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Research Article

# Dental students' perception and performance in final year undergraduate clinical examination during COVID-19

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ABSTRACT

**Objective:** To assess the perception and the performance of dental students on clinical component of the final year examination held during COVID-19 pandemic. **Methods:** Final year dental undergraduates (n=86) in year 2014 participated in the study. A pre tested, self-administered questionnaire (online Google form) was used to assess their preparedness and perception regarding changed clinical set up. Percentage marks obtained for each component was used to assess their performance during pre COVID and COVID times. **Results:** The mean scores for knowledge, attitude and fear were 82%, 94% and 77% respectively. There was no significance in the perception regarding the clinical set up for prosthetic dentistry (p= 0.317) and restorative dentistry (p=0.384) when pre and during COVID-19 groups were compared. However, a statistically significant difference was observed for oral surgery component (p=0.005) for the same. There was no significant correlation between the perception scores and the students' performance for all three clinical components. (Spearman r ≈ 0.000, p-value = 0.998). Similarly, no significant correlation was found between actual performance and the statements 'they could have performed better'; 'needed more time' (Spearman r ≈ 0.057, p-value = 0.742) (spearman r ≈ -0.023, p-value = 0.778) were considered. **Conclusion:** These results suggest students' knowledge and attitude regarding preparedness for clinical examination during COVID-19 is satisfactory. Students' performance is not significantly affected by their perception or subjective opinion in all three clinical components.

**Keywords:** Assessments; COVID-19; Dental education; Perception; Student performance

## INTRODUCTION

The Corona Virus Disease 2019 (COVID-19) is an ongoing global pandemic of corona virus with more than 100 million confirmed cases and more than two million reported deaths worldwide.[1] The virus has surged in many regions with multiple waves in countries that had apparent success in suppressing initial outbreaks and Sri Lanka is no exception. The COVID-19 pandemic has forced the world into a health and economic crisis interrupting numerous regular routine activities and has affected work, free movement, trade, and education.[2]

During the current pandemic, the Occupational Safety and Health Administration (OSHA, gov) classified dentists in the very-high risk category due to due to potential exposure to corona virus through close contact with the oral and nasal cavities which are portals of exit of viral particle and the routine use of aerosol-generating procedures.[3,4] Recent studies suggesting COVID-19 may become airborne through aerosols formed during medical procedures or be transmitted indirectly through saliva has also been published.[5–9]

Continuing dental education in a pandemic of this nature is a challenge due to many reasons. Dental education can be considered to have four major domains. The first is imparting knowledge which can easily be delivered through various online modes. The second domain is the simulation laboratory courses to develop hand skills prior to handling patients which can be delivered with improved infrastructure facilities to maintain social distancing with a small group of students. The third domain is the clinical training which is also considered the most vital aspect of the dental education.[10] Moreover, the practice of dentistry is unique as a majority of the procedures practiced are aerosol generating with close contact of the patient. Thus, improvement of the infrastructure, meticulous planning and adoption of standard guidelines are required. The fourth domain is the assessments which are even more challenging when clinical components are considered. The examiners have to abide by a social responsibility to ensure the graduates are competent enough to handle patients in a safe environment. The pandemic can influence the outcome of the assessments in many ways by its impact on students, staff, and patients and ultimately to the community.

The lockdown resulted in postponement of examinations in many dental schools whereas some had their examinations entirely online.[11] Some educational institutes have proposed that their assessments will be conducted in alternative formats to allow students to complete them remotely. The faculties had to work to different schedules and requirements and some variations relating to assessment periods had to be introduced in order to mitigate the lost time and allow for continuous function of the higher education institutes.[12] Harvard School of Dental Medicine successfully conducted Objective Structured Clinical Examinations (OSCEs) online and students had rated it as similarly successful as traditional OSCEs.[13] Assessment strategies based on learning management systems like Canvas[14] for formative exams and third-party online proctoring by ProctorU[15] for summative exams on ExamSoft[16] are recommended by Iyer et al[17] but may be unaffordable for schools in developing countries.

In Sri Lanka when the universities were closed, the final year dental undergraduates were in the midst of their examinations. They had only few clinical components to complete. It was decided to conduct the overdue examination for the final year students abiding by the guidelines issued by World Health Organization (WHO) and the institutional infection control committee. A specific issue was encountered as part of the batch had already completed the examination just before the COVID-19 pandemic was emerged. Thus, due to the high risk of spread of the disease among the candidates, staff and patients due to close contact, the high risk of contaminating the operating environment, the requirement of full personal protective equipment for the first time in the examination by the students and the deskilling of students due to the lack of clinical practice for four months it was decided to conduct the operative dental procedure in restorative dentistry clinical examination on a mannequin. In order to make the examination uniform and standardized the examination component of the students who had completed the clinical prior to the stoppage due to COVID-19 had to be annulled requiring those students to re-sit the practical. It was decided to continue the same clinical examination format for oral surgery and prosthetic dentistry due to them being minimal or non-aerosol generating.

Although there are a number of studies pertaining to influence of novel Corona virus disease in dental hospital practice and dental education, authors hardly could retrieve any research carried out considering students' and staff perception in adjusting to the new clinical assessment set up with specific infection control practices. Therefore, the aim of this study was to assess the perception of the dental students and the staff on clinical component of the final year examination held during COVID-19 pandemic. Further it was also to assess whether the change has affected the students' performance at the examination. This study will be helpful in identifying the perception of students and staff in the only dental school in the country who were involved in the examination conducted in the new set up to comply with COVID-19 guidelines. Furthermore, the results would influence necessary improvements in the clinical setup, teaching and conducting examinations in the future.

## METHODS

The study was approved by the Ethics Review Committee of the Faculty of Dental Sciences, University of Peradeniya, Sri Lanka. (ERC/FDS/UOP/1/2020/27). All the final year dental undergraduates (n=86) in year 2014 and all the staff involved in the clinical components of oral surgery, prosthetic dentistry and restorative dentistry of the Final BDS examination were invited to participate in the study with their informed written consent.

### *Study Instruments / Data Collection*

A pre tested, self-administered questionnaire (online Google form) was used as the study instrument for the students. The web link of the survey was disseminated among dental students and the examiners by electronic mail and social media. Identification details were not collected through the questionnaire and the anonymity of all participants was ensured.

### *Students' Questionnaire*

Section A of the students' questionnaire consisted of three questions to identify the socio demographic data and eight questions to assess the preparedness of the students in terms of knowledge and attitudes to participate in the clinical components of the examination. Section B consisted of

fourteen statements which had to be completed in a five point Likert scale (strongly disagree, disagree, neutral, agree and strongly agree) and was used to assess the perception of the students regarding challenges faced while participating in the examination.

*Staff Questionnaire*

Two separate questionnaires were used to assess the perception of the examiners and the non- examiners involved in the examination. Examiners' questionnaire consisted of nine questions with thirty-three statements which had to be completed in a five point Likert scale while the questionnaire of the non-examiners consisted of nine questions with twenty-six statements completed in five point Likert scale. In addition, staff was asked to rate the successes of conducting a practical examination during the COVID-19 time using a visual analogue scale.

*Examination structure*

*Prosthetic dentistry component*

In this component, students were given one hour to perform a task related to patient management in clinical prosthetic dentistry. The range of procedures included were treatment planning for a partially dentate patient, making preliminary impressions, carrying out jaw relation registration, carrying out the denture insertion stage and management of denture related complaints. Afterwards the students had a discussion with examiners for ten minutes.

*Oral surgery component*

Assessment was carried out in a form of long case presentation on a given patient in the ward of the dental hospital. Students were given twenty minutes to complete history taking and examination to arrive at a tentative diagnosis and ten minutes for the presentation and discussion.

*Restorative dentistry component*

Operative procedure was carried out in phantom heads. Only ten students were taken inside the simulator lab, and they were seated maintaining proper social distancing. A proximal cavity preparation and restoration with amalgam were the tasks for all the students. Performance of the students during the clinical components of the final year examination during pre COVID and COVID times Percentage marks of the prosthetic dentistry, oral surgery and restorative dentistry were considered to assess the performance of the students during pre COVID and COVID times.

*Data analysis*

Data was analyzed using the Minitab v18.0. Section A in the questionnaire was used to assess the preparedness of the final year students, in terms of knowledge and attitude and the fear of the students regarding risk of exposure to COVID-19 infection in the clinical environment. Separate scores were obtained for knowledge (Qs 4 & 5), attitude (Qs 8, 12, 13, 14), and fear (Qs 6 & 7). The scores were compared for significance difference between genders. Statistical significance was considered as p value <0.05.

Section B was used to assess the perception of students regarding challenges faced at the new clinical set up. A score for perception about clinical set up was obtained by summing up positive statements (1-6 and 13) and perception regarding Personal Protective Equipment (PPE) by (statements 7-10 and 12). Students' subjective perception regarding their performance was also obtained (statements 11 and 14) and these were compared between the examinations held during pre COVID and COVID times.

A separate analysis was undertaken to compare the students' performance in three disciplines during pre COVID and COVID times by using marks they obtained. Further, correlation was calculated between the students' perception during COVID and the performance in the three clinical components separately. Mann-Whitney U test was used to compare the means and Pearson correlation test was used to assess the correlations. The statements in common, of the two questionnaires given to the examiners and non-examiners were used to generate two separate scores for positive and negative statements.

## RESULTS

*Response to students' Questionnaire*

Response rate for the students' questionnaire was 82%. Seventy-one students out of the eighty-six students of the 2014 batch had submitted their response via Google form. Out of the participants, 28% were males and 72% were females.

*Students' preparedness as shown by knowledge, Attitude, and fear scores*

The average scores for knowledge, attitude and fear were 82%, 94% and 77% respectively in the group of students indicating that they were knowledgeable and had a positive attitude to participate in the clinical session despite having fear. However, there was no significant difference in the means of knowledge, attitude, and fear scores with respect to the gender (Table 1).

*Students' perception regarding challenges faced at the examination held during COVID-19 pandemic*

When the students' perception was considered, more than 70% of the students were positive with regard to the changed clinical environment. Twenty four percent to 100% of the students were in agreement with the negative impact of PPE on clinical set up. Majority (88%) agreed that they were able

**Table 1:** Knowledge, attitude and fear scores for total student group and between gender groups

| Variable | Total group Mean | Gender | Mean | SD | Minimum | Median | Maximum | P-value |
|---|---|---|---|---|---|---|---|---|
| Knowledge Score | 82 | Male | 95.00 | 10.26 | 75.00 | 100.00 | 100.00 | 0.063 |
| | | Female | 93.63 | 12.09 | 50.00 | 100.00 | 100.00 | |
| Attitude Score | 94 | Male | 77.00 | 14.55 | 60.00 | 80.00 | 100.00 | 0.052 |
| | | Female | 84.31 | 11.18 | 50.00 | 90.00 | 100.00 | |
| Score for fear | 77 | Male | 76.25 | 20.64 | 50.00 | 75.00 | 100.00 | 0.757 |
| | | Female | 77.94 | 20.40 | 50.00 | 75.00 | 100.00 | |

to complete the examination within the allocated time but also felt they could have performed better if the changes due to pandemic had not been there (Figure 1).

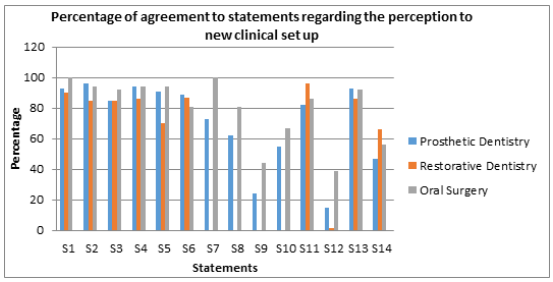


**Fig. 1:** Percentage of agreement to statements regarding the 14 statements of section B

When the perception regarding the examination set up was considered, there was no significance in the perception for prosthetic dentistry (p= 0.317) and restorative dentistry (p=0.384) when pre and during COVID-19 groups were compared. However, there was a statistically significant difference of the perception about the oral surgery component between pre and during COVID-19 groups (p=0.005) (Table 2). When the mean perception score about PPE was compared between genders for groups who did the exam during COVID-19, there was no significant difference between the mean perception score about PPE in oral surgery.

### *Comparison of students' performance at the final year examination held in pre COVID and during COVID times*

Since the students' marks were not normally distributed, a nonparametric two-sample (Mann-Whitney U test) test has been performed. The summary statistics indicated that the median marks for the group who did restorative dentistry and oral surgery during the pandemic was less than the marks obtained for the same during pre-COVID-19 time.

In the analysis of the marks, to assess the students' performance between pre COVID-19 and during COVID-19 groups for each clinical component, there was no statistical significance for oral surgery component (p= 0.064) but there was a significant difference for restorative dentistry component (p= 0.041). The analysis could not be performed for the prosthetic dentistry component since there was no sufficient number of respondents for the group who did the examination during pre COVID-19 time. (Table 3)

### *Correlation between perception scores and the students' performance in examination*

There was no significant correlation between the perception scores and the students' performance for all three clinical components (Spearman r ≈ 0.000, p-value = 0.998). There was no significant correlation between the perception on PPE and the students' performance either for prosthetic dentistry and oral surgery (Spearman r ≈ -0.053, p-value = 0.615) (Figure 2).

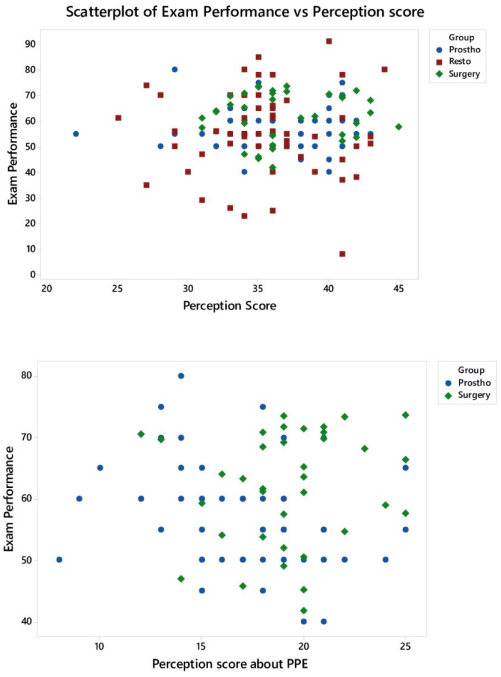


**Fig. 2:** Scatter plots regarding; the correlation of the Perception to the new clinical set up, with the exam performance and, the correlation of negative effect of PPE as perceived by the students with the exam performance

**Table 2:** Students' perception about Prosthetic dentistry, Restorative dentistry and Oral surgery clinical components between Pre -COVID and During COVID groups

| Group | Status | Mean | SD | Minimum | Median | Maximum | p-value |
|---|---|---|---|---|---|---|---|
| Dentistry | During-COVID | 36.291 | 4.157 | 22.000 | 36.000 | 43.000 | 0.317 |
| | Pre-COVID | 34.81 | 5.31 | 27.00 | 34.00 | 44.00 | |
| Restorative Dentistry | During COVID | 35.393 | 4.301 | 25.000 | 35.000 | 44.000 | 0.384 |
| | Pre- COVID | 36.54 | 4.14 | 31.00 | 36.00 | 45.00 | |
| Oral Surgery | During COVID | 37.000 | 3.787 | 31.000 | 36.000 | 45.000 | 0.005 |
| | Pre-COVID | 33.727 | 5.311 | 25.000 | 34.000 | 44.000 | |

**Table 3:** Performance of students compared between Pre - COVID and during COVID groups for all disciplines

| Group | Status | Mean | SD | Minimum | Median | Maximum | p-value |
|---|---|---|---|---|---|---|---|
| Prosthetic Dentistry | During COVID | 57.36 | 8.38 | 40.00 | 55.00 | 80.00 | |
| | Pre-COVID | 52.50 | 3.54 | 50.00 | 52.50 | 55.00 | |
| Restorative Dentistry | During COVID | 55.50 | 16.48 | 8.00 | 55.00 | 91.00 | 0.041 |
| | Pre-COVID | 63.42 | 10.16 | 46.00 | 62.50 | 78.00 | |
| Oral Surgery | During COVID | 61.84 | 9.29 | 41.80 | 63.40 | 73.70 | 0.064 |
| | Pre-COVID | 66.03 | 8.90 | 46.30 | 66.40 | 82.10 | |

*Exam marks were available only for two students in Prosthetic Dentistry group

When the students' subjective perception regarding their performance was assessed, there was no significant correlation between either with the statement 14 of section B (I think I could have performed better if these changes were not there) and the students' performance (Spearman r ≈ 0.057, p-value = 0.742) or statement 11 (I was able to finish the examination within the given time) with the students' performance (Spearman r ≈ -0.023, p-value = 0.778) (Table 4).

### *Perception of the staff*

There was no statistical significance in either the total score for positive statements or negative statements between the examiner and non-examiner staff categories (p>0.05). The mean percentage of perception regarding success of the examination in the new clinical set up was 68%. When two staff categories were compared, there was a statistical significance (p=0.007) of the percentage of success as perceived by the examiners (Mean = 76%) and non-examiners. (Mean = 60%). The average percentage score, regarding the reduction of the performance of the after group of students' comparative to before group, as perceived by the examiners was 67%.

We further identified a mean positive score of 18.14 for examiners and 19.12 for non-examiners when the results were analyzed out of total of 25. (Table 5)

**Table 4:** The 14 statements of section B, regarding the perception of the students to the new clinical set up

| No | Statement |
|---|---|
| S1 | Adequate information on the procedure was given before commencement of the examination |
| S2 | Exam set up was well organized |
| S3 | Exam environment was friendly |
| S4 | Infection control procedures practiced during the examination were adequate |
| S5 | Adequate PPE was provided during the examination |
| S6 | Adequate chair side assistance was provided to me during the examination |
| S7 | Wearing PPE affected the communication |
| S8 | I was Uncomfortable wearing the PPE |
| S9 | I felt that the professionalism was affected while wearing PPE |
| S10 | Wearing PPE needed extra time to carry out the procedure |
| S11 | I was able to finish the examination within the given time |
| S12 | After completing the procedure, I felt that my hands eyes or face might have got contaminated |
| S13 | The measures that were taken was adequate for my safety |
| S14 | I think I could have performed better if these new changes were not there |

## DISCUSSION

Conducting clinical examinations involving patients where aerosol generating procedures are carried out is an issue of serious concern during a pandemic. It becomes mandatory to be knowledgeable regarding the precautionary guidelines and clinicians need to be responsible both within the clinical environment and outside to minimize the spread of infection. Our findings are supportive of the fact that the dental students' preparedness in terms of knowledge and attitudes is satisfactory to participate in sessions involving

**Table 5:** Comparison of perception between examiners and non-examiners

| | Positive score (out of 25) | | | Negative score (out of 75) | | | Success rate of examination | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | P value | Mean | SD | P value | Mean | P value |
| Examiners | 18.14 | 6.02 | 0.31 | 55 | 8.5 | 0.58 | 76 | 0.007 |
| Non-examiners | 19.12 | 2.77 | | 56.8 | 9.44 | | 60 | |

direct patient contact during COVID-19 time. This is in agreement with the previous studies which ascertain the same.[18–20] In a study done in Iran[19] it has been shown that mean knowledge score regarding COVID-19 was 59.7% and the mean attitude score was 66% compared to a knowledge score of 63% and attitude score of 79.8% among medical and dental students in Nepal.[20] Our score for knowledge on COVID-19 is higher than reported in previous studies possibly due to stream of recent knowledge at the time of the present study.

Further, our results indicate that the students had positive attitudes in terms of being a responsible individual in the society to prevent cross infection from themselves to patients, peers and other staff. This seems to be a positive finding giving insight to re-start practice of clinical teaching should the pandemic continue. On the contrary, the score of fear of getting the infection and transmitting the infection to others was also high (77%) but is comparatively low considering 93% reported in a recent study.[21] However this could be considered a positive finding which will lead to stringent adherence to good practices in terms of infection control protocols.

On the other hand, both the examiners and non-examiners demonstrated positive attitudes on conducting clinical component of the examination. The mean percentage of perception regarding success of the examination in the new clinical set up as expressed by the examiners and non-examiners was 68%. However, the concerns expressed by the staff in arranging logistics, implementing sterilization and disinfection procedures, having adequate numbers of PPE should be considered when planning clinical training and future examinations involving patients. The faculty administration took various measures to successfully restart the clinical training based on some of the findings expressed in the study. The students of the seventh semester underwent a fully pledged clinical training for five weeks before the universities were again closed due to the second wave of COVID-19.

Our findings suggest that the students' perception regarding the challenges faced in the clinical set up was positive. More than 90% of students felt that the infection control procedures practiced during the examination were adequate. This is in contrast with a study done in New Zealand[21] where a significant proportion of staff (53%) and students (81%) did not think that universal precautionary measures and PPE currently used in clinics were effective to prevent cross-infection with COVID-19.

More than half of the students (56%) felt they could have performed better if the changes had not been there. This is in agreement with a previous study where 53% stated their clinical performance was negatively affected by the COVID pandemic.[21] Moreover, case presentation used which required communication both with the patient and the examiner could have been affected to a certain degree due to wearing of PPE and might have led to a lower mean in the marks in oral surgery. Further, conducting the examination in mannequins could be the reason for poor performance in restorative dentistry compared to pre COVID-19 time since students did not have an opportunity to practice such procedures after their pre-clinical time which was about 18 months before. Possible de-skilling which might have occurred due to the lock down could have been another contributory factor for lower performance in the restorative dentistry component. However, no significant correlation was observed with the students' subjective opinion regarding their performance and the students' actual performance. This was a very encouraging finding to endorse both the clinical training and the assessments involving direct patient contact can be undertaken in 'new normal' situation provided the whole dental team adapts to the recommended precautionary guidelines. Unfortunately, authors could not track down any studies carried out in similar settings for discussion.

There had been many practical changes in different institutions such as clinical reasoning exercises, case presentation narratives and self-reflection activities based on portfolios/log diaries.[11] Even though some of these had already been incorporated in the formative assessments in our institution they had not been used for summative assessments. Thus, it was not possible to make use of those modalities in the examination. However, portfolios/log diaries could be used to assess the much required hand skill of a student which is a fact to be remembered should the pandemic continues.

A high-stake online exam had been implemented during COVID-19 time for final year dental students for their exit exam in the form of Modified Essay Questions (MEQs), Multiple Choice Questions (MCQs), OSCEs and an oral exam to assess didactic knowledge, clinical acumen, and communication skills.[22] While it is possible to assess the analytical and decision making skills of a student by these methods it would hardly be of any importance to assess the actual hand skills of the operator. Even though technology can supplement education in many ways it can never replace

face to face real patient experiences especially in education programmes such as dentistry as there are many variables that cannot be simulated to a great degree in mannequins. On the other hand if clinical training involving direct contact with the patients can be undertaken there seems to be no reason why the same cannot be applied in assessments.

### *Limitations of the study*

A better analysis could have been undertaken if the sample size of the students who had their examinations before the pandemic was larger. However, this was not a factor under control if the same cohort is taken into consideration. This can be considered as a limitation of the study.

Examination formats may have to be modified to ensure the continuation of the dental education in the era of the 'new normal'. However, the academics should also see that their graduates are competent enough to handle patients in the years to come. Assessing hand skill in a simulated environment using a mannequin is recommended for aerosol generating procedures.

## SUMMARY

Students and staff were positive regarding change in the clinical set up during COVID-19 pandemic. Students' preparedness in terms of knowledge to carry out clinical procedures in the changed set up during COVID-19 is satisfactory. Assessments involving direct patient contact can be implemented with proper planning, patient selection and under recommended infection control guidelines for non-aerosol generating procedures. While online assessments are preferred during a pandemic of this nature to test theory and other soft skills it is still possible to retain the traditional assessments using live patients in selected disciplines and procedures to ensure the consistency and the quality of the assessment. However, to minimize the risk of infection, simulated exam settings are recommended to assess hand skills in aerosol generating procedures. These tend to reduce risk of infection transmission and are uniform in nature.

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