergraduates and new graduates (trainees).

2. MATERIALS AND METHODS

Fourteen radiographs of twenty-one extracted human premolar and twenty-one sprocket teeth were utilized in the current investigation. Sample preparation has been described elsewhere [6]. Briefly, teeth were mounted in dental stone models in rows of three with their proximal surfaces contacting. Two additional human posterior teeth that were not part of the sample were used to simulate proximal contacts on each side of the actual sample. Standardized bitewing projection geometry was obtained using a full-size (active area of 26mm x 34mm) CCD Sidexis sensor at 0.16 seconds, direct digital radiographs were obtained following manufacturer recommendations. Histological examination of the sample teeth was done after image acquisition in order to determine the presence and depth of the carious lesions. This sample was previously used in three different studies [6-8].

A total of 39 observers of dental students (20) and recent dental graduates (19 interns) from two different universities were selected. There were 17 male and 22 female observers. Verbal as well as written instructions were given to all observers at the start of the observation sessions. Observers were asked to evaluate the presence of interproximal carious lesions coronal to the cemento-enamel junction (CEJ) regardless of their depth. Any radiolucencies apical to the CEJ were excluded. The viewing procedure consisted of two observation sessions that took place at least two weeks apart to allow for a washout period using a five-point confidence scale (1 = Caries definitely absent, 2 = Caries probably absent, 3 = Uncertain as to whether caries is present or absent, 4 = Caries probably present, 5 = Caries definitely present) to report the likelihood of caries presence in each surface. All sessions took place in quiet, dim-lighted rooms and images were displayed on MacBook Pro laptops set at a resolution of 1280 X 800 pixels using a Liquid Crystal Display (LCD). No alteration, but magnification, in the display settings was allowed.

Accuracy of caries detection (Az score) was measured using a procedure reported previously

by Khan et al. [7], and MI scores were recorded by a modified, bilingual (to improve validity) MIS self-recorded questionnaire [9]. Microsoft Excel was applied to calculate means, percentages and correlation. The correlation coefficient was calculated using the Correlation function.

3. RESULTS

The little and mild positive correlation was shown among Az and Visual/Spatial (0.29) and Intrapersonal (0.31) domains of MI respectively (Table 2).

The current correlation was mild for students (0.38) and (0.40), and it was lowered for interns (0.28) and (0.26) respectively.

4. DISCUSSION

Radiological proximal caries detection is primarily a visual task. Visual acuity (and other visual skills including near point of convergence, amplitude of accommodation, accommodative facility, convergence break and recovery, divergence break and recovery, and developmental eye movement) are important when we consider Visual intelligence, and to find that radiological caries detection is correlated with spatial/visual intelligence is not surprising. We found a positive correlation between the spatial/visual domain and radiological caries detection accuracy. However, this is just a weak correlation which means that there are other factors that are more important in achieving better accuracy. Intrapersonal intelligence was found to be better

correlated than spatial/visual intelligence. The moderate correlation of Intrapersonal domain might be related to the confidence of the observer, which is a factor in the statistical model calculating the Az from the ROC analysis [10]. It might be a positive finding that intrapersonal intelligence is correlated with radiological caries detection accuracy because confidence is critical in decision-making for diagnosis and treatment planning [11].

These two domains were the only ones that are correlated with radiological caries detection accuracy.

It is interesting that although we have found this correlation at the students level, it is diminished at the interns level. This indicates that education and training might have closed the MI gap and MI becomes less important in caries detection compared to other factors as the student/trainee progresses in experience.

One of the limitations of this study is the inherent flaw of self-reported questionnaires especially the ones that are affected by differences in understanding oneself (Intrapersonal Intelligence). To improve and increase validity we have modified and translated the MI inventory and piloted it on an independent sample of interns to get their feedback before distributing the questionnaire to the study group. Other common limitation is the sample size. These limitations are very difficult to overcome. However, we have to acknowledge and address them for future studies.

Table 2. Correlation of radiological caries detection (Az) and the different domains of MI of students and interns

Correlation with	Mean Az (\pm SD)		
	Students	Interns	All
	0.73 (0.10)	0.8 (0.06)	0.76 (0.09)
Linguistic	0.06	0.07	0.07
Logical/Mathematical	0.06	0.10	0.09
Musical	0.14	0.15	0.07
Bodily/Kinesthetic	0.05	0.01	0.09
Spatial/Visual	0.38	0.28	0.29
Interpersonal	0.25	-0.05	0.17
Intrapersonal	0.40	0.26	0.31

5. CONCLUSIONS

There is positive weak correlation among caries detection accuracy and of Spatial/Visual and Intrapersonal domains of MI. This correlation is gender sensitive and might be reduced by learning and practice.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Gardner H. Frames of Mind: The Theory of Multiple Intelligences. Basic Books; 1983.
2. Ayesha B, Khurshid F. The relationship of multiple intelligence and effective study skills with academic achievement among university students. Glob J Hum-Soc Sci Res. 2013;13(1):21-32.
3. Holding L. Howard Gardners theory of multiple intelligences. J Sing. 2009;66(2): 193.
4. Katzowitz EC. Predominant learning styles and multiple intelligences of postsecondary allied health students. uga, USA; 2002.
5. Ahmad R, Abu Kasim N, Palaniappan A. Multiple intelligences and academic performance among Malaysian undergraduate dental students. J Dent Res; 2006.
6. Abreu M Jr, Mol A, Ludlow JB. Performance of RVGui sensor and Kodak Ektaspeed Plus film for proximal caries detection. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001;91(3):381-5.
7. Khan EA, Tyndall DA, Ludlow JB, Caplan D. Proximal caries detection: Sirona Sidexis versus Kodak Ektaspeed Plus. Gen Dent. 2005;53(1):43-8.
8. Ludlow JB, Abreu M Jr, Mol A. Performance of a new F-speed film for caries detection. Dentomaxillofac Radio 2001;30(2):110-3
9. Chapman A. Howard Gardners Multiple Intelligences. Available: <https://www.businessballs.com/self-awareness/howard-gardners-multiple-intelligences/> Accessed September 19, 2019.
10. Metz CE. Basic principles of ROC analysis. Semin Nucl Med 1978;8(4):283-98.
11. Rohlin M, Mileman P. Decision analysis in dentistry—the last 30 years. J Dent. 2000; 28(7):453-468.

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