

Comparison between different educational methods in orthodontic teaching for undergraduate dental students

(A cross sectional study)

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ABSTRACT

Background: Nowadays, E learning can be used along with traditional learning methods as a result of internet networks infrastructure development and available access to the most of students. This study aimed to compare students' responses and satisfaction regarding online, blended and traditional learning methods in relation to orthodontic knowledge and skills acquired for undergraduate students. **Materials and Methods:** An online survey was done among 262 students studying in Ahram Canadian University. The students were divided into 3 groups, where Group I represented the traditional method of teaching, Group II represented the online method and Group III, the blended method of teaching. A questionnaire including 14 questions was filled with students' opinions regarding different teaching methods. Then the data were collected and analyzed. Simple descriptive statistics was used to compare questionnaire responses for the whole sample and T-independent and Mann-Whitney tests to compare the 3 groups. **Results:** The results showed that there was no significant difference between the 3 groups in students' opinions regarding different teaching methods. The traditional teaching method group was

satisfied with the way traditional lectures were conducted before the covid-19 pandemic. In the online teaching method group, most of the students agreed that lecture recordings during online classes were beneficial for self-study. While, in the blended teaching method group, most of the students agreed that regarding the lectures, they preferred a combination of traditional and online learning. **Conclusion:** The blended learning was the most preferable method for teaching orthodontics for undergraduate dental students.

Key Words: E-learning, Traditional learning, Blended learning

INTRODUCTION

There are different methods in teaching, the successful method is the method that allows the students to gain the maximum benefits from the course and to obtain the necessary skills. The most popular kind of teaching for undergraduate students worldwide is lecturing, which is one of the conventional teaching techniques. ⁽¹⁾ Traditional learning is described as a learning process in which students and tutors are physically present in the same location at the same time. There is face-to-face interaction between the teacher and the learner during the teaching or

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learning process in the classroom. ⁽²⁾ During the COVID-19 pandemic, the cross-contamination by aerosols generating particles didn't affect orthodontic practice only but also orthodontic teaching, so E-learning became the main choice, and many dental schools had to shift to this teaching method with very little or no practice at all in distance learning. ⁽³⁾

Nowadays, web-based education is utilized as a supplement to traditional education. In actuality, the number of students increases in direct proportion to the increase in its utilization. Most of the world's international universities now use e-learning as a tool in the teaching and learning process. ⁽⁴⁾ There's another method of teaching that includes both of the previous methods, which is known as the blended learning method, thus gathering the advantages of both methods. ⁽⁵⁾ There are many advantages of traditional face to face learning, the most important one is that students have a higher concentration level due to lesser distractions, body language and physical interaction. As there are advantages there are also disadvantages for traditional face to face learning. From these disadvantages is the limited time on how much material the lecturer can cover, which may lead to leaving a subject uncovered. The limited time may also cause the lecturer to be unable to respond to all of the students' inquiries. Also, face-to-face learning is much more expensive than e-learning ⁽⁶⁾ Unlike the traditional face to face learning, E-learning allows students to access the study material unlimited times. Also, it gives them the chance to study their courses whenever and

wherever they want. The main benefit of online education is that it keeps students up to date with other contemporary learners. It also provides open, secure, and uninterrupted access to content that is both exclusive and often updated. ⁽⁷⁾ E-learning has also several disadvantages. The majority of students may experience health issues with their vision, which is typically seen when someone spends more time using a computer or a tablet. E-learning may also increase the tendency for isolation between students and decrease students' motivation to read textbooks in-depth. It may also reduce the physical interaction between students and each other and between students and their tutors. ⁽⁷⁾

Although live demonstration helps in providing greater knowledge of procedures than didactic teaching and thus enhances students' confidence and communication abilities, procedure videos can also be an effective teaching tool that improves students' understanding of laboratory techniques and provides media-rich audio and visual stimulation that responds to a wider range of learning preferences. ⁽⁸⁾ Blended learning was introduced to take advantage of the benefits of both learning methods: face-to-face learning and e-learning. In this process, student study before class and then apply their knowledge in classroom discussion and through practical operation. ⁽⁹⁾ According to the learning pyramid, learners retain approximately 90% of what they learn when they teach someone else immediately; 75% when they practice what they learned; 50% when they are engaged in a group discussion; 30% when they see a demonstration; 20% from audio-visual; 10%

from reading; and 5% from lectures.⁽¹⁰⁾ This research aimed to compare students' opinions regarding online, blended and traditional learning methods in relation to orthodontic knowledge and skills acquired for undergraduate students.

MATERIALS AND METHODS

A cross-sectional study was carried out by distributing a survey that included a sample size of 262 students studying in Ahram Canadian University. Epi-calc 2000 was used to calculate the sample size of the study. Assuming 80% power and 0.05 level of significance, the sample size should be 218 student⁽¹¹⁾. Ethical clearance was obtained and the research approved by the Institutional Review Board Organization IORG0010868, Faculty of Oral and Dental Medicine, Ahram Canadian University by the research number IRB00012891 #44.

The distribution of the survey was done online using Google Forms sent to students in Dentistry through Microsoft teams who took Orthodontics in the following years: 2019, 2020 and 2021. The students that took Orthodontics in year 2019 represented the traditional teaching method group (group I) as they were only taught by attending lectures in halls by face-to-face strategy and labs for clinical practice, while students that took Orthodontics in year 2020 composed the e-learning teaching method group (group II) as they received pure online teaching due to corona virus pandemic. However, students

who received Orthodontics in 2021 represented the blended teaching method group as they took lectures in the form of recorded videos and online live discussions and they attended labs in the university for practical practices and tutorial videos were also sent to them through Microsoft teams.

The survey was created to assess the acceptance of the students of Ahram Canadian University, Faculty of Dentistry regarding different teaching methods in orthodontics. The survey was divided into 2 sections. The first section included the name, course academic year and course teaching method. The second section included 14 questions assessing the opinion of students regarding the online educational process. The questions were divided into 4 categories: lectures, practical and psychological. The possible answers for each question were agree, disagree or uncertain, table 1^(8,11,12).

Data Analysis

Students' responses were downloaded from Google Forms into a Microsoft Excel file. Then the responses were exported to a SPSS file (Statistical Package for Social Sciences software 22.0-SPSS). Simple descriptive statistics was done to analyze the frequency of responses. T-independent and Mann-Whitney tests were performed to compare quantitative data and P value was calculated to assess statistical significance between the 3 groups.

Table (1) The lecture category in the questionnaire distributed among students

Category	Question	Answer options
Lectures	Before Covid-19 pandemic, traditional lectures were conducted satisfactorily	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	Online learning is a good option for learning theoretical subjects	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	Recorded lectures for online classes are beneficial for self-study	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	Online lectures, presented on power point presentations are more useful than traditional lectures	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	During online lectures, there is a better communication with the teacher than traditional lectures	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	Regarding to lectures, a combination of traditional and online learning is preferable	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain

Table (2) The psychological category in the questionnaire distributed among students

Category	Question	Answer options
Psychological	Online learning makes me braver to ask questions in class	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	Lack of body language (e.g., face expression, eye contact) in online classes demotivates me	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	During online learning social interactions are limited with the teachers	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain

Table (3) The practical practice category in the questionnaire distributed among

Category	Question	Answer options
Practical	Classical lab practices are preferred than online tutorials	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	Video tutorials for wire exercises are more useful than live demonstrations	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	Online wire video tutorials should partially replace the traditional lab practices	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain
	For the practical practice, a combination of online videos with traditional labs are preferable	<ul style="list-style-type: none"> • Agree • Disagree • Uncertain

RESULTS

The results showed that there was no significant difference between the 3 groups in students' opinions regarding different teaching methods. When comparing the total number of students' responses for the questions on the lectures, table 4 and figure 1 show that 73.3% of students were satisfied with the way traditional lectures were conducted before covid-19 pandemic, while table 4 and figure 2 show that 70.2% of students agreed that online learning is a good option for learning theoretical subjects. From table 4 and figure 3 it can be deduced that

most students (79.8%) agreed that lecture recordings during online classes were beneficial for self-study. However, 66.4% of students considered that online lectures presented on power point presentations were more useful than traditional lectures, table 4 and figure 4. Table 4 and figure 5 show that nearly half of the students (55%) felt that during online lectures they were able to communicate better with the teacher compared to the traditional way. Most students (74.4%) agreed that regarding lectures, a combination of traditional and online learning is preferable, table 4 and figure 6.

Table (4) Students' responses to questions regarding lectures

Lectures		Groups								P- value
		Group I		Group II		Group III		Total		
		N	%	N	%	N	%	N	%	
Before Covid-19 pandemic, traditional lectures were conducted satisfactorily	Agree	60	70.6 %	72	72.7%	60	76.9%	192	73.3%	0.928
	Uncertain	8	9.4%	9	9.1%	6	7.7%	23	8.8%	
	Disagree	17	20.0 %	18	18.2%	12	15.4%	47	17.9%	
Online learning is a good option for learning theoretical subjects	Agree	58	68.2 %	69	69.7%	57	73.1%	184	70.2%	0.935
	Uncertain	9	10.6 %	11	11.1%	6	7.7%	26	9.9%	
	Disagree	18	21.2 %	19	19.2%	15	19.2%	52	19.8%	
Recorded lectures for online classes are beneficial for self-study	Agree	67	78.8 %	81	81.8%	61	78.2%	209	79.8%	0.975
	Uncertain	7	8.2%	7	7.1%	6	7.7%	20	7.6%	
	Disagree	11	12.9 %	11	11.1%	11	14.1%	33	12.6%	
Online lectures, presented on power point presentations are more useful than traditional lectures	Agree	62	72.9 %	70	70.7%	42	53.8%	174	66.4%	0.083
	Uncertain	7	8.2%	8	8.1%	12	15.4%	27	10.3%	
	Disagree	16	18.8 %	21	21.2%	24	30.8%	61	23.3%	
During online lectures, there is a better communication with the teacher than traditional lectures	Agree	46	54.1 %	61	61.6%	37	47.4%	144	55.0%	0.373
	Uncertain	10	11.8 %	10	10.1%	8	10.3%	28	10.7%	
	Disagree	29	34.1%	28	28.3%	33	42.3%	90	34.4%	
Regarding to lectures, a combination of traditional and online learning is preferable	Agree	65	76.5%	73	73.7%	57	73.1%	195	74.4%	0.928
	Uncertain	9	10.6%	9	9.1%	9	11.5%	27	10.3%	
	Disagree	11	12.9%	17	17.2%	12	15.4%	40	15.3%	

Significant at $P < 0.05$, N= number of participants

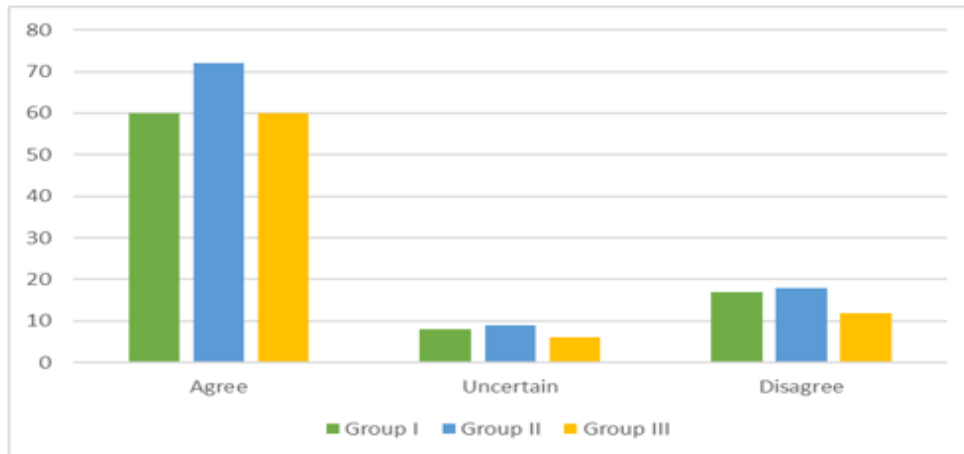


Figure (1) Before Covid-19 pandemic, traditional lectures were conducted satisfactorily

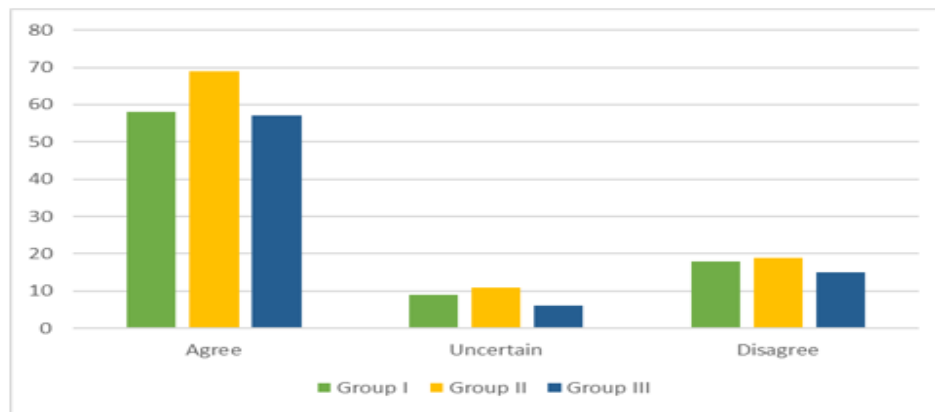


Figure (2) Online learning is a good option for learning theoretical subjects

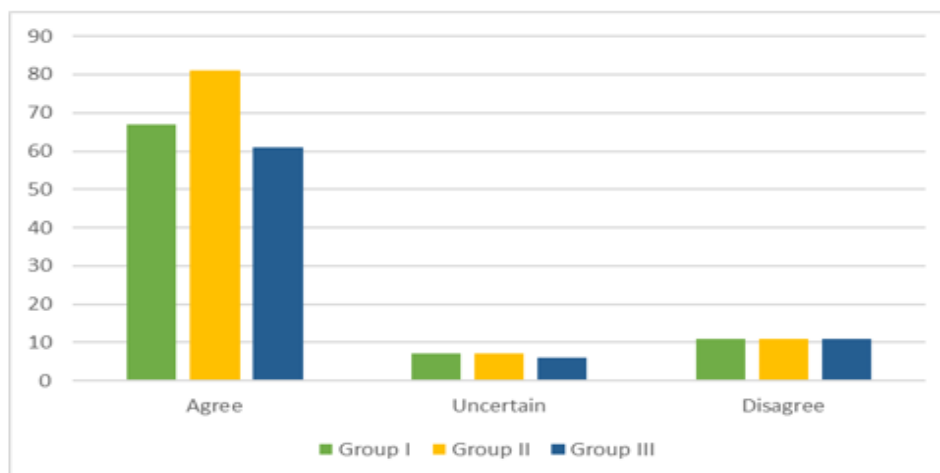


Figure (3) Recorded lectures for online classes are beneficial for self-study

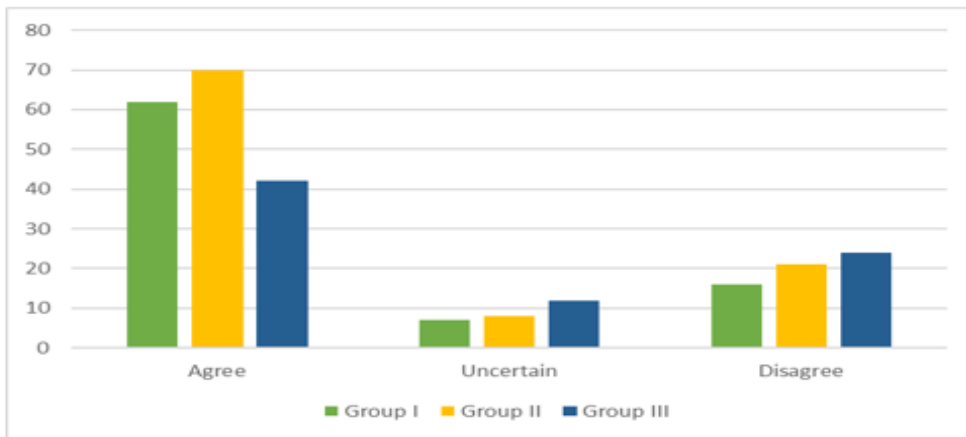


Figure (4) Online lectures, presented on power point presentations are more useful than traditional lectures

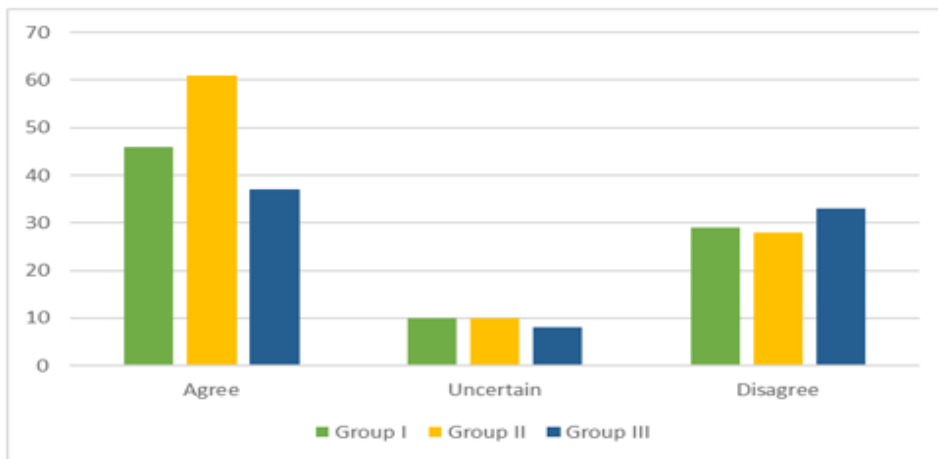


Figure (5) During online lectures, there is a better communication with the teacher than traditional lectures

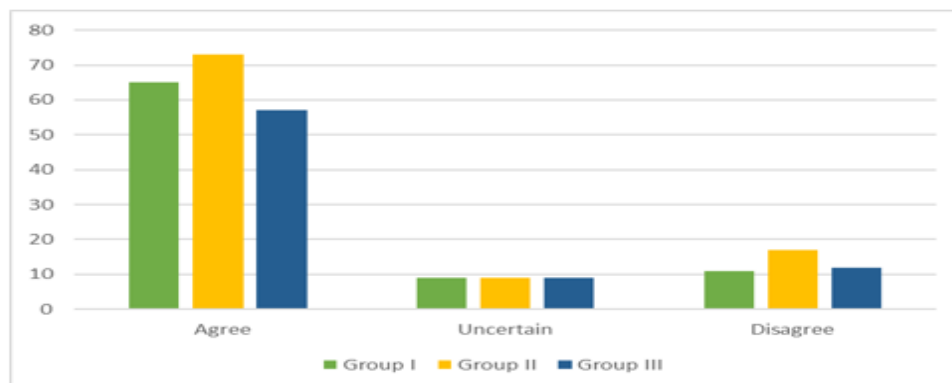


Figure (6) Regarding to lectures, a combination of traditional and online learning is preferable

When considering students' opinions regarding the psychological aspect as shown in table 5 and figure 7, the results showed that 68.3% of the total number of students agreed that online learning made them braver to ask questions than traditional learning. 66.8% of students found

that the lack of body language during online classes demotivated them, table 5 figure 8. However, most students (71%) agreed that online learning limited their social interaction with the teacher and classmates in class, table 5 figure9.

Table (5) Students' responses to questions regarding psychological aspects

Psychological		Groups								P-value
		Group I		Group II		Group III		Total		
		N	%	N	%	N	%	N	%	
Online learning makes me braver to ask questions in class	Agree	61	71.8 %	66	66.7 %	52	66.7 %	179	68.3 %	0.828
	Uncertain	7	8.2%	13	13.1 %	8	10.3 %	28	10.7%	
	Disagree	17	20.0 %	20	20.2 %	18	23.1 %	55	21.0%	
Lack of body language (e.g., face expression, eye contact) in online classes demotivates me	Agree	60	70.6 %	66	66.7 %	49	62.8 %	175	66.8 %	0.714
	Uncertain	12	14.1 %	13	13.1 %	10	12.8 %	35	13.4%	
	Disagree	13	15.3 %	20	20.2 %	19	24.4 %	52	19.8%	
During online learning social interactions are limited with the teachers	Agree	60	70.6 %	70	70.7 %	56	71.8 %	186	71.0 %	0.614
	Uncertain	9	10.6 %	13	13.1 %	5	6.4%	27	10.3%	
	Disagree	16	18.8%	16	16.2%	17	21.8%	49	18.7%	

Significant at $P < 0.05$, N= number of participants

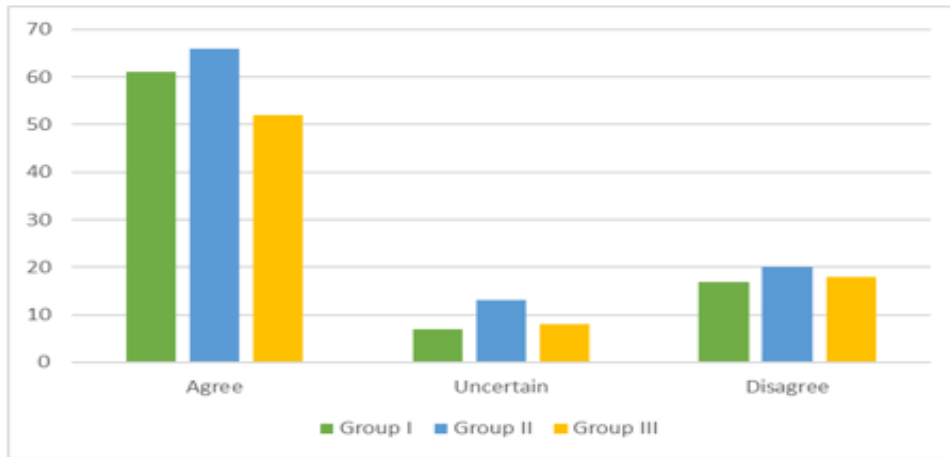


Figure (7) Online learning makes me braver to ask questions in class

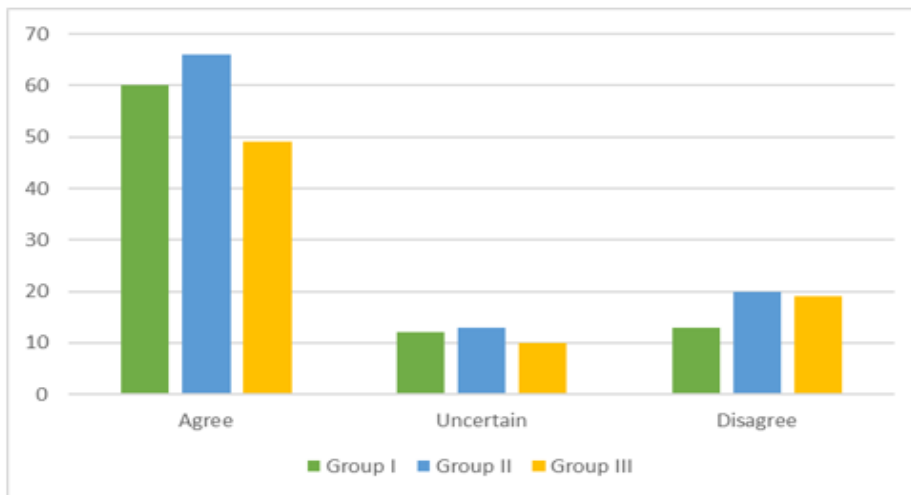


Figure (8) Lack of body language in online classes demotivates me

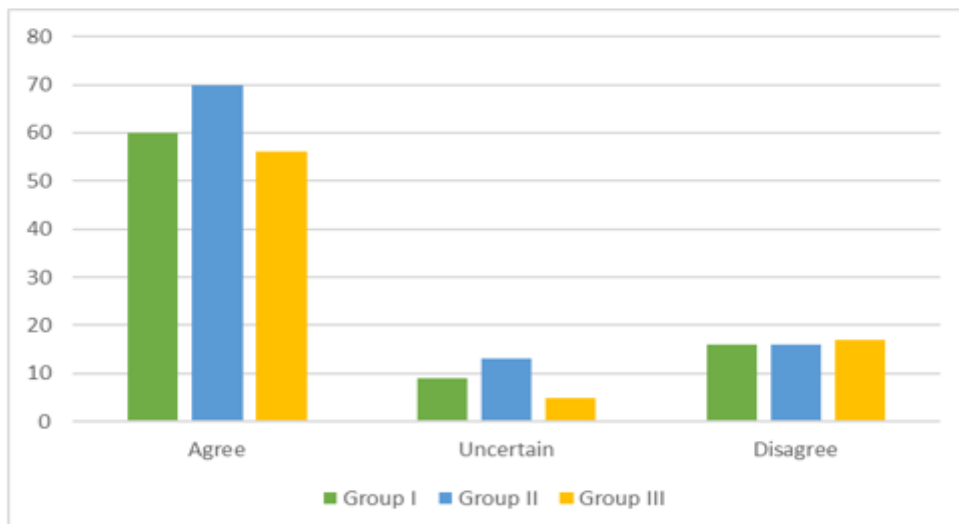


Figure (9) During online learning social interactions are limited with the teachers

When students' responses considering practical practices was analyzed, 71.8% from the total number of students agreed that they would prefer the classical lab practice than online tutorials as shown in table 6 and figure 10. Nearly half of the students (55%) stated that the presented wire exercise video tutorials were more useful than the live demonstrations during the lab practice, table 6 and figure 11. Also as shown from table 6 and figure 12,

59.5% of the students agreed that online wire video tutorials should partially replace the traditional lab practice. As shown at table 6 and figure 13, the results also revealed that most students (75.6%) acknowledged that for the practical activity, a combination of online tutorials and traditional labs would be more beneficial.

Table (6) Students' responses to questions regarding the practical course

Practical		Groups								P-Value
		Group I		Group II		Group III		Total		
		N	%	N	%	N	%	N	%	
Classical lab practices are preferred than online tutorials	Agree	59	69.4%	73	73.7%	56	71.8%	188	71.8%	0.909
	Uncertain	11	12.9%	10	10.1%	7	9.0%	28	10.7%	
	Disagree	15	17.6%	16	16.2%	15	19.2%	46	17.6%	
Video tutorials for wire exercises are more useful than live demonstrations	Agree	41	48.2%	57	57.6%	46	59.0%	144	55.0%	0.186
	Uncertain	22	25.9%	14	14.1%	10	12.8%	46	17.6%	
	Disagree	22	25.9%	28	28.3%	22	28.2%	72	27.5%	
Online wire video tutorials should partially replace the traditional lab practices	Agree	50	58.8%	63	63.6%	43	55.1%	156	59.5%	0.808
	Uncertain	9	10.6%	11	11.1%	9	11.5%	29	11.1%	
	Disagree	26	30.6%	25	25.3%	26	33.3%	77	29.4%	
For the practical practice, a combination of online videos with traditional labs are preferable	Agree	67	78.8%	77	77.8%	54	69.2%	198	75.6%	0.395
	Uncertain	6	7.1%	11	11.1%	8	10.3%	25	9.5%	
	Disagree	12	14.1%	11	11.1%	16	20.5%	39	14.9%	

Significant at $P < 0.05$, N= number of participants

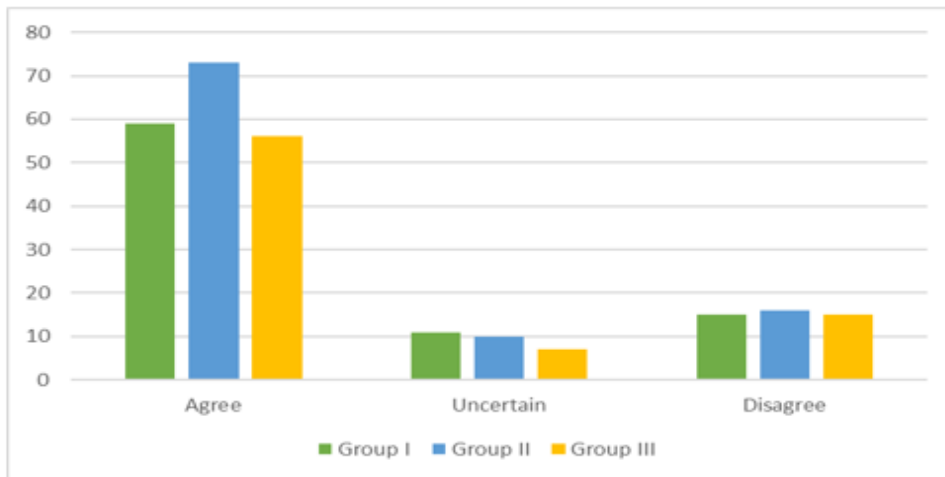


Figure (10) Classical lab practices are preferred than online tutorials

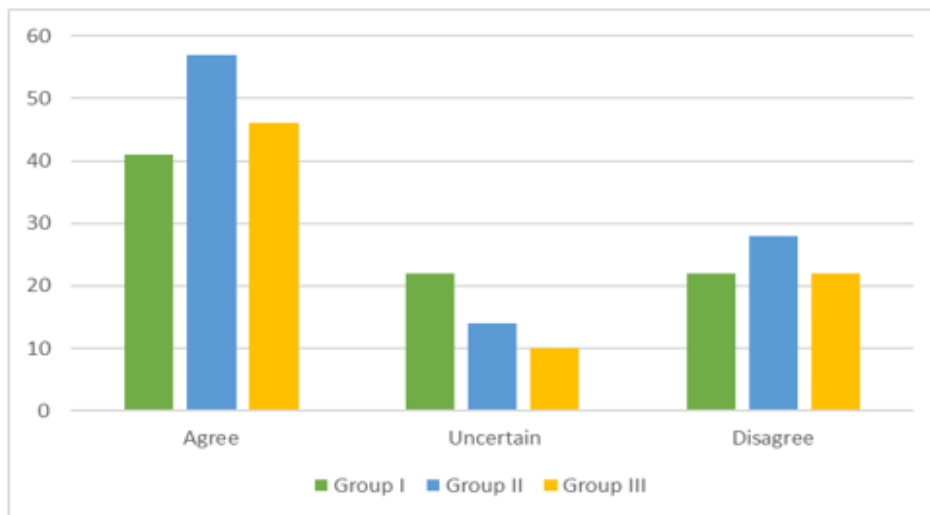


Figure (11) Video tutorials for wire exercises are more useful than live demonstration

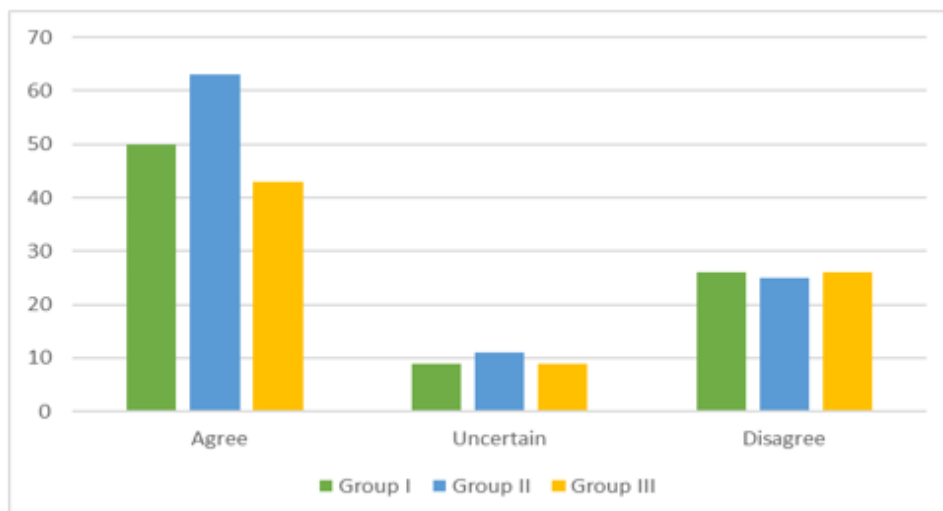


Figure (12) Online wire video tutorials should partially replace the traditional lab practices

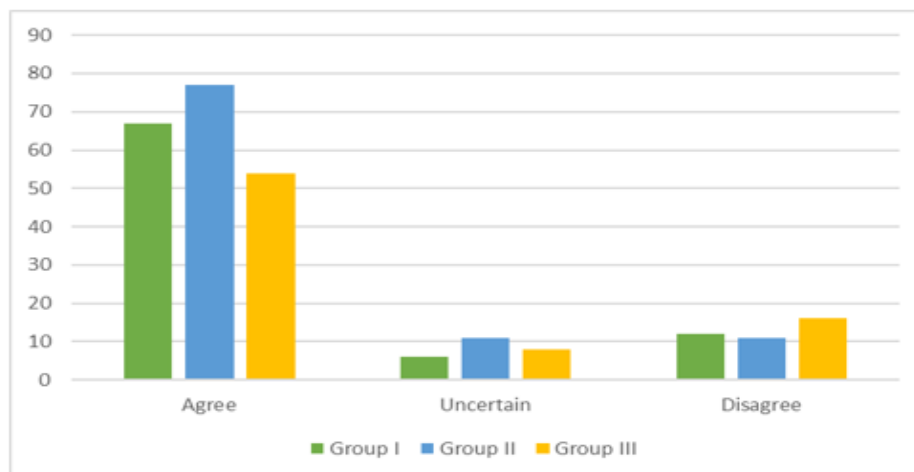


Figure (13) For the practical practice, a combination of online videos with traditional labs are preferable

DISCUSSION

Over the last decade dental students' responses had dramatically changed regarding the learning process especially with the variations brought by the new Covid-19 pandemic, students and teachers had to adapt rapidly to the distant teaching. Students enrolled in orthodontics must acquire both practical skills and also gain important theoretical knowledge. Thus, this research aimed to conduct the opinions of dental students regarding the different methods of learning orthodontics to assess the most suitable way of teaching.

The results showed that there was no significant difference between the 3 groups in students' opinions towards different teaching methods. According to the lectures' questionnaire, when comparing the total number of students' responses (73.3%) were satisfied with the way traditional lectures were conducted before covid-19 pandemic, (70.2%) of students agreed that online learning is a good option for learning theoretical subjects. Most of students (79.8%) agreed that lecture recordings during online

classes were beneficial for self-study. However, (66.4%) of students considered that online lectures presented on power point presentations were more useful than traditional lectures, nearly half of the students (55%) felt that during online lectures they were able to communicate better with the teacher compared to the traditional way. Most of students (74.4%) agreed that regarding lectures, a combination of traditional and online learning is preferable. These results were in accordance with a previous study⁽¹¹⁾ which found that (85.8%) of students were satisfied with the traditional lectures, and only (51.7%) viewed that online lectures were more beneficial than the traditional one. (82.9%) would prefer a combination between the traditional and online lectures. Another study⁽²⁾ was done for evaluating postgraduate student perceptions of face to face and distance education in orthodontics.

The results of the study were in agreement to results of the present study, where students preferred a blended approach for teaching. A previous comparative study⁽¹³⁾ between

traditional and virtual teaching methods observed no significant difference between the two groups in the overall orthodontic skills and knowledge at the end of the course in spite of the students in the traditional group had lower scores in the final theory exam than the virtual group. The results of another survey⁽¹⁴⁾ showed that students did not find online teaching to be beneficial, and there weren't adequate chances for asking questions. Moreover, when students were asked if online learning could be more appealing, they were mainly neutral, but they did not think it was as useful as face-to-face learning.

When analyzing the results regarding the questionnaire related to the practical practices, (71.8%) from the total number of students agreed that they would prefer the classical lab practice than online tutorials. Nearly half of the students (55%) stated that the presented wire exercise video tutorials were more useful than the live demonstrations during the lab practice. (59.5%) of the students agreed that online wire video tutorials should partially replace the traditional lab practice. The results also revealed that most students (75.6%) acknowledged that for the practical activity, a combination of online tutorials and traditional labs would be more beneficial. A comparative study⁽⁸⁾ between live demonstration and procedural video for teaching orthodontic laboratory procedure showed that both methods are equally effective. Also, another study⁽¹⁵⁾ which tested the effect of live versus videotaped demonstrations showed that both learning methods have the same level of

understanding the principles of exercise. While a previous study⁽¹¹⁾ revealed that (88.6%) of students were convinced with the traditional practical practices, however only (16.1%) viewed those online activities were more beneficial to them, and (25.6%) thought that video tutorials should replace the traditional practical practices.

When considering students' opinions regarding the psychological aspect, the results showed that (68.3%) of the total number of students agreed that online learning made them braver to ask questions than traditional learning. (66.8%) of students found that the lack of body language during online classes demotivated them. However, most students (71%) agreed that online learning limited their social interaction with the teacher and classmates in class.

The results were in accordance with other study⁽¹⁶⁾ where most of students agreed that their social interactions were limited with online learning and they were demotivated during class due to the lack of interaction with the lecturers where they feel isolated. Another survey⁽¹⁷⁾ to evaluate the online dental education across covid 19 pandemic revealed that the physiological well-being and academic outcome were adversely affected. A previous study⁽¹²⁾ found that online learning motivated less than half of the students to study, only (33.8%) of students agreed that family motivated them to learn while being at home. Most of students (53%) agreed that the absence of body language between the students and lecturers demotivated them to focus throughout online class. while,

some students are more convinced during online class in asking questions.

CONCLUSION:

- The blended learning is the most preferable method at teaching orthodontics for undergraduate dental students, where it allows them to communicate and participate during teaching, also they can review at their own place the electronic materials, thus motivates learning.

- Both live and video demonstrations are effective in transferring orthodontics practical skills and knowledge for undergraduate dental students.

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