

Clinical Relevance Of Wax Carving And Its Integration In The Undergraduate Dental Curriculum: Students' Perceptions And Experiences

Research Article

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Abstract

Introduction: Dental anatomy is an integral component of the dental undergraduate curriculum that includes tooth carving exercises for the recognition of morphological and functional characteristics of teeth. The objective of the study was to explore the clinical relevance & predictive validity of tooth carving exercises and their correlation with clinical skills.

Material and methods: This cross-sectional study was conducted from September 2021 till October 2021 at constituent dental colleges of Dow University of Health Sciences. Undergraduate dental students in clinical years were targeted. A modified questionnaire comprising of 14 items was distributed through Google Forms. Data were analyzed using SPSS 21. Chi-square was used for finding a correlation between wax carving and clinical performance.

Results: A total of 216 students consented and participated in this study. The majority of the participants (74.1%, p-value= 0.008) agreed that tooth carving helped them understand the intricacies of tooth morphology and (81.5%, p-value= 0.057) agreed that it developed manual dexterity and familiarity of dental instruments. Almost half of the participants (46.3%) valued its clinical significance in restorative dentistry. Regarding inclusion in the undergraduate curriculum 120 participants agreed that it was a clinically relevant subject (0.002).

Conclusion: Dental students in their clinical undergraduate years valued the dental wax carving exercises taught in their undergraduate curriculum and these carving exercises helped them in understanding and learning tooth morphology and improved their clinical skills in restorative dentistry.

Keywords: Dental Carving, Tooth Morphology, Perception, Curriculum.

Background

Dental anatomy is an integral component of the dental curriculum forming the very basis of preclinical knowledge of dentistry. The knowledge acquired by students in their foundation year is later on utilized in their clinical practice.[1] Oral anatomy explores the relationship of the skull to jaws, the complex joints and the muscles that control movement, the blood vessels, and the nerves that supply these structures.[2] Woelfel et al portray learning the principles of dental anatomy as a “foreign language, which students will use for the rest of their professional lives.”[3] Hence, to acquire clinical skills or to excel in dentistry throughout life, it is important to pay the utmost attention to tooth morphology and

anatomy. Considering minimally invasive procedures as a new paradigm in evidence-based dentistry, preserving the normal tooth anatomy is imperative during restorative treatment.[4, 5] Dental students are expected to not only know the proper anatomy of each tooth but also be capable of recreating it. It is not just about the esthetics but the proper function of teeth is also very crucial for the longevity of dental restorations.[6] Furthermore, It is imperative to learn and maintain manual dexterity for good clinical practice.[7]

Tooth anatomy which is the foundation for clinical and laboratory dentistry is traditionally taught by didactic lectures followed by small group learning activities such as drawing graphs, indi-

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vidual tooth models, digital atlases, and wax carving. Theoretical knowledge of dental anatomy is essential but at the same time, psychomotor skills in clinical dentistry need to be developed. 8 Theoretical teaching methods may not be sufficient in developing psychomotor skills. Though, traditional wax carving exercises portray some shortcomings that may become a source of annoyance among students and teachers. [9, 10] Hence, students' perceptions regarding wax carving must be sought to design and redefine the dental curriculum.[11] In most of the universities introduction of dental morphology is done initially by traditional lecture delivering method to large and small group sessions followed by written examination.[12] Online resources and computer-assisted programs like 3D modeling and computer graphics can assist in understanding the 3D dental anatomy,[13-15] a blended program was found to be the most useful.[16] Wherever tooth carving is integrated as a part of pre-clinical dentistry, it is usually practiced on standardized wax blocks or soap bars.[17-19]

The main aim of tooth carving is to recreate morphological features of the dentition so that both tooth form and physiological function can be restored. It is an exercise to replicate the particular convexities, concavities, and contours in all dimensions of the tooth, moreover, students also develop hand instrumentation skills for example; handgrip, dexterity, precision, and aiming. [20] Equipping dental students with these basic skills to carry on to their clinical practice should be the end goal.

Some arguments are coming forward regarding the relevance of tooth carving in the clinical practice of dental students. These opinions are mostly personal giving rise to further discussions. [9, 21, 22] The perception of students doing their clinical rotations must be focused upon, as this will provide valuable feedback regarding the applicability of wax carving. The perception that a correlation exists between tooth carving in preclinical years and their performance in the final years of the graduate program must be further investigated as there is a lot of research gap, especially in Pakistan. As teachers, we believe that dental curriculum planning concerning tooth carving should most importantly include suggestions and feedback of dental students and clinicians.

Therefore, this study aimed to gain students' perspectives regarding the use of dental wax carving and whether it familiarizes them with dental anatomy and improves manual dexterity. The relevance to their present-day practice along with their recommendations was also sought.

Methodology

The cross-sectional study was conducted on students in their clinical undergraduate years and dental interns in three affiliated dental colleges of Dow University of Health Sciences from September 2021 till October 2021. This study was conducted in commonly accepted educational settings and was following the ethical standards of the Helsinki Declaration. This study was approved by the Institutional Review Board of Dow University of Health Sciences (Ref: IRB-2168/DUHS/Approval/2021). The anonymity and confidentiality of all students were guaranteed.

All students in their clinical years from the dental colleges of Dow University of Health Sciences were included in this study. During the study period, 216 students of clinical undergraduate years

consented and participated in this study. A questionnaire was adapted based upon available literature review [10, 23] comprising of three sections including socio-demographic data, close-ended questions regarding the perceptions of students, and a recommendations portion.

This questionnaire was distributed online through Google Forms amongst the target population. It required five minutes to complete and was kept anonymous to protect their data. The questions focused on students' opinions regarding the importance of tooth carving and whether it helped them better to understand the overall tooth morphology, whether it helped in developing hand instrumentation skills, whether the exercises were useful and familiarized them with lab instruments and whether it was relevant to their present clinical practice. Some questions were also asked about their views on the inclusion of tooth carving in the undergraduate dental curriculum, the time allotted to this lab exercise, whether dental carving exercises should be assessed or not, and whether computer programs aid in improving the exercise.

Lastly, suggestions and recommendations were asked regarding its clinical application. Data were analyzed using SPSS version 20 for frequency and percentage of responses. Chi-square was used for other comparisons with a 95% confidence interval while the p-value was set at less than 0.05 for statistical significance.

Results

There was a total of 216 participants who responded to the questionnaire. Among which 144 were female and the remaining were male. Ages were from 20-23 years and the majority were dental interns. (Table: 1)

All the participants had practiced dental wax carving (Table: 2) in their academic session among which 196 participants carved only permanent teeth and the remaining carved both sets of dentition, these results were significant (p -value = 0.002) when were associated with years of practice of participants. Regarding the importance of anatomy of crown and root, 180 (p -value = 0.000) participants considered both as being equally important, however, 28 (13%) students thought that only crown was important to carve for clinical significance. The majority of the participants (74.1%, p -value = 0.008) agreed that tooth carving helped them better understand the morphology of tooth and (81.5%, p -value = 0.057) agreed that it had helped them familiarize themselves with the lab instruments. Almost half of the participants (46.3%) accepted its importance in clinical restorative dentistry, and the finding was significant when associated with all the variables (age-group = 0.000, gender = 0.085, and years of practice = 0.000). Many (53.7%) understood the concept of occlusion (p -value = 0.000) while the practice of carving helped 48.1% of participants in improving their overall clinical skills (p -value = 0.013).

Regarding the time allotment for carving in the dental undergraduate curriculum, 120 participants agreed that it is relevant enough (0.002) and 68.5% believed that it should be continued in the dental UG curriculum (0.036), however, 61.1% of participants did not agree to include this as an assessment parameter in university exams which was significant when associated with all the variables (0.000, 0.003 & 0.000)

Table 1. Demographic details of the participants.

Characteristics	n = 216 (%)
Age	
20 & 21 years	100 (46.3%)
23 & 24 years	116 (53.7%)
Mean ± SD	21.62±0.97
Sex	
Female	144 (66.7%)
Male	72 (33.3%)
Years of undergraduate	
3rd year	48 (22.2%)
Final year	68 (31.5%)
House officer	100(46.3%)

Table 2. Responses from participants and their association with years of education/gender.

Responses	Yes	No	Don't know	Association with years of education/Gender	
Did you carve complete set of teeth?	Permanent	Deciduous	both	p-valueα	
	196 (90.70%)	NONE	20 (9.30%)	0.002	0.619*
Which part of tooth anatomy do you think is important?	Crown	Root	Both		
	28 (13.00%)	8 (3.70%)	180 (83.30%)	0	0
Has tooth carving exercises helped you better understand tooth morphology?	160 (74.10%)	44 (20.40%)	12 (5.60%)	0.008	0.629
Has the carving session helped you familiarize with lab instruments and understand the proper grip of instruments?	176 (81.50%)	32 (14.80%)	8 (3.70%)	0.407	0.057
Was the tooth carving useful in restorative dentistry?	100 (46.30%)	48 (22.20%)	68 (31.50%)	0	0.085
Did carving of tooth help you in understanding dental occlusion?	116 (53.70%)	84 (38.90%)	16 (7.40%)	0	0.026
Carving has helped me to improve my clinical skills?	104 (48.10%)	68 (31.50%)	44 (20.40%)	0.013	0
Is the total time allotted for tooth carving in UG dental syllabus relevant?	120 (55.60%)	56 (25.90%)	40 (18.50%)	0.001	0.002
Do you think carving should be continued in undergraduate dental syllabus?	148 (68.50%)	56 (25.90%)	12 (5.60%)	0.147	0.036
Should carving be included as an assessment parameter in university exams?	64 (29.40%)	132 (61.10%)	20 (9.30%)	0.000	0.003
Do you think computer software with image simulation techniques will help in learning tooth anatomy better?	188 (87%)	16 (7.40%)	12 (5.60%)	0.025	0.762
Do you think the carving exercise has room for improvement and needs to be taught better?	116 (53.70%)	44 (20.40%)	56 (25.90%)	0.000	0.002

αChi Square test /*Fisher's exact test

Most of the dental students and interns (87%, p-value= 0.025) stated that computer software with image simulation techniques would significantly help them in learning dental anatomy. Regarding the continuation of the carving exercise with improvement in clinical practice, half of the participants (53.7%, p-value= 0.002) agreed on keeping the carving exercise in the dental undergraduate program.

Discussion

Dentistry is the blend of both science and art, and a dentist is obligated to have sufficient knowledge with aesthetic perception to restore the lost tooth structure with its function and appearance. [24] Dental wax carving is a part of the curriculum of the subject

of Oral Biology in the first year of the undergraduate dentistry program in Pakistan, which is very important in terms of the recognition of morphological and functional characteristics of teeth. [25] As part of curricular reforms and program evaluation, students' perception of the applicability of tooth carving was measured. Students who were in their initial clinical years were the population of this research as only these students can gauge the usefulness and clinical relevance of carving exercise in their undergraduate years. This study was needed to get an idea regarding the practical usefulness of wax carving.

It was noticed that all participants answered the first part of the questionnaire but the part about recommendations was left unanswered. It could be probably because they wanted to complete the questionnaire in a haste or they did not feel the need to write

individual comments as the questions before that pretty much covered it all. All the participants in this research had practiced tooth carving in their academic years among which 33.3% were males and the remaining were females and the majority were house officers. Only 9.3% of students carved both sets of teeth (deciduous and permanent) however, the majority 90.7% carved only permanent teeth. Considering the importance of carving, the majority of students agreed that carving of both parts (crown and root) is equally important, which is in agreement with the previous research conducted in Nepal [6] and disagrees with the findings of India where students think that carving of the root is a total waste of time. [26]

Dental carving sessions in wax are part of the dental curriculum but not all universities in Pakistan make their students practice carving in their undergraduate course, probably because some of the educators believe its time consuming and a waste of resources. However, 74.1 % of students in this research believed that carving sessions at the undergraduate level have helped them in better understanding of tooth morphology with almost similar findings in all previous researches, 70.7 % in research in Nepal-10 with 71.1 % in Malaysian research [23] with higher findings 94.2% in the research conducted in Nepal in 2019. [6] Dentistry is an art associated with science and its knowledge and manual dexterity play an important role in maintaining dental skills. Regarding the familiarization with lab instruments with the improvement in professional grip, 81.5% of students believe that has improved due to carving sessions with almost similar findings in previously done researches in Nepal and Malaysia. [6, 23] Dental wax carving not only improves psychomotor skills for restoring teeth in terms of form and function but also improves overall clinical skills. [9] Regarding its allotted time in an undergraduate course, 55.6% of students were satisfied with it, and these findings were almost similar in the research in Nepal which reported 58.8% [6], 68.5% of students wanted this to remain a part of the dental curriculum in future, which is less than the finding in Nepal where almost all the participants agreed to keep this exercise in the undergraduate course. [6] However, only one-third of students (29.4%) were willing to include it as an assessment parameter in university exams which is also opposite to the findings of Nepali research where 28.3% of students wanted to remove this exercise from university summative exams. [6] We intend to give rise to further discussions with our subject experts regarding its assessment.

Methods of learning dental anatomy in different dental colleges of Dow University of Health Sciences includes lectures and tutorials from the content of books along with a different range of practical sessions that include color-coding on models for identification of landmarks, articulation of both arches (maxilla and mandible) on plane line articulators and ground sectioning of anterior and posterior teeth for viewing and learning histological features of dental hard tissues under the light microscopy. Learning of tooth morphology is further facilitated by studying and identifying features from macro-models of the individual tooth and ideal set of teeth models for better visualization and identification of teeth. Students are further instructed to draw individual teeth on graph books for a better understanding of measurements. A systematic review has shown that similar educational interventions have resulted in improving the learning of dental anatomy. [27] Newer innovative technology like viewing teeth on digital apps was appreciated by 87% of students who think that such image simulation techniques enhance their learning of tooth anatomy and these

findings were more than the previous research. [6]

Wax carving is an auxiliary method to reinforce the dental anatomy landmarks, improve manual dexterity, familiarity, and grip on hand instruments which is very important in improving the clinical skills in restorative dentistry and prosthodontics. [25] Almost half of the participants (53.7%) suggested that this component has room for improvement and should be taught in a better way. We intend to ponder more on this point and convey this dilemma to our subject experts for further discussion.

The majority of the dental students in their clinical undergraduate years valued the dental wax carving experience and stated that these helped them to develop their clinical skills in restorative dentistry and prosthodontics. These findings are in concordance with studies conducted in Brazil that showed that dental wax carving exercises helped in learning dental anatomy and predicted the clinical ability of students. [28]

Conclusion

The present research revealed students' perceptions of the wax carving exercise. All the students agreed that the carving exercise in their undergraduate course helped them in understanding and learning tooth morphology and practicing this exercise also improved their clinical skills. Almost half of the students were satisfied with its time allotments and wanted this exercise to remain a part of the dental curriculum in the future.

Declarations

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Ethics approval and consent to participate:

This study was approved by the Institutional Review Board of Dow University of Health Sciences (Ref: IRB-2168/DUHS/Approval/2021)

Informed consent was taken from all the participants according to Helsinki's declaration.

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