

## Research Paper: Evaluation of the effect of scad training software on the shade mathching ability of guilan dental students in 2019



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**Citation:** Moein N, Daneshvar MM. Evaluation of the effect of scad training software on the shade mathching ability of guilan dental students in 2019 Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2020; 9(3):18-23. <http://dx.doi.org/>

<http://3dj.gums.ac.ir>



### **ABSTRACT**

**Introduction:** The aim of this study was the evaluation of the effect of scad training software on shade matching ability of dental students.

**Materials and Methods:** 84 students who passed shade matching topic in their theoretical courses were devided into two groups of case and control. They passed the exam of scad software in two steps. Interval of tests was six weeks. The case group unlike the control group get the training of scad between these two steps. The data were entered into SPSS software (version 21) to determine the progress of the students ability for shade mathching after training.

**Results:** In this study the case group showed significant progress in results Their score varied in various tests from the minimum 0.9 to the maximum 9.2 . According to the results, training effect of the scad software method was better than conventional method in Color differentiation in Exact Match II/100 (P,0.0001) and from statistical point of view it has been improved shade matching ability rather than conventional method as much as 6 score. Also Difference in Matching Pair Total Light & Dark /29 evaluation was statistically significant that means after training , scad group had less wrong Diagnosis than control group. (P,0.001)

**Conclusion:** Training with scad software had significant effect on increasing the accuracy of students shade matching ability.

#### Article info:

**Received:** 2020/08/07

**Accepted:** 2020/09/17

#### Keywords:

Color Perception  
Students, Dental  
Lichen Planus

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## Introduction

The demand for esthetic dentistry in clinical practice is consistently increasing(1). Shape, form, and color of the final restoration affect the esthetic result of dental treatment. Shade selection is a crucial step in the success of definitive restoration because No single tooth has of uniform color.

Dentists and dental technicians have challenges to do accurate shade matching for dental restorations. The most commonly used method is still visual color matching using shade guides. Although the method of comparing and matching the color of shade tabs with the color of teeth is seemingly simple but often leads to mistakes that range from minor to severe mismatches.

Multiple factors such as age, gender, emotion, fatigue, physiological factors (color deficiency), experience, education, and training can play a role in the observer's perception in visual shade-matching(1–5). Education and training have been found to be the most effective ones among these factors(4–9)

Toothguide Training Box (TTB), Toothguide Trainer (TT) are two of several methods of color training that have been introduced. TT is software that uses the images of tabs, while TTB uses physical shade tabs.

The TTB method was designed as a training system. Many researches have investigated the effectiveness of TTB as a method of color training. A positive effect has been associated with training using the TT and the TTB(5,7,10,11). In a recent study, the TTB quickly led to an improvement in tooth color differentiation among students. However, after 6 months, the effect of training was decreased(10).

Shade-matching may be difficult even for dental practitioners. Recent study showed that 87.5% of the dentists surveyed in the study felt the need for continuing education in shade selection(12) Another research highlighted that there is inconsistencies in the visual shade-matching approach during the shade-matching procedure. (13). Although that TTB is very effective for color training, it was intended for use by students at

dental schools. Therefore, it is not cost effective for dentists to pay for TTB only for color training.

Education and training together was found to be the best method to improve shade matching skills. Several color education and training programs for dental professionals have been developed during the time(3,14–17)

The most recent color education and training program is Dental Color Matcher(18). which is a free online program. in this study, we utilize dental color matcher , combined with a traditional lecture in a class setting aiming to find out whether it improve color matching ability of dental students. The null hypothesis was that education and training did not improve shade matching results.

## Material and Methods

This study was approved by the Ethics Committee of Guilan University of Medical Sciences(Code of Ethics:1394.331. All participants were provided with a personal consent form and items to be evaluated.

In this case-control study, the fifth and sixth year students (seniors) of the Guilan Dental school who passed shade matching topic in their theoretical courses were participated. Since gender does not affect the validity of shade matching, all participants were included in one group (both male and female)(19).

Students were randomly divided into two groups; case group which trained by SCAD software; and Control group which received no virtual training. Initially, all participants were examined with Ishihara color blindness test.

For this purpose, the Ishihara color blindness evaluation chart was given to participants. This test consisted of 11 tests, if more than one out of 11 the tests conducted by the participants were false, the test continued until lasted the test 14, and if the number of falsehoods were more than two, one would be excluded from the study.

At first, SCAD test was applied for both groups. Then, the case group was treated using SCAD software and subsequently, both of them were subjected to the final dental color

According to the ( Table 3 ), the changes in

matcher at intervals of 6 weeks after the first stage. In the first page of the SCAD test, Personal information including demographic questions was completed by the examiner. The next step was Closest Match exercise (A). In this part, it's necessary to match the color of the eight testing samples using the Vita 3D master. The goal is to select the closest color. At this stage, Value is first selected, and the second test is to choose Chroma and Hue. The score was scaled of 10. After completing these 8 series, next step was followed by Matching pairs test (D/E). To do this, Vita 3D Master was divided into two parts ; Light(D) & Dark(E), which light part included 15 tests. The pairs were matched using the Drag & Drop method. Then for the Eye Relaxation, the Screen interchanged to gray for 60 seconds. The next step was Dark part which contains 14 tests and then eyes were rested again for 120 seconds through gray screen. The final stage was the Exact Match(B,C) ; including four initial one-step tests which only scored to Value (B-Exact Match I ). After 30

seconds of resting, the next step was applied including 10 tests to choose Chroma and Hue (C-Exact Match II). After collecting the data, they were entered into SPSS software (version 21) to determine the progress of the students ability for shade matching after the training. The significance level of the tests was considered as  $P < 0.05$ .

## Results

The results of the data collection showed that the accuracy of diagnostic A-CLOSEST MATCH / 80 and C-EXACT MATCH II / 100 were significant in both case group (taught by SCAD method) and control group (without any virtual training) (for case group  $P < 0.001$  and for control group  $P < 0.002$ ). This means that students in the second stage of the measurement have achieved a lower mistake rate in A-CLOSEST MATCH / 80 and C-EXACT MATCH II / 100. But the diagnostic accuracy in B-EXACT MATCH / 40 in both groups did not change significantly before and after training. (Table 1,2)(Chart 1)

Table 1: Assessment of diagnostic accuracy of tests by students based on time to do it in scad software group

	time	average	Standard deviation		Diagnostic accuracy status	number	Average rating	P
A-CLOSEST MATCH /80	Before treatment	72/97	4/58	→	Better	34	22/15	0/0001
	After treatment	76/21	2/87		Worse	7	15/43	
					No change	1		
					Total	42		
B-EXACT MATCH I /40	Before treatment	39/90	0/43	→	Better	2	1/50	0/157
	After treatment	40	0		Worse	0	0	
					No change	40		
					Total	42		
C-EXACT MATCH II/100	Before treatment	85/43	6/78	→	Better	40	22/35	0/0001
	After treatment	93/59	3/20		Worse	2	4/50	
					No change	0		
					Total	42		

Chart 1: linear graph of comparing diagnostic accuracy of shade matching of two educational method in two measurement time

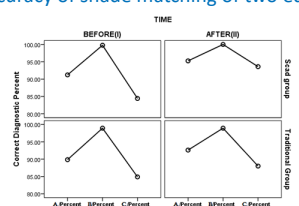


Table 2: Assessment of diagnostic accuracy of tests by students based on time to do it in traditiobal group

	time	average	Standard deviation		Diagnostic accuracy status	number	Average rating	P
A-CLOSEST MATCH /80	Before treatment	71/89	4/74	→	Better	28	20/93	0/002
	After treatment	74/09	3/79		Worse	10	15/50	
					No change	4		
					Total	42		
B-EXACT MATCH I /40	Before treatment	39/58	0/99	→	Better	5	6/80	0/927
	After treatment	39/57	0/89		Worse	6	5/33	
					No change	31		
					Total	42		
C-EXACT MATCH II/100	Before treatment	84/88	5/95	→	Better	30	22/22	0/002
	After treatment	88	4/28		Worse	11	17/68	
					No change	1		
					Total	42		

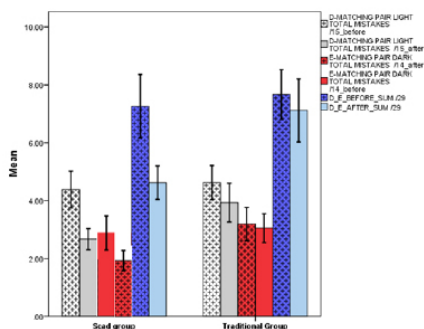
D-MATCHING PAIR LIGHT TOTAL MISTAKES / 15 (P = 0.019) and E-MATCHING PAIR DARK TOTAL MISTAKES / 14 (P = 0.0001) and DEF\_D\_E / 29 (P = 0.001) were significant statistically before and after the training. This means that after training, the SCAD trained samples have

scored less mistake rate versus another group In DEF\_D\_E / 29, number of false recognition cases decreased in both group. However, the incorrect choices for shade matching in the SCAD group were less than another group after training (P <0.001) (reduction of false recognition -2.6 versus -0.55).(Table 3)(Chart 2)

Table 3: Comparing diagnostic wrong changes of two different shade matching test in dental students of scad and conventional group in two measurement time

	Group	Number	Changes average	Standard deviation	Average rating	P
Difference D-MATCHING PAIR LIGHT TOTAL MISTAKES / 15_before_after	SCAD	42	-1/71	1/84	48/6	0/019
	CONVENTIONAL	42	-0/69	1/94	36/4	
Difference E-MATCHING PAIR DARK TOTAL MISTAKES / 13_before_after	SCAD	42	-0/93	1/70	50/3	0/0001
	CONVENTIONAL	42	0/14	1/62	34/7	
DEF_D_E/29	SCAD	42	-2/64	2/91	33/49	0/001
	CONVENTIONAL	42	-0/55	2/3	51/51	

Chart 2: chart of comparing wrong shade matching average of two educational method in two measurement time

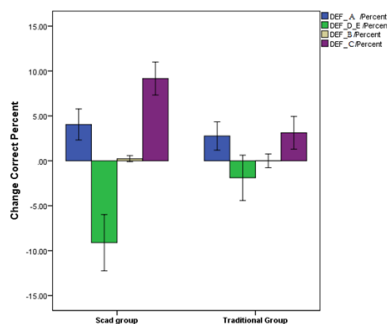


Based on the table below, the educational effect of the SCAD software was better than conventional training method in DEF\_C / 100 (P, 0.0001), and enhanced statistically the accuracy of color selection more than 6 points rather conventional training.(Table 4)(Chart 3)

Table 4: comparing diagnostic wrong changes of three different shade matching test in dental students of scad and conventional group in two measurement time

	Group	Number	Changes average	Standard deviation	Average rating	P
DEF_A/80	SCAD	42	3/23	4/44	45/45	0/265
	CONVENTIONAL	42	2/21	4/06	39/55	
DEF_B/40	SCAD	42	0/09	0/43	43/86	0/418
	CONVENTIONAL	42	0	0/99	14/14	
DEF_C/100	SCAD	42	9/16	5/88	54/48	0/001
	CONVENTIONAL	42	3/11	3/84	30/52	

Chart 3: chart of comparing average percentage of wrong changes and diagnostic accuracy of two educational method of shade matching in two measurement time



## Discussion

According to the results of Table 4-4, despite the fact that in all three different tests of color selection A, B and C, the results of case group showed better performance than the control group, Similar to SCAD trained group, in the exact match I (A) test for control group, we had the highest level of test impairment. In the case of closest match (A) and exact match II (C) in both case and control groups, the accuracy of post-training recognition was better than the first one, but this difference in exact match II was significant (a 6 points of difference in the rate of improvement among two groups).

To interpret this, it seems reasonable that eye training in order to select step-by-step from value to hue can reveal the closest selections to the test sample, while if two tabs are to be exactly pairs, the untrained eye will be probably able to do it. On the other hand, since the focus of the test (exact match I) is on value, according to Charles J. Goodacre (22), the difference in value is easily evaluated, even untrained eye and

ill-value restorations is expressed as very dark or very white by patients. In fact, selection of value is the simplest step of shade matching that is less complex and untrained people could also be able differentiate as expert people. With this interpretation, SCAD training software will not have an impact on the exact match I (P: 1/57). Since the exact match II assesses the skill in choosing the hue and chroma, it is reasonable to accept that training cause skill improvement.

Based on the data of Table 4-4, which compares separately and totally the discrepancies in false recognition shade matching in matching pairs, it can be concluded that although both the case and control groups have improved correct recognition, these changes have been greater in the case group.

Our findings were in agreement with the result of Colms (20) which recorded 33% of the control group with improvement, we observed a slight improvement in scores of the control group ranging from at least 0.5 to a maximum of 1.3 in various tests. However, this result is in contrast to the studies of m.lue(21) and Ivan Ristic (22), in which the control group did not show statistically significant progress and concluded that re-test failed to result improvement lonely.

Concerning the cause of improvement in our results in the control group, it can be explained by the following: the familiarity of the participants with the tests and improvement of their accuracy in the second stage in order to improve their previous performance.

In our study, similar to Colms study, which recorded better results of 47.6% of the study group, the case group showed a sig-

nificant improvement in the results which their scores varying from a minimum of 0.9 to a maximum of 9.2 in the different tests.

## Conclusion

According to the results obtained from the study, It can be said that SCAD training software has a significant impact on improvement of the accuracy of students' shade matching.

Finally, since the improvement of dental restoration appearance causes to increases patient satisfaction, dental schools need to apply advanced and Evidence based shade matching methods in their curriculum. These programs can also be implemented for training of Specialist Residents and continuous training of dentists and dental technicians.

### Acknowledgement

None

### Conflicts of interest

There are no conflicts of interest

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