



## Knowledge, Attitudes and Practices Related to Tooth Morphology Among Dental Students and Dental Technician Students

Gonca Deste Gökay<sup>1-a\*</sup>, Perihan Oyar<sup>2-b</sup>

<sup>1</sup> Department of Prosthodontics, Bursa Uludağ University, Faculty of Dentistry, Bursa, Türkiye.

<sup>2</sup> Dental Prosthetics Technology, School of Health Services, Hacettepe University, Ankara, Türkiye.

\*Corresponding author

### Research Article

#### History

Received: 24/04/2024

Accepted: 14/08/2024

### ABSTRACT

**Objectives:** Students are introduced to the morphological features of primary and permanent human dentition in a dental anatomy course, which is a part of the basic core sciences program in the Department of Dentistry and Dental Prosthesis Technology. The purpose of this study was to compare dental students' (DSs') and dental technician students' (DTs') knowledge, attitudes, and practices related to dental morphology.

**Materials and Methods:** Using a 26-item self-administered questionnaire, the DSs and DTs participated in a descriptive cross-sectional study. Three components made up the questionnaire: four items for demographic profile, ten items for dental morphology knowledge level, seven items for attitude toward tooth morphology, and five items for practice in tooth morphology. There were 274 student answers in all. The data were analyzed using an independent t test and one-way ANOVA. A p value of less than 0.05 was considered to indicate statistical significance for each test.

**Results:** Between DSs and DTs, there was a statistically significant difference in their knowledge and practices of tooth morphology ( $p < 0.001$ ). However, DTs knowledge of dental morphology was significantly greater, and DSs practice scores were significantly greater. There was no significant difference in the attitude of tooth morphology between the two groups ( $p = 0.379$ ). Both groups had low levels of dental morphology knowledge, with an average of 3.86 correct answers for DTs and an average of 3.16 correct answers for DSs. In the DSs group, first-year students had a greater knowledge level ( $4.22 \pm 1.63$  correct answers) than did the other students.

**Conclusions:** Knowing the variations in dental morphology knowledge, attitudes, and practices between a dentist and dental technician may help us take preventative measures. While preclinical dentistry students and dental technician students had different levels of expertise, both groups were less knowledgeable about tooth morphology. Both groups had similarly high attitudes toward tooth morphology.

**Keyword:** Dental Student, Dental Technicians, Knowledge, Anatomy.

## Diş Hekimliği Öğrencileri ve Diş Teknisyenliği Öğrencilerinin Diş Morfolojisi ile İlgili Bilgi, Tutum ve Uygulamaları

### Research Article

#### Süreç

Geliş: 24/04/2024

Kabul: 14/08/2024

### ÖZ

**Amaç:** Diş Hekimliği ve Diş Protez Teknolojisi Bölümü programlarının temel bilimlerinden olan Diş Anatomisi ve Morfolojisi dersinde öğrencilere süt ve daimi dişlenmenin morfolojik özellikleri tanıtılmaktadır. Bu çalışmanın amacı, diş hekimliği öğrencilerinin (DÖ'ler) ve diş teknisyenliği öğrencilerinin (DTÖ'lerin) diş morfolojisi ile ilgili bilgi, tutum ve uygulamalarını karşılaştırmaktır.

**Gereçler ve Yöntemler:** DÖ'ler ve DTÖ'ler, kendi kendilerine uygulayabilecekleri 26 maddelik bir anket aracılığı ile tanımlayıcı kesitsel bir çalışmaya katıldılar. Demografik profil için dört madde, diş morfolojisi bilgi düzeyi için on madde, diş morfolojisine yönelik tutum için yedi madde ve diş morfolojisi pratiği için beş madde olmak üzere anketi üç bileşen oluşturdu. Toplamda 274 öğrenci yanıtı alındı. Veriler bağımsız bir t testi ve tek yönlü ANOVA kullanılarak analiz edildi. 0,05'ten küçük bir p değerinin her test için istatistiksel anlamlılığa işaret ettiği kabul edildi.

**Bulgular:** DÖ'ler ve DTÖ'ler arasında diş morfolojisi bilgi ve uygulamaları arasında istatistiksel olarak anlamlı bir fark vardı ( $p < 0.001$ ). Bununla birlikte, DTÖ'lerinin diş morfolojisi bilgisi önemli ölçüde daha fazlaydı ve DÖ'lerinin uygulama puanları da önemli ölçüde daha yüksekti. İki grup arasında diş morfolojisi tutumu açısından anlamlı bir fark yoktu ( $p = 0,379$ ). Her iki grubun da diş morfolojisi bilgisi düşük düzeydeydi; DTÖ'ler için ortalama 3,86 doğru cevap ve DÖ'ler için ortalama 3,16 doğru cevap vardı. DÖ grubundaki birinci sınıf öğrencilerinin bilgi düzeyi ( $4,22 \pm 1,63$  doğru cevap) diğer öğrencilere göre daha yüksekti.

**Sonuçlar:** Bir diş hekimi ile diş teknisyenisi arasındaki diş morfolojisi bilgisi, tutumları ve uygulamaları arasındaki farklılıkları bilmek, önleyici tedbirler alınmasına yardımcı olabilir. Klinik öncesi diş hekimliği öğrencileri ve diş teknisyenliği öğrencileri farklı uzmanlık düzeylerine sahipken, her iki grup da diş morfolojisi konusunda düşük düzeyde bilgi sahibiydi. Her iki grubun da diş morfolojisine yönelik tutumları benzer şekilde yüksekti.

**Anahtar kelimeler:** Diş Hekimliği Öğrencisi, Diş Teknisyenleri, Bilgi, Anatomi.

#### License



This work is licensed under  
Creative Commons Attribution 4.0  
International License

<sup>a</sup> [goncadeste@uludag.edu.tr](mailto:goncadeste@uludag.edu.tr)

<sup>b</sup> <https://orcid.org/0000-0003-1028-9461>

<sup>c</sup> [pyoar73@gmail.com](mailto:pyoar73@gmail.com)

<sup>d</sup> <https://orcid.org/0000-0002-6704-0774>

**How to Cite:** Deste Gökay G, Oyar P. (2024) Knowledge, Attitudes and Practices Related to Tooth Morphology Among Dental Students and Dental Technician Students, Cumhuriyet Dental Journal, 27(3):166-172.

## Introduction

Dental anatomy forms the basis of dental studies. Therefore, a good understanding of dental anatomy is very important in clinical practice.<sup>1</sup> To restore the aesthetics of the smile, professionals must have technical scientific knowledge about current composites, artistic sense, and manual dexterity.<sup>2-5</sup> Without this knowledge, it is impossible to practice dentistry, which helps restore teeth that are missing or broken and maintain dental health. The anatomical shape of the rebuilt teeth must be correct for the restoration of dental function.<sup>6-8</sup> Dentistry demands specialized skills in applying knowledge of dental morphology and anatomy.<sup>9</sup> Dental restorations and prostheses are supposed to achieve an aesthetically acceptable aspect and accomplish functioning in the patient through both direct and indirect oral rehabilitation.<sup>9,10</sup> Dental students must therefore be familiar with tooth anatomy and sculpting procedures.

Given that dental technicians never work directly with patients and are always supervised by a dentist or prosthodontist, dental technicians need to possess a similar level of fundamental knowledge in the anatomical sciences without considering clinical applications.<sup>5</sup> Dental anatomy involves an overview of how teeth work together in a normal occlusion in addition to a descriptive examination of individual teeth. A more comprehensive approach to dental treatment is made possible by knowledge of dental anatomy and an awareness of the principles of proper occlusion. Dental technicians can communicate with other oral health professionals in an effective manner since they are knowledgeable about dental anatomy. In recent years, interdisciplinary dental collaboration has gained increasing popularity.<sup>11</sup> Since oral biology enables a complete approach to dental issues, dental technicians and other dental practitioners should be aware of the often-stated statement that "the mouth is connected to the rest of the body". It was determined that the careers of dental technicians and dentists depend on understanding tooth morphology.<sup>5</sup>

The undergraduate dentistry programs in Türkiye cover a total of 5 years of professional education. Conversely, dental technicians who successfully completed a two-year vocational program in dental prosthesis technology were awarded the title of health technician (dental prosthesis). Students are introduced to the morphological features of primary and permanent human dentition in a dental anatomy course, which is a part of the fundamental core sciences program in dental schools and dental prosthesis technology programs. Students learn about the morphology of teeth, how to identify teeth, and how to spot abnormalities in teeth. The course also starts to build the psychomotor abilities needed by students to restore teeth to their proper form and function. Typical activities for practical study sessions included wax, chalk, or soap carving of teeth,<sup>3,12</sup> plastic tooth replicas,<sup>12,13</sup> extracted teeth,<sup>12,14</sup> and sketching two-dimensional (2D) representations of teeth.<sup>12,15,16</sup> The general course was offered as part of the undergraduate dentistry and dental technician program in the first year. Approximately 28 hours of theoretical classes and 84 hours of practical classes are required for this course

during the first semester of the dentistry degree. Approximately 42 hours of theoretical classes and 70 hours of practical classes are needed for the dental prosthesis program. According to "Curriculum Guidelines for Dental Anatomy" by Okeson and Buckman,<sup>17</sup> the goal of the dental anatomy course is to provide students with the basic cognitive skills related to tooth morphology.

Knowledge of dental anatomy, which facilitates professional communication between dentists and dental technicians and enables them to speak the same language, should be similar in both professional groups. Thus, clinical and laboratory processes can be better managed. To the best of the authors' knowledge, no study has compared tooth morphology knowledge, attitudes and practices between dentists and dental technicians. This study aimed to evaluate the differences, if any, in the knowledge, attitudes and practices of dental morphology between dental students (DSs) and dental technician students (DTs).

## Materials and Methods

Participation was voluntary, and only data from consenting participants were included in the study. Written informed consent was obtained from the study participants. The study was approved by the Health Sciences Research and Publication Ethics Committee of Bursa Uludağ University, Bursa, Türkiye (reference number: 2024-03-27/2024-03).

The questionnaire was structured with open-ended and closed-ended questions. The questionnaire consisted of three sections: demographic profile (four items), dental morphology knowledge level (ten items), attitudes toward tooth morphology (seven items) and practices related to tooth morphology (five items).

Demographic data were collected regarding gender, age, academic program and term of the students in the first section. In order to assess participants' knowledge of dental anatomy, ten questions covering basic concepts in morphology and dental anatomy were asked in the second section (Supp. 1). In the third and fourth sections, the students were asked to rate their level of agreement with statements describing various aspects of the attitude and practice of dental morphology using a 5-point Likert-type scale with the options of strongly disagree (1), disagree, neutral, agree, and strongly agree (5).<sup>4</sup>

A self-administered questionnaire consisting of 25 closed-ended questions and 1 open-ended question was used in a descriptive cross-sectional study including the DSs and DTs. A questionnaire survey was conducted with the students who could be reached face to face and the students who could not be reached via the Google Forms link. The online survey remained accessible for a month. After the set deadline, the gathered data were transferred to a Microsoft Excel spreadsheet. A total of 274 student responses were received, including 163 from dental students and 111 from dental technician students. Only preclinical dental students were included in the study.

The data were analyzed using Jamovi (V2.3.21, The Jamovi Project, Australia) software. The Kruskal-Wallis test was used to assess the normality of the data. One-way

ANOVA was applied to analyze the differences in knowledge, attitudes and practices between the DSs and DTs. Furthermore, an independent t test was used to observe whether any differences existed in the above parameters when two groups were compared at a time. In addition, the differences in knowledge, attitudes, and practices among the DSs were analyzed using One-way ANOVA. For all the tests,  $p < 0.05$  was considered to indicate statistical significance.

## Results

Of the 274 students, 93 (33.9%) were men, and 181 (66.1%) were women. The participants' ages ranged from 17 to 46 years, with an average of 20.4 years. The study included 104 (38%) first-year, 104 (38%) second-year, and 66 (24%) third-year students.

Between the DSs and DTs groups, there was a statistically significant difference in their knowledge and practices of tooth morphology ( $p < 0.001$ ) (Table 1). However, DTs' knowledge scores were significantly greater, and DSs' practice scores were significantly greater. With an average of 3.86 accurate answers for DTs and 3.16 correct answers for DSs, it was noted that both groups showed poor levels of knowledge regarding dental morphology. There was no significant difference in the attitude of tooth morphology between the two groups ( $p = 0.379$ ).

In the DSs group, there was a statistically significant difference in the knowledge of tooth morphology among first-, second- and third-year students ( $p < 0.001$ ) (Figure 1). The first-year students answered  $4.22 \pm 1.63$  questions correctly, which was a higher knowledge level than that of the other students. The knowledge levels of second-year ( $2.80 \pm 1.64$ ) and third-year ( $2.71 \pm 1.58$ ) dental students were comparable. However, there was no significant difference in

the attitudes or practices related to tooth morphology regarding the term of the students in the DSs group ( $p > 0.05$ ).

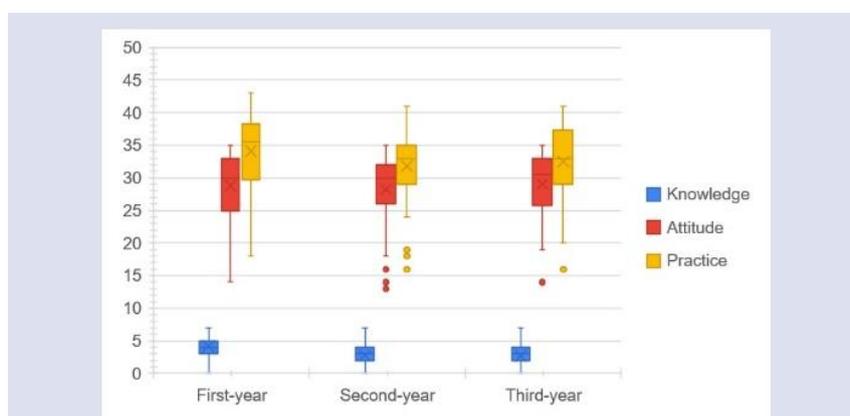
In the DTs group, there was no significant difference in the knowledge, attitudes or practices of tooth morphology regarding the term of the students ( $p > 0.05$ ). The knowledge, attitudes, and practices of first- and second-year dental technician students were comparable (Figure 2).

In response to a specific question about attitudes toward tooth morphology, 65.03% of DSs and 63.96% of DTs strongly agreed that providing the necessary aesthetics increases the confidence and satisfaction of patients, which is the greatest challenge in practice. The majority of participants strongly agreed that knowing tooth morphology will help them in their daily clinical/laboratory work (57.06% of DSs and 63.06% of DTs), that knowing the anatomic landmarks of the teeth strengthens the communication network between the dentist and the dental technician (57.67% of DSs and 55.86%), and that the morphology of each tooth plays an important role in determining occlusion (54.6% of DSs and 58.56% of DTs). A total of 38.65% of the DSs agreed that the current curriculum was effective in helping them gain sufficient dental anatomy knowledge, whereas 35.14% of the DTs were neutral. However, the results were not statistically significant for the "attitude" set of questions ( $p > 0.05$ ).

The DSs group ( $32.7 \pm 5.81$ ) had greater tooth morphology scores than did the DTs group ( $15.9 \pm 4.65$ ) ( $p < 0.001$ ). The majority of participants in both groups gave neutral answers to all questions with respect to the practice of tooth morphology (Table 2). A total of 33.74% of the DSs were neutral, and the authors disagreed that they could modify crown restoration for primary teeth according to morphological needs.

**Table 1.** Comparison of knowledge, attitudes and practices related to tooth morphology between dental students (DSs) and dental technician students (DTs).

	DSs	DTs	p value
Knowledge	$3.17 \pm 1.73$	$3.86 \pm 1.40$	$< 0.001$
Attitude	$28.7 \pm 5.26$	$28.1 \pm 5.72$	0.379
Practice	$32.7 \pm 5.81$	$15.9 \pm 4.65$	$< 0.001$



**Figure 1:** Comparison of knowledge, attitudes and practices scores related to tooth morphology among first-, second- and third-year dental students

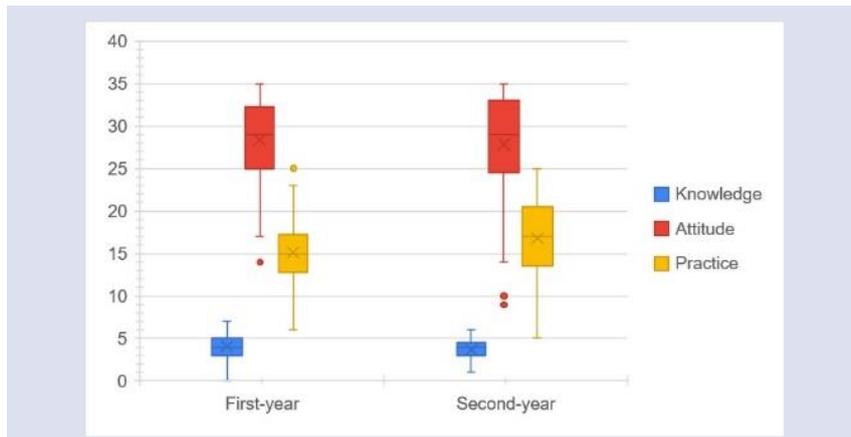


Figure 2: Comparison of knowledge, attitudes and practices scores related to tooth morphology between first- and second-year dental technician students

Table 2. Responses of dental students (DSs) and dental technician students (DTs) regarding knowledge, attitudes and practices related to tooth morphology

Parameters Questions	n (%)										
	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		
	DSs	DTs	DSs	DTs	DSs	DTs	DSs	DTs	DSs	DTs	
Attitude	Knowing tooth morphology will help me in my daily clinical/laboratory work.	93 (57.06)	70 (63.06)	39 (23.93)	14 (12.61)	23 (14.11)	14 (12.61)	7 (4.29)	8 (7.21)	1 (0.61)	5 (4.50)
	The current curriculum was effective in helping me gain sufficient dental anatomy knowledge.	32 (19.63)	26 (23.42)	63 (38.65)	26 (23.42)	40 (24.54)	39 (35.14)	23 (14.11)	11 (9.91)	5 (3.07)	9 (8.11)
	Dental carving sessions are a practical training that enables effective recording and preservation of information of tooth morphology.	61 (37.42)	40 (36.04)	43 (26.38)	35 (31.53)	35 (21.47)	17 (15.32)	18 (11.04)	12 (10.81)	6 (3.68)	7 (6.31)
	Knowing the anatomic landmarks of the teeth strengthens the communication network between the dentist and the dental technician.	94 (57.67)	62 (55.86)	36 (22.09)	26 (23.42)	23 (14.11)	12 (10.81)	9 (5.52)	6 (5.41)	1 (0.61)	5 (4.50)
	The morphology of each tooth plays an important role in determining occlusion.	89 (54.60)	65 (58.56)	46 (28.22)	31 (27.93)	20 (12.27)	10 (9.01)	7 (4.29)	3 (2.70)	11 (0.61)	2 (1.80)
	Knowledge of tooth morphology plays an important role in forensic cases and investigations.	63 (38.65)	44 (39.64)	46 (28.22)	17 (15.32)	34 (20.86)	25 (22.52)	17 (10.43)	19 (17.12)	3 (1.84)	6 (5.41)
Practice	Providing the necessary esthetics increases the confidence and satisfaction of patients, which is the greatest challenge in practice.	106 (65.03)	71 (63.96)	32 (19.63)	20 (18.02)	17 (10.43)	14 (12.61)	8 (4.90)	5 (4.50)	0	1 (0.90)
	Subconscious knowledge of tooth morphology has transformed into a good tooth sculptor	28 (17.18)	20 (18.02)	34 (20.86)	23 (20.72)	62 (38.04)	30 (27.03)	33 (20.25)	26 (23.42)	6 (3.68)	12 (10.81)
	Can effectively carry out the stages of crown restoration for permanent teeth because of knowing the morphology of each tooth in detail	18 (11.04)	22 (19.82)	51 (31.29)	20 (18.02)	55 (33.74)	34 (30.63)	33 (20.25)	24 (21.62)	6 (3.68)	11 (9.91)
	Can modify the crown restoration for primary teeth	12 (7.36)	20 (18.02)	24 (14.72)	22 (19.82)	55 (33.74)	32 (28.83)	55 (33.74)	28 (25.23)	17 (10.43)	9 (8.11)

according to morphological needs.											
There is no scope for deviation from the normal while carving or restoring the lost tooth structure	19 (11.66)	20 (18.02)	37 (22.70)	30 (27.03)	61 (37.42)	33 (29.73)	35 (21.47)	19 (17.12)	11 (6.75)	9 (8.11)	
Confident to apply tooth morphology knowledge as an investigative tool in forensic sciences	23 (14.11)	22 (19.82)	35 (21.47)	25 (22.52)	65 (39.88)	32 (28.83)	33 (20.25)	16 (16.41)	7 (4.29)	16 (14.41)	

## Discussion

Anatomy studies provide dental technicians and dentists a deeper understanding of how tissues function, which helps them with diagnosis, treatment planning, and making referrals when needed.<sup>5</sup> Conventional teaching methods for dental anatomy include textbooks, manuals, lectures, big three-dimensional models, preserved tooth samples, and sectioned natural teeth that display the internal structure.<sup>3</sup> In addition, issues with traditional teaching methods have been underlined again and time again. During the initial years of dental school, dental anatomy and sculpture are taught in a time-constrained manner away from preclinical and clinical settings. Dental anatomy is taught early in most dentistry programs in Türkiye; thus, by the time students need to apply this information in a clinic, they have already lost part of it. This may depend on the commitment to be continuously updated on the issue, which causes gaps in student successes during the transition to the clinical year.<sup>3</sup> According to the current study, first-year dental students had greater knowledge of dental morphology than did second- and third-year dental students. As a result, teaching strategies should focus on helping dental students retain their knowledge of dental anatomy and morphology over time. The study's teaching method, which is restricted to the first semester of the dental course, is based on a conventional step-by-step geometrical approach. de Azevedo *et al.*<sup>18</sup> still gave preclinical dental students a reinforcement theoretical session in an effort to help them remember significant anatomical and morphological concerns, and as a result, they saw an improvement in their ability to carve. In this way, innovative methods that modify teaching and take into account students' learning preferences are added to conventional teaching methods.<sup>19,20</sup>

The results of the current study indicated that DSs and DTSs had poor knowledge of tooth morphology. This may be due in part to the numerous obstacles faced in teaching the basic sciences in the dental field. These difficulties include an increase in the number of students enrolled, a decrease in the amount of time spent teaching, increased access to discipline-specific resources, and an expanding focus on relevant clinical applications.<sup>5,21</sup> Another reason may be that since preclinical dentistry students do not perform clinical applications on patients, they may not need to recall their dental anatomy knowledge. Likewise, dental technician students may not need to use their dental anatomy knowledge due to the limited practice of prosthetics in the laboratory. However, both groups need to update their

dental morphology knowledge with reminder courses and have applications that can use this information.

It is essential to maintain knowledge regarding the complex interaction between teeth and anatomical tissues when performing restorative and prosthetic procedures.<sup>5,22</sup> Consequently, it is important to improve the way dental anatomy courses are taught, especially the skill of carving, which is necessary to accurately replicate teeth while taking shape, function, and aesthetics into account. According to previous studies, almost 80% of dental students thought that tooth morphology through session activities such as carving helped them better comprehend dental anatomy.<sup>23-25</sup> The majority of participants in this study (63.80% of DSs and<sup>27</sup> at enables effective recording and preservation of tooth morphology information.

Regarding attitudes toward tooth morphology, there was no significant difference between the DSs and DTSs groups or within the groups in terms of DSs or DTSs. The majority of the DSs and DTSs responded favorably to the attitudes of comprehending and implementing their knowledge of tooth morphology. Overall, 54.60% of the DSs and 58.56% of the DTSs strongly agreed that the morphology of each tooth plays an important role in determining occlusion. As shown in a study by Sierpiska *et al.*,<sup>26</sup> the occlusal morphology of molars and premolars significantly affects the duration of occlusion. The majority of the participants in the current study had this awareness. In the current study, 38.65% of the DSs agreed that the current curriculum was effective in helping them gain sufficient dental anatomy knowledge, whereas 35.14% of the DTSs were neutral. In a self-reported study, Abu Eid *et al.*<sup>15</sup> reported that while tooth carving has helped to improve manual dexterity, the dental anatomy curriculum still needs to be improved.

Collaboration between the dental technician and dentist is more important because the two professions work together more often.<sup>27</sup> Effective teamwork between the dentist and dental technician is crucial for achieving optimal outcomes from removable partial denture therapy.<sup>28</sup> A dental technician should be able to recall the information covered in dental anatomy and interact with the other members of the team at a suitable level when discussing prosthetic rehabilitation.<sup>5</sup> In the current study, DSs (57.67%) and DTSs (55.86%) also strongly agreed that knowing the anatomic landmarks of the teeth strengthens the communication network between the dentist and the dental technician. Similarly, they agreed that knowing tooth morphology will help them in their daily clinical/laboratory work.

Dental students outperformed dental technician students in the current study in terms of their practice with tooth morphology. The following theories could be put up as to why DTSs are novices who lack confidence, have fewer practical sessions than DSs, have little experience in the lab, and are under time constraints due to limited posting hours in the lab; they are constantly focused on passing exams and have a mindset of meeting departmental quotas; they are preoccupied with completing an immediate goal and are unsure of how to react when things do not go as planned; and they require a recipe for action. When faced with difficult situations related to dental morphology, DTSs believe they might not be able to accomplish.

Tooth dimensions and nonmetric factors are utilized in forensic anthropology and odontology to determine ethnicity and gender. Furthermore, individual or distinctive dental morphological characteristics are employed to compare premortem and postmortem dental results in forensic dental identification instances.<sup>29</sup> In the current study, dental students (38.65% of DSs) and dental technician students (39.64% of DTSs) both strongly agreed that knowledge of tooth morphology plays an important role in forensic cases and investigations. But DSs (39.88% neutral) and DTSs (28.83% neutral) were unconfident in applying their knowledge of tooth morphology as an investigative tool in the forensic sciences. In light of these results, it is intended that students expand their practices in this area. This can be accomplished by including the content of the forensic odontology course in the dental anatomy and morphology course rather than as a separate course, as is currently done.

Within the findings of the present study, differences were shown between dental students and dental technician students in terms of dental morphology knowledge and practice. In universities and dental clinics, interprofessional education for dentists and dental technicians can be extended beyond attending lectures and creating treatment plans for patients with removable dentures to include actual dental therapy. Incorporating shared learning into the curriculum can assist students understand communication and their individual roles while also teaching them the value of teamwork by allowing them to work as members of teams and other professions.<sup>30</sup>

There were several limitations of the current study. The effects of dental morphology teaching strategies on the knowledge, attitudes, and practices of dental students and dental technician students were not assessed in this study. There was no comparison of the two groups' tooth carving ability, which is correlated with theoretical knowledge of dental morphology. The limited number of dental technicians included in the study prevents the generalization of the results to the group. This study included only preclinical dentistry students. Future studies can reveal the dental morphology knowledge, attitudes and practice levels of clinical students and compare these characteristics between preclinical and clinical dental students as well as dental technician students.

## Conclusions

One of the basic core sciences courses in the dental school and dental prosthesis technology program curricula is dental anatomy. Knowing the variations in knowledge, attitudes, and practices of dental morphology between a dentist and dental technician may help us take preventative measures. While preclinical dental students and dental technician students had different levels of practice, both groups were less knowledgeable about tooth morphology. First-year dental students had greater knowledge than second- and third-year students. Dental students had more practices in tooth morphology than did dental technician students. Both groups had similarly high attitudes toward tooth morphology.

## Acknowledgments

The authors would like to thank all the dental students and dental technician students for their participation in this study.

## Conflict of interest

The authors declare no conflict of interest.

## References

1. McHanwell S. Teaching anatomical sciences to dental students. In: Chan LK, Pawlina W (Editors). *Teaching Anatomy: A Practical Guide*. 1st Ed. New York, NY: Springer International Publishing 2015. p. 353–361.
2. Rubinstein S, Nidetz A. The art and science of the direct posterior restoration: Recreating form, color, and translucency. *Alpha Omega* 2007;100:30–35.
3. de Azevedo RA, da Rosa WL, da Silva AF, Correa MB, Torriani MA, Lund RG. Comparative effectiveness of dental anatomy carving pedagogy: A systematic review. *J Dent Educ* 2015; 79:914–921.
4. Patil S, Sowmya SV, Rao RS, Raj T. Knowledge, attitude and practice of tooth morphology among dental students. *J Adv Clin Res Insights* 2015;2:124-130.
5. Bakr MM, Thompson CM, Massadiq M. Anatomical sciences: A foundation for a solid learning experience in dental technology and dental prosthetics. *Anat Sci Educ* 2017;10:395–404.
6. Magne P. A new approach to the learning of dental morphology, function, and esthetics: The “2D-3D-4D” concept. *Int J Esthet Dent* 2015;10:32–47.
7. Erdemir U, Yuçel T, Yildiz E, Cakan DG, Sayinsu K. Dental analysis. In: Erdemir U, Yildiz E (Editors). *Esthetic and Functional Management of Diastema: A Multidisciplinary Approach*. 1st Ed. Cham, Switzerland: Springer International Publishing. 2016. p. 101–120.
8. Culp T, Culp L. Communicating with dental laboratories. In: Weinstein GM, Zientz MT (Editors). *The Dental Reference Manual: A Daily Guide for Students and Practitioners*. 1st Ed. Cham, Switzerland: Springer International Publishing. 2017. p. 409–426.
9. Conte DB, Zancanaro M, Guollo A, Schneider LR, Lund RG, Rodrigues-Junior SA. Educational interventions to improve dental anatomy carving ability of dental students: A systematic review. *Anat Sci Educ* 2021;14:99–109.

10. Elgreatly A, Mahrous A. Enhancing student learning in dental anatomy by using virtual three-dimensional models. *J Prosthodont* 2020;29:269–271.
11. Leisnert L, Karlsson M, Franklin I, Lindh L, Wretling K. Improving teamwork between students from two professional programmes in dental education. *J Dent Educ* 2012;16:17–26.
12. Lone M, McKenna JP, Cryan JF, Downer EJ, Toulouse A. A Survey of tooth morphology teaching methods employed in the United Kingdom and Ireland. *Eur J Dent Educ* 2018;22:e438–e443.
13. Wang H, Xu H, Zhang J, Yu S, Wang M, Qiu J, et al. The effect of 3D-printed plastic teeth on scores in a tooth morphology course in a Chinese university. *BMC Med Educ* 2020;20:469.
14. Cantín M, Muñoz M, Olate S. Generation of 3D tooth models based on three-dimensional scanning to study the morphology of permanent teeth. *Int J Morphol* 2015;33:782-787.
15. Abu Eid R, Ewan K, Foley J, Oweis Y, Jayasinghe J. Self directed study and carving tooth models for learning tooth morphology: Perceptions of students at the University of Aberdeen, Scotland. *J Dent Educ* 2013;77:1147-1153.
16. Magne P. A new approach to the learning of dental morphology, function, and esthetics: The “2D-3D-4D” concept. *Int J Esthet Dent* 2015;10:32–47.
17. Okeson J, Buckman J. Section on Dental Anatomy and Occlusion, American Association of Dental Schools. Curriculum guidelines for dental anatomy. *J Dent Educ* 1993;57:382–383.
18. de Azevedo RA, Torriani MA, Correa MB, Lund RG. Optimizing quality of dental carving by preclinical dental students through anatomy theory reinforcement. *Anat Sci Educ* 2018;11:377–384.
19. Alzahrani AA, Alhassan EM, Attia MA, Albanghali MA. Enhancing dental carving skills of preclinical dental hygiene students using online dental anatomy resources. *Open Dent J* 2019;13:499–504.
20. Zafar S, Zachar JJ. Evaluation of holohuman augmented reality application as a novel educational tool in dentistry. *Eur J Dent Educ* 2020;24:259–265.
21. Darda DM. Observations by a university anatomy teacher and a suggestion for curricular change: Integrative anatomy for undergraduates. *Anat Sci Educ* 2010;3:73–76.
22. Al-Asmar AA, Al-Nsour M, Alsoleihat F. Is there a correlation between students’ performance in dental anatomy and performance in operative dentistry? *Int J Morphol* 2019;37:93-97.
23. Singh D, Pandey P, Kudva S, Singh MK, Chandra S. Perception of dental students about tooth carving in dental education at a tertiary level health care facility. *Medico Legal Update* 2020;20:1493-1499.
24. Oweis Y, Eriefej N, Eid RA. Students’ perceptions of dental anatomy course at the University of Jordan. *Jordan Med J* 2015;49:147-154.
25. Mandalaywala D, Pillai JP, Monpara P, Gadhavi T. Perception of dental anatomy among dental students, dental practitioners, and dental academicians: A questionnaire-based cross-sectional study. *J Acad Dent Educ* 2022;8:9-14.
26. Sierpinska T, Kropiwnicka A, Kuc J, Jacunski P, Gołębiewska M. The influence of occlusal morphology on occlusion time. *Cranio* 2017;35:101-109.
27. Kamijo S, Sugimoto K, Oki M, Tsuchida Y, Suzuki T. Trends in domiciliary dental care including the need for oral appliances and dental technicians in Japan. *J Oral Sci* 2018;60:626-633.
28. Davenport JC, Basker RM, Heath JR, Ralph JP, Glantz PO, Hammond P. Communication between the dentist and the dental technician. *Br Dent J* 2000;189:471-474.
29. Gupta S, Agnihotri A, Chandra A, Gupta OP. Contemporary practice in forensic odontology. *J Oral Maxillofac Pathol* 2014;18:244-250.
30. Takeuchi Y, Koizumi H, Imai H, Furuchi M, Takatsu M, Shimoe S. Education and licensure of dental technicians. *J Oral Sci* 2022;64:310-314.