



# Journal of Health and Medical Sciences

**Kara, R., & Velibeyoğlu, M. B. (2022), The Effect of Tooth Carving Technique on Dental Technician Student Perception and Performance in Tooth Morphology and Manipulation Course. *Journal of Health and Medical Sciences*, 5(2), 19-25.**

ISSN 2622-7258

DOI: 10.31014/aior.1994.05.02.207

The online version of this article can be found at:  
<https://www.asianinstituteofresearch.org/>

Published by:  
The Asian Institute of Research

The *Journal of Health and Medical Sciences* is an Open Access publication. It may be read, copied, and distributed free of charge according to the conditions of the Creative Commons Attribution 4.0 International license.

The Asian Institute of Research *Journal of Health and Medical Sciences* is a peer-reviewed International Journal. The journal covers scholarly articles in the fields of Medicine and Public Health, including medicine, surgery, ophthalmology, gynecology and obstetrics, psychiatry, anesthesia, pediatrics, orthopedics, microbiology, pathology and laboratory medicine, medical education, research methodology, forensic medicine, medical ethics, community medicine, public health, community health, behavioral health, health policy, health service, health education, health economics, medical ethics, health protection, environmental health, and equity in health. As the journal is Open Access, it ensures high visibility and the increase of citations for all research articles published. The *Journal of Health and Medical Sciences* aims to facilitate scholarly work on recent theoretical and practical aspects of Health and Medical Sciences.



ASIAN INSTITUTE OF RESEARCH  
Connecting Scholars Worldwide



# The Effect of Tooth Carving Technique on Dental Technician Student Perception and Performance in Tooth Morphology and Manipulation Course

Recep Kara<sup>1</sup>, Mehmet Baki Velibeyođlu<sup>2</sup>

<sup>1,2</sup>Dental Prostheses Technologies Department, Istanbul Aydın University, Istanbul, Turkey

Correspondence: Dental Prostheses Technologies Department, Istanbul Aydın University, Küçükçekmece, 34295, Istanbul, Turkey. Tel: +905448844788 - E-mail: drecepkara@gmail.com

## Abstract

Tooth carving is done to develop the psychomotor skills necessary for dental technician practice and teach tooth morphology. This study aimed to determine the effect of tooth carving as a teaching method for tooth morphology and assessment. 116 students trained in teeth carving at Istanbul Aydın University Dental Technician Department were subjected to 2 different teeth carving exams with soap and wax. Instructors evaluated tooth carvings according to a standard checklist. At the end of this study, a student satisfaction survey was carried out to get feedback on tooth carving as a teaching methodology. The scores given by the instructors did not differ by material and gender ( $p > 0.05$ ). Overall, student feedback on teeth carving was equally positive. The vast majority found the tooth they carved to be confirmed (75.86%). They believed that carving exercises would help develop laboratory skills (76.03%). They found the training method and materials applied sufficient. Dental carving applications develop dexterity and psychomotor skills for dental prosthesis technician applications. Before laboratory applications, it should be an integral component of the dental prosthesis technician curriculum to develop cognitive and psychomotor skills related to clinical applications. Based on this study, live representation of teeth carving skills and different educational materials (plaster models, videos, slides, etc.) should be the preferred teaching method.

**Keywords:** Prosthodontics, Dental Technician, Dental Education, Dental Models, Psychomotor Performance, Dental Laboratories

## 1. Introduction

The dentist needs to have comprehensive knowledge of morphology and function of teeth in the construction of aesthetic restorations (Nance et al., 2009; Obrez et al., 2011). Along with theoretical knowledge of tooth structure and function, it is essential to have technical skills, dexterity, and more for proper restoration. It makes purely artistic sense (Rubinstein & Nidetz, 2007). A clinician can only reproduce anatomical details to make a dental restoration look natural (Capote et al., 2018).

Dental students' psychomotor skills in carving need to be developed early to acquire the dexterity to reconstruct fine-tooth forms for restorative clinical procedures and functional purposes (Giuliani et al., 2007). In the preclinical years, dental anatomy and dental morphology is the first course that introduces dental students to the structure and function of human teeth (Schroeter, 1959). Knowledge of tooth morphology, alignment, and occlusion is critical for identifying teeth and relating morphology. It is vital to develop psychomotor skills as it helps students later identify the details of the tooth surface and the changes that may occur (A. Kilistoff, 2011). Oral anatomy and dental morphology are traditionally taught through didactic lectures, books, manuals, artificial tooth models, and extracted teeth. Wheeler's first introduced tooth carving in wax blocks. 10 In many dental schools worldwide, dental carving is an integral part of the curriculum. Students carry out carving teeth from wax or soap molds (Capote et al., 2018).

The purpose of tooth carving is to reconstruct different positive and negative anatomical features, such as tubercles, cingulum, ridges, fossae, and grooves, close to the dimensions of natural teeth. Each tooth has six surfaces, and each surface of the tooth has its characteristics. Dental wax carving is an exercise for learning the contours, convexities, and concavities specific to tooth type and location. Dental wax carving skills introduce dental students to hand tool techniques. Provides improvements in-hand manipulation.

Today, many experts think that the examination of tooth morphology is an age-old exercise that serves no purpose, even though it has been practiced for many years (Baskar, 2009; Rao, 2010; Sivapathasundharam, 2008). Teaching dental morphology is exhausting as it requires expertise and manual dexterity. Although it is an education that is also applied in the education of dental students, several reasons can be given that dental morphology education is not necessary. First, learning dental morphology can prepare a student to be a good technician rather than a clinician (Baskar, 2009). Second, since most restorative work is done by dental technicians, they may not need dental morphology and carving training to perform surgery and learn anatomy (Sivapathasundharam, 2008).

These assumptions are a precious argument against not including dental morphology in education for dental students (undergraduate and graduate students). Dental technicians can benefit from pre-carved dental materials and earn this title without school. (Some of the current technicians have never been enrolled in dental schools or colleges in Turkey). In addition, dental technicians do not need more information about tooth morphology other than the exact determination of the tooth to be replaced. Dental students or technicians do not necessarily need to learn dental morphology at the curriculum level, which takes a lot of time and effort. Even if they learn all the tricks of tooth morphology, there is no guarantee that they will pass the exam successfully (Ponniah, 2010).

Since dental anatomy is one of the first lessons directly related to teeth and mouth function, it presents particular challenges for students and teachers (Mitov et al., 2010). In most schools, the didactic part of dental morphology is usually taught in the traditional course format, and written exams test students' knowledge (Maggio et al., 2012). These conventional teaching methods have revealed some weak points that cause frustration for both students and faculty (Nayak et al., 2014). The student's perception of the education received is valuable information for curriculum planners and should include advice from dental carving students and educators (Nayak et al., 2014). Therefore, the study evaluates dental technician students' knowledge, perception, and attitudes about tooth carving.

## **2. Method**

The research was conducted on 116 students studying in the first year of dental prosthesis technology (man=58, woman=58) at Istanbul Aydın University. The study was carried out with the permission of the ethics committee of Istanbul Aydın University, numbered 2022/44. All participants signed consent forms.

Tooth morphology was taught to both groups (woman and man) with handouts, plaster models, slides, videos, and demonstrations. The demonstrations included a step-by-step application of the notes given in the laboratory environment. The demonstrations were recorded as videos and regularly watched during the training. Carving training was given for the same tooth from the wax and soap block in equal time (6 hours), and carving operations were carried out in the laboratory studies. The maxillary first molar was selected for this study. A soap and wax block (50x25x25mm) were given to the students. The teeth were collected anonymously without disturbing the group's integrity. Both groups were asked to carve a right maxillary molar tooth from wax and soap blocks. Ninety

minutes were given for carving from each block. 2 prosthodontists and two dental technicians evaluated carved teeth.

The examiners evaluated the teeth against the same grading chart. A grading chart was formulated based on work by Kilistoff et al. (Table 1) to standardize the grading of the teeth (A. J. Kilistoff et al., 2013). This standardized chart scored different morphological features of the maxillary first molar. (2 marks for each completed feature, 1 mark for a full feature, and 0 points for a missing feature.)

Table 1: Scoring criteria

Tooth Characteristics	Score: 0= No feature, 1 = feature exists but weak not as desired, 2= feature is evident as requested
The geometric form of surfaces	Labial
	Palatal
	Approximal
	Occlusal
	Roots
Tooth dimensions	Cervico-occlusal
	Mesio-distal ve Labio-palatal
	Roots
Anatomical features	Developmental grooves
	Tubercles
	Fossas (central, mesial, distal)
	Edge ridges (Mesial-Distal)
	Cusp ridges (triangular, oblique, transversal)
	Roots

A survey created by Abu Eid et al. was modified to collect students' feedback on tooth carving (Table 2) (Eid et al., 2013). Descriptive tests were applied for the gender and exam results of the students. An independent sample t-test was used to compare the average results of scores given by students and examiners. A P value less than 0.005 was retained as significant. The frequency of the answers to the questionnaire was calculated by applying descriptive tests (Table 2).

### 3. Results

The answers to the survey questions are shown in Table 2. The scores obtained from the answers given in the questions graded according to the Likert scale were converted into percentages. The percentages of the responses given give information about the perceptions and thoughts of the students. The majority state that they are successful while they think that the training provided helps to improve their laboratory skills. The usefulness and accuracy of the materials used during the training are confirmed by the results obtained. It was found that the material and gender did not affect success in the teeth carving process. The difficulty of carving specified for materials affects time but not success. Although 72% of participants stated that they liked tooth carving, 53.62% viewed carving as an unnecessary waste of time. It was found that 3D plaster models were more useful in the materials used during training.

Table 2: Surveys questions and evaluation results

1- Do you like teeth carving? (72%)*					11- How long does it take to carve a big molar out of wax?						
(1)	(2)	(3)	(4)	(5)	15 m	30 m	45m	1 h	1.5h	2 h	2 h
8	7	33	30	38	1	3	5	1	45	35	10
6,9%	6,0%	28,4%	25,9%	32,8%	0,9%	2,6%	4,3%	14,7%	38,8%	30,2%	8,6%

<b>2- Did carving help recognize the morphological features of the teeth? (79%)*</b>					<b>12- How long does it take to carve a big molar out of soap?</b>							
(1)	(2)	(3)	(4)	(5)	15 m	30 m	45 m	1 h	1.5 h	2 h	2 h	
7 6,0%	5 4,3%	20 17,2 %	36 31,0 %	48 41,4 %	2 1,7%	16 13,8%	31 26,7%	40 34,5%	24 20,7 %	3 2,6%	-	
<b>3- Were plaster tooth models helpful? (88,79%)*</b>					<b>13- Which material is easy to work with?</b>							
(1)	(2)	(3)	(4)	(5)	soap		wax	both easy		both hard		
1 0,9%	5 4,3%	9 7,8%	28 24,1 %	73 62,9 %	86 74,1%		7 6,0%	15 12,9%		8 6,9%		
<b>4- Did the tooth carving practice help you get to know some lab equipment? (79,31%)*</b>					<b>14- Which part of the tooth is difficult for carving?</b>							
(1)	(2)	(3)	(4)	(5)	root		crown		both			
9 7,8%	9 7,8%	19 16,4 %	29 25% %	50 43,1 %	9 7,8%		93 80,2%		14 12,1%			
<b>5- Will tooth carving help improve your lab skills? (76,03%)*</b>					<b>15- Is the time allotted for tooth carving training sufficient?</b>							
(1)	(2)	(3)	(4)	(5)	no				yes			
8 6,9%	11 9,5%	22 19,0 %	30 25,9 %	45 38,8 %	28 24,1%				88 75,9%			
<b>6- Is it easy to work on wax blocks? (47,24%)*</b>					<b>16- Which of the following do you think would be useful in education?</b>							
(1)	(2)	(3)	(4)	(5)	Slides	51	12,4%					
45 38,8%	22 19,0 %	22 19,0 %	16, 13,8 %	11 9,5%	Models	90	21,8%					
					Animations	31	7,5%					
					Videos	61	14,8%					
					Plastic teeth	35	8,5%					
					Extracted teeth	37	9,0%					
					Atlas	5	1,2%					
					Drawing	38	9,2%					
					Carving exercise	60	14,6%					
<b>7- Do you think the anatomical structures in the carved tooth are realistic? (75,86%)*</b>												
(1)	(2)	(3)	(4)	(5)								
3 2,6%	9 7,8%	32 27,6 %	37 31,9 %	35 30,2 %								
<b>8- Did you find tooth carving a waste of time? (53,62%)*</b>					<b>Exam</b>							
					<b>material</b>		<b>Gender</b>		<b>n</b>		<b>Exam grade</b>	
											<b>Mean ± SD</b>	
											<b>p</b>	
					Wax		Man		58		61,20±17,72	
							Woman		58		59,91±17,35	
					Soap		Man		58		62,03±19,60	
							Woman		58		58,27±19,43	
(1)	(2)	(3)	(4)	(5)								
35 30,2%	21 18,1 %	30 25,9 %	14 12,1 %	16 13,8 %								
<b>9- Do you think the applied teaching method improved your skills? (78,62%)*</b>					<b>(1),(2),(3),(4),(5) = Likert scale values, m= minute, h= hour, n= respond, P= 0.05 significantly degree, *= Average preference rate = [ 380 (maximum score (maximum likert value (5) x total number of participants)) / score obtained</b>							
(1)	(2)	(3)	(4)	(5)								
6 5,2%	9 6,9%	20	38	44								

		17,2 %	32,8 %	37,9 %	(preferred likert value x number of participant preferences)] x 100
<b>10- Should carving be taught in Grade 1? (88,96%)*</b>					
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>Exam grade</b> = (Total score obtained according to Table 1 x 100) / 28 (maximum score according to Table 1)
7 6,0%	4 3,4%	11 9,5%	17 14,7 %	77 66,4 %	

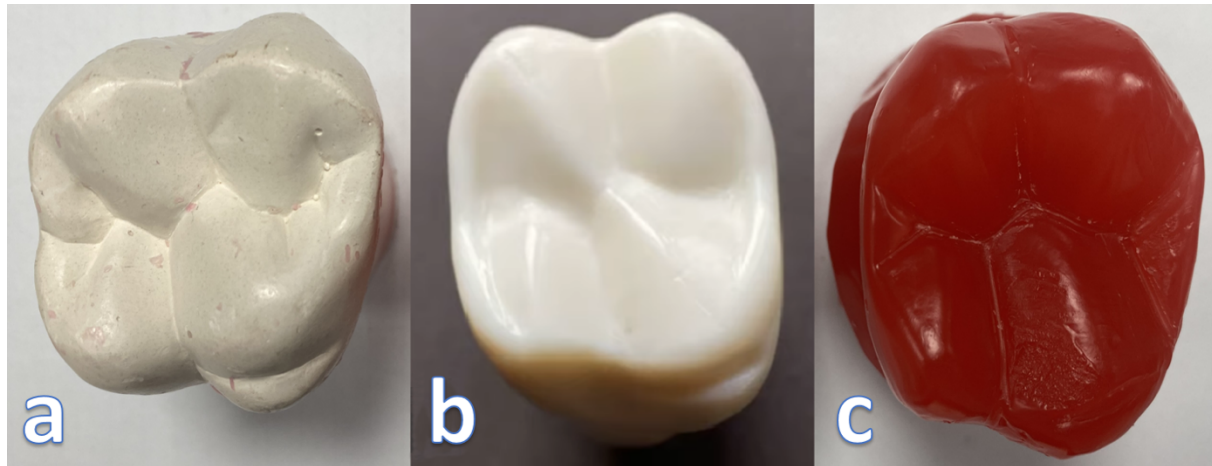


Figure 1: a: plaster model; b: soap tooth; c: wax tooth

#### 4. Discussion

The demographic information of the students and grades given by faculty members are shown in Table 2. The morphological features on the plaster model teeth given to the students during the scoring were taken as a basis. Therefore, plaster models can also help reproduce the same features on the surface of the carved tooth. 88.79% of the students responded positively to whether plaster models were good teeth. This demonstrates that magnified dental plaster models provide a three-dimensional teaching method for tooth morphology that surpasses videos and other resources. So it can be used as a reference for tooth carving practice.

When students were asked if they found the crown or root part difficult when carving, 80.2% of the participants stated that the crown part was more complex than the root. This contrasts with the results of the study by Azevedo RA et al., who reported that the root is thinner than the crown and, therefore more difficult to carve and manage because it can easily break during the carving (de Azevedo et al., 2018).

The majority of students in this study agreed that tooth carving should be taught in the first year of education (88.96%). Regarding the usefulness of the teaching methodology used, 78.62% of the group's students agreed that it helped improve their skills. 76.86% of students of both groups agreed that the marking criteria for dental carving were realistic, robust, and comprehensive. The marking criteria included a detailed analysis of all the anatomical features of a maxillary right upper molar. Similar surveys previously conducted on dental students reported similar results. They also emphasized that dental carving is important to clinical skills and should be an integral part (Eid et al., 2013; Nayak et al., 2014). They find it challenging to carve from wax while they need about 1.5-2 hours. This difficulty and duration can be attributed to the material's physical properties being harder than soap.

The teaching of dental morphology begins with two-dimensional (2D) drawing and proceeds toward making the wax and tooth model in 3D. Carving wax teeth different from actual tooth size and morphology is a controversial teaching practice, as it significantly impairs the development of visual ability as does not give the student an idea of the deviations that actually exist. Newer technologies such as videos, computerized 3D models, and mobile

applications such as 3D tooth anatomy have been and should be implemented by authors (Chowdhry & Sircar, 2020). Since the morphology of restoration is determined by the morphology and location of neighboring and opposing teeth, meticulous carving exercises can be helpful to some extent in crown carving. However, the logic behind root carving remains unclear. Although the knowledge of the shape, the number of roots, and several canals within the root are significant in endodontic and exodontic applications, this is not needed in laboratory applications, and it makes root carving exercises in dental techniques unnecessary.

A systematic review of PRISMA guidelines suggested that practical demonstration of dental wax carving with an instructor is one of the most effective ways to learn about dental anatomy (de Azevedo et al., 2018). The limitations of this study are that it was based on a single institution. It is necessary to include more central studies to generalize and confirm the findings of this study. Based on the recommendations from the results of this study, dental carving should be an integral component of the dental technician curriculum in Turkey.

Based on the results of this study, dental wax carving was found to be an effective strategy for improving lab psychomotor skills of dental prosthesis technician students by recreating dental morphological features in wax and soap. Students' progress will be traced to their laboratory skills and then their laboratory work. Therefore, it is imperative that dental carving be included in the national prosthesis technician curriculum for longitudinal or spiral integration to be possible.

## References

- Baskar, P. K. (2009). Tooth carving. In *Indian Journal of Dental Research* (Vol. 20, Issue 1). <https://doi.org/10.4103/0970-9290.49055>
- Capote, T. S. O., Barroso, R. A. A., Pinto, S. T. P., Conte, M. B., Campos, J. A. D. B., Bolini, P. D. A. & Gonçalves, M. A. (2018). A contribution to the anatomical study of the mandibular premolars. *Journal of Morphological Sciences*, 35(1). <https://doi.org/10.1055/s-0038-1660493>
- Chowdhry, A. & Sircar, K. (2020). Need for innovative course module for teaching tooth morphology in India. In *Journal of Oral and Maxillofacial Pathology* (Vol. 24, Issue 3). [https://doi.org/10.4103/jomfp.jomfp\\_371\\_20](https://doi.org/10.4103/jomfp.jomfp_371_20)
- de Azevedo, R. A., Correa, M. B., Torriani, M. A. & Lund, R. G. (2018). Optimizing quality of dental carving by preclinical dental students through anatomy theory reinforcement. *Anatomical Sciences Education*, 11(4). <https://doi.org/10.1002/ase.1752>
- Eid, R. A., Ewan, K., Foley, J., Oweis, Y. & Jayasinghe, J. (2013). Self-Directed Study and Carving Tooth Models for Learning Tooth Morphology: Perceptions of Students at the University of Aberdeen, Scotland. *Journal of Dental Education*, 77(9). <https://doi.org/10.1002/j.0022-0337.2013.77.9.tb05586.x>
- Giuliani, M., Lajolo, C., Clemente, L., Querqui, A., Viotti, R., Boari, A. & Miani, C. M. (2007). Is manual dexterity essential in the selection of dental students? *British Dental Journal*, 203(3). <https://doi.org/10.1038/bdj.2007.688>
- Kilistoff, A. (2011). A systematic technique for carving amalgam and composite restorations. *Operative Dentistry*, 36(3). <https://doi.org/10.2341/10-311-T>
- Kilistoff, A. J., Mackenzie, L., D'Eon, M. & Trinder, K. (2013). Efficacy of a Step-by-Step Carving Technique for Dental Students. *Journal of Dental Education*, 77(1). <https://doi.org/10.1002/j.0022-0337.2013.77.1.tb05444.x>
- Maggio, M. P., Hariton-Gross, K. & Gluch, J. (2012). The Use of Independent, Interactive Media for Education in Dental Morphology. *Journal of Dental Education*, 76(11). <https://doi.org/10.1002/j.0022-0337.2012.76.11.tb05412.x>
- Mitov, G., Dillschneider, T., Abed, M. R., Hohenberg, G. & Pospiech, P. (2010). Introducing and Evaluating MorphoDent, a Web-Based Learning Program in Dental Morphology. *Journal of Dental Education*, 74(10). <https://doi.org/10.1002/j.0022-0337.2010.74.10.tb04968.x>
- Nance, E. T., Lanning, S. K. & Gunsolley, J. C. (2009). Dental Anatomy Carving Computer-Assisted Instruction Program: An Assessment of Student Performance and Perceptions. *Journal of Dental Education*, 73(8). <https://doi.org/10.1002/j.0022-0337.2009.73.8.tb04786.x>
- Nayak, M. T., Sahni, P., Singhvi, A. & Singh, A. (2014). The perceived relevance of tooth carving in dental education: Views of practicing dentists and faculty in West India. *Education for Health: Change in Learning and Practice*, 27(3). <https://doi.org/10.4103/1357-6283.152177>
- Obrez, A., Briggs, C., Buckman, J., Goldstein, L., Lamb, C. & Knight, W. G. (2011). Teaching Clinically Relevant Dental Anatomy in the Dental Curriculum: Description and Assessment of an Innovative Module. *Journal of Dental Education*, 75(6). <https://doi.org/10.1002/j.0022-0337.2011.75.6.tb05108.x>

- Ponniah, I. (2010). Why tooth carving. In *Indian Journal of Dental Research* (Vol. 21, Issue 3). <https://doi.org/10.4103/0970-9290.70783>
- Rao, A. (2010). Tooth carving. In *Indian Journal of Dental Research* (Vol. 21, Issue 1). <https://doi.org/10.4103/0970-9290.62789>
- Rubinstein, S. & Nidetz, A. J. (2007). The Art and Science of the Direct Posterior Restoration: Recreating Form, Color, and Translucency. *Alpha Omegan*, 100(1). <https://doi.org/10.1016/j.aodf.2006.07.001>
- Schroeter, C. (1959). Practical application of tooth morphology. *The Journal of Prosthetic Dentistry*, 9(5). [https://doi.org/10.1016/0022-3913\(59\)90053-8](https://doi.org/10.1016/0022-3913(59)90053-8)
- Sivapathasundharam, B. (2008). Tooth carving. In *Indian Journal of Dental Research* (Vol. 19, Issue 3). <https://doi.org/10.4103/0970-9290.42946>