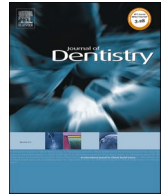




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## Patients' and dentists' perceptions of tele-dentistry at the time of COVID-19. A questionnaire-based study

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### ABSTRACT

**Objectives:** COVID-19 has had a significant impact on dentistry in unforeseen ways, including a substantial rise in the development and implementation of video consultations. The research aimed to investigate dentists' and patients' attitudes towards dental video consultations (tele-dentistry) and to identify potential ways to improve the experience.

**Methods:** A cross-sectional, pre-post design, online survey was carried out with patients' and dentists' before and after video consultations. A total of 249 participants accessed the survey and 228 of them consented to take part in the study and answered the online questions. Participants' attitudes towards video consultations were assessed using a questionnaire constructed by a multidisciplinary team of periodontists and psychologists. The measure assessed the perceived efficacy of the video consultations on patients and the dental team. Video consultations were performed to risk assess, triage and manage remotely via a video link out at (deleted name of institution as double blinded peer review) via NHS England's Attend Anywhere platform.

**Results:** The majority of patients strongly agreed and were satisfied using tele-dentistry in the five domains which we explored: the ease, comprehensiveness and helpfulness of the video consultations and the anxiety and satisfaction levels of the patient. Dentists and students alike felt more confident and competent after having carried out a video consultation. The majority of clinicians found the tele-dentistry platform helpful and easy to perform. Just over 70% of patients strongly agreed that the video consultation ran smoothly and 75.7% strongly agreed that they were comfortable accessing the consultation from home rather than travelling in for the consultation. Just under 80% of patients stated that they would recommend the video consultation.

**Conclusions:** This study shows that tele-dentistry may be a valid option to help service providers and dental patients, as it seems to be well accepted by both patients and dentists. JM to typesetter.

**Clinical significance:** Patients' and dentists' perceptions of Tele-Dentistry at the time of COVID-19. A questionnaire-based study. To our knowledge this is one of the first studies evaluates perceptions of patients and clinicians before and after a tele-dentistry encounter in and across different dental departments. The majority of survey participants expressed positive views towards tele-dentistry across all domains including ease and comprehensiveness of the video consultation, perceived helpfulness and anxiety and satisfaction of the patient. Dentists appear to be competent and confident to carry out these video consultations and find them to be helpful and easy to complete. As a result, we suggest readers adopt tele-dentistry in their daily activities to help patients and clinicians alike.

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## 1. Introduction

COVID-19 has had a significant impact on dentistry in the UK. Face-to-face consultations were severely curtailed since dental procedures considerably increase the risk of transmission [1]. At the start of the pandemic these concerns caused much anxiety to patients and dental professionals alike, and national guidance and regulation led to complete paralysis of routine dental care, with provision of emergency dental care only [1]. Tele-dentistry utilises a combination of telecommunications and dentistry which involves the exchange of clinical information and relevant imaging over remote distances for consultation and treatment planning [2]. The literature on the value of tele-dentistry is still quite limited [3,4] however, since the global pandemic started, tele-dentistry has been encouraged by many hospital trusts and dental offices. Standard operating procedures for urgent dental care systems often encourage risk assessment, triage and management remotely via telephone or video link as a first stage of care.

Tele-dentistry allows reduced attendance at care settings which lessen the risk of COVID transmission, this is particularly beneficial for patients and clinicians shielding. These encounters can be seen as an adjunct to face-to-face appointments, saving time and cost of travelling to see a specialist if the problem could be managed with advice, or to confirm appropriateness of a referral. At the time of writing, video consultations are still being used in the management of the lockdown in the United Kingdom. The use of video consultations allows clinicians to continue communication with their patients without any physical interaction. Moreover, both patients and healthcare workers can feel safe reducing non-essential contact and the psychosocial effects of fear and anxiety, especially those who are more vulnerable members of society. There is also the added benefit of promoting sustainability in dentistry, by reducing carbon emissions as consultations are performed remotely.

Nonetheless, there is limited published evidence to show patient readiness and acceptance of tele-dentistry services [5], resulting in difficulty in planning for future service provision. The current literature on the value of tele-dentistry is limited to care providers [6–8] and assessing outcomes at the patient and dentist level, may be helpful in evaluating successful implementation of new procedures, such as video consultations into dental service [9]. The outcomes we chose include the ease, comprehensiveness and helpfulness of the video consultations and the anxiety and satisfaction levels of the patient. These outcomes help advance understanding of implementation processes and enhance efficiency in implementation research. We designed patient and dentist surveys to explore their attitudes towards the effectiveness and usefulness of these video consultations.

Based on the above, the primary objective of this study was to assess dentists' and patients' attitudes towards video consultations during the COVID-19 pandemic in various different dental departments. A secondary objective was to review which dental specialities and which patient demographics this methodology suited best.

## 2. Methods

This was a questionnaire-based study aimed at both dental practitioners and patients. The study was carried out in the Periodontology, Restorative Dentistry, Oral Medicine, Dental Sleep Medicine and Orthodontics departments at our hospital. The video consultations were performed using the NHS England's Attend Anywhere platform. Here, consultations were carried out to risk assess, triage and manage patients remotely via video link. The Attend Anywhere platform is hosted on a website where the clinician and patient can communicate through video and audio. The study was granted approval as a service evaluation by the (deleted as double blinded peer reviewed journal) (reference number 11117). Four questionnaires (two each for dental practitioners and patients) were created through a Qualtrics survey. The survey stayed open for 6 months (1st July to the 14th December 2020). Initially at the start

of this period, numerous video consultations were taking place. As the numbers of reported COVID-cases dropped during the autumn of 2020 the number of video consultations also reduced as they were replaced by more face-to-face appointments. Subsequently, the video consultations increased again in December as the community transmission rate of COVID 19 began to rise again.

## 3. Survey instrument

Four simple questionnaires were constructed by a multidisciplinary team of periodontists and psychologists and aimed to assess the perceived efficacy of the video consultations on patients and the dental team. The questionnaires that were completed prior to the video consultations for both patients (Survey 1) and dentists (Survey 2) were designed to help gauge both the patients' and dentists' expectations to the tele-dentistry service. After the video consultation, the patient and clinician were contacted once again with a different questionnaire with questions to see whether the service met their expectations (Surveys 3 and 4 respectively). Some of the questions came from the reliable and valid Dental Visit Satisfaction Scale [10].

The pre-consultation survey (S1) sent to patients asked questions regarding ease of arrangement and perception of usefulness of the video consultation. We also explored their level of anxiety and whether they had previously experienced a video consultation in a healthcare setting. All questions were asked using a five-point Likert agreement scale. The last question collected free-text data allowing the patient to tell us anything else they so desired about the consultation.

In a similar fashion, all dentists were sent a link and were asked to answer a few questions prior to the consultation and again after the consultation. The pre-consultation survey for dentists (S2) asked questions regarding the demographics of the patient, whether the clinician was a dentist or a dental student and which department they worked in (Including Periodontology, Oral Medicine, Restorative Dentistry, Orthodontics and Dental Sleep Medicine). We also probed for the reason for referral, and perceptions of clinicians regarding how difficult and useful the video consultation would be. Finally, the level of confidence and competence the clinician felt carrying out a dental video consultation (using a visual analogue scale).

The post-consultation survey (S3) sent to patients asked questions regarding perceptions of the video consultations including anxiety and helpfulness. We also explored their opinions on whether they were comfortable, their understanding, confidence in their assessment, satisfaction levels, whether they had enough time to discuss their concerns and whether they would have preferred a face-to-face appointment instead.

The post-consultation survey for dentists (S4) asked questions regarding the perception of difficulty and helpfulness in carrying out the consultation and solving the patient's dental health issue. We explored the level of confidence and competence the clinician feels after carrying out a dental video consultation, (using a visual analogue scale). Lastly, the outcome of the visit was recorded, including whether the patient was discharged, booked for a face-to-face appointment, a follow up video consultation or other. The clinician and the patient were then able to enter any free text comments. Please see Fig. 1 for a flow chart of the study methods.

## 4. Patient recruitment

Using the Attend Anywhere telehealth system, we offered scheduled appointments for new and follow-up patient consultations and to allow patients to interact with the clinicians from either their computer, tablet or smart phone. Patients booked for video consultations in Periodontology, Restorative Dentistry, Oral medicine and Orthodontics were sent a link for the surveys with their appointment. The patients were then contacted prior to the video consultation to be reminded or re-sent the link by email by a member of the research/clinical team for S1 (pre-

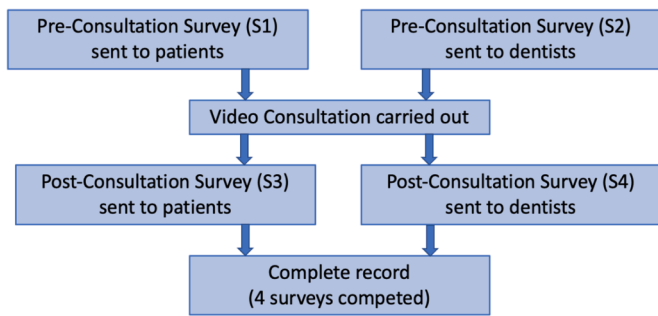


Fig. 1. Flow chart presenting the study methods.

consultation) and S3 (post-consultation). The other 2 survey links (S2 and S4) were sent to the dentist, 1 one survey to be completed pre- and one survey to be completed post-consultation. A convenience sample of 200 patients was selected as the target of this service evaluation, since no available data for a formal sample size calculation were available.

### 5. Data analysis

Data were transferred from Qualtrics into an Excel database and then into SPSS 26.0. Descriptive statistics were used to summarise demographics and data. Inferential analyses were carried out to assess differences between dentist and dental student responses and between different departments, using chi-square tests and ANOVA for categorical and continuous data respectively. Normal distribution of continuous data for Likert scale answers were explored. Differences in patient responses by age group (younger than 45 years old vs.  $\geq 45$  years old) were also assessed by chi-square.

## 6. Results

### 6.1. Demographics

A total of 249 participants accessed the survey, and 228 of them consented and answered the online questions. The response rate amongst patients who accessed the survey was thus 91.5%. As there were 4 sets of surveys to complete (2 for patients and 2 for dentists), this resulted in some incomplete data. The patient pre-consultation survey (S1) was the highest completed ( $N = 205$ ), with a reduction in patients completing the post-consultation survey (S3), ( $N = 140$ ). A total of 157

pre-consultation (S2) and 157 post-consultation (S4) clinician surveys respectively were completed. Therefore, in total there were ( $N = 131$ ) complete sets of data and ( $N = 97$ ) of incomplete data sets. Ten consultations ended up becoming telephone consultations due to technical issues.

The most common age group of participants was between 45–54 years of age (29.2%). The sample was predominantly female (60.9%). Most of the clinicians who carried out the surveys were from the periodontology department ( $N = 68$ ). The other dental disciplines who contributed in descending order were dental sleep medicine ( $N = 44$ ), oral medicine ( $N = 41$ ), orthodontics ( $N = 28$ ) and restorative dentistry ( $N = 18$ ). Out of the 157 clinicians who filled the S2/S4 surveys, the majority ( $N = 142$ ) were dentist and 15 were undergraduate dental students.

### 6.2. Patient expectations

The majority of respondents (80.5%) had no previous experience of tele-medicine (data not reported in tables or figures). Many of those respondents who had experience of tele-medicine, did not have any experience in tele-dentistry. Fig.2 reports data relative to the patient's expectations prior to the video consultation during the COVID-19 Pandemic. The majority (83.4% of the sample) agreed it was easy to arrange the online appointment (strongly agree/somewhat agree). In a similar fashion, the majority of patients (84.9%) found the instructions of the appointment easy to follow.

### 6.3. Perceptions of patients post video consultation

Fig 3. displays patients' perceptions after the video consultations. The majority of patients (70.7%) strongly agreed that the video consultation ran smoothly. 75.7% strongly agreed that they were comfortable in their homes rather than travelling to the hospital for their consultation. Most respondents agreed that they have a better understanding of their dental condition with only a small number of patients strongly disagreeing (2.1%). Similarly, only a small number of respondents (2.8%) thought that they were not in a better position in understanding changes to their dental health after discussion with the dentist. The majority (59.2%) strongly agreed that the dentist told the patient everything they needed to know, and thus answered all questions. Sixty-four percent of patients thought that the consultation was performed thoroughly, with only one participant strongly disagreeing. The results for whether the patients would prefer to see a dentist in

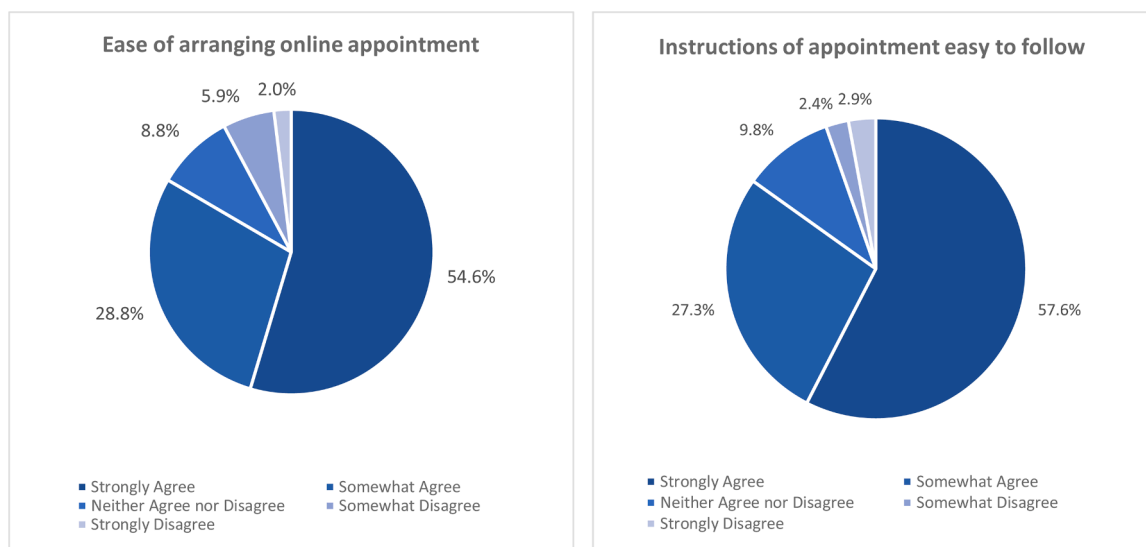


Fig. 2. Participant responses regarding expectations prior to the video consultation. Percentages amongst respondents are reported. ( $N = 205$ )

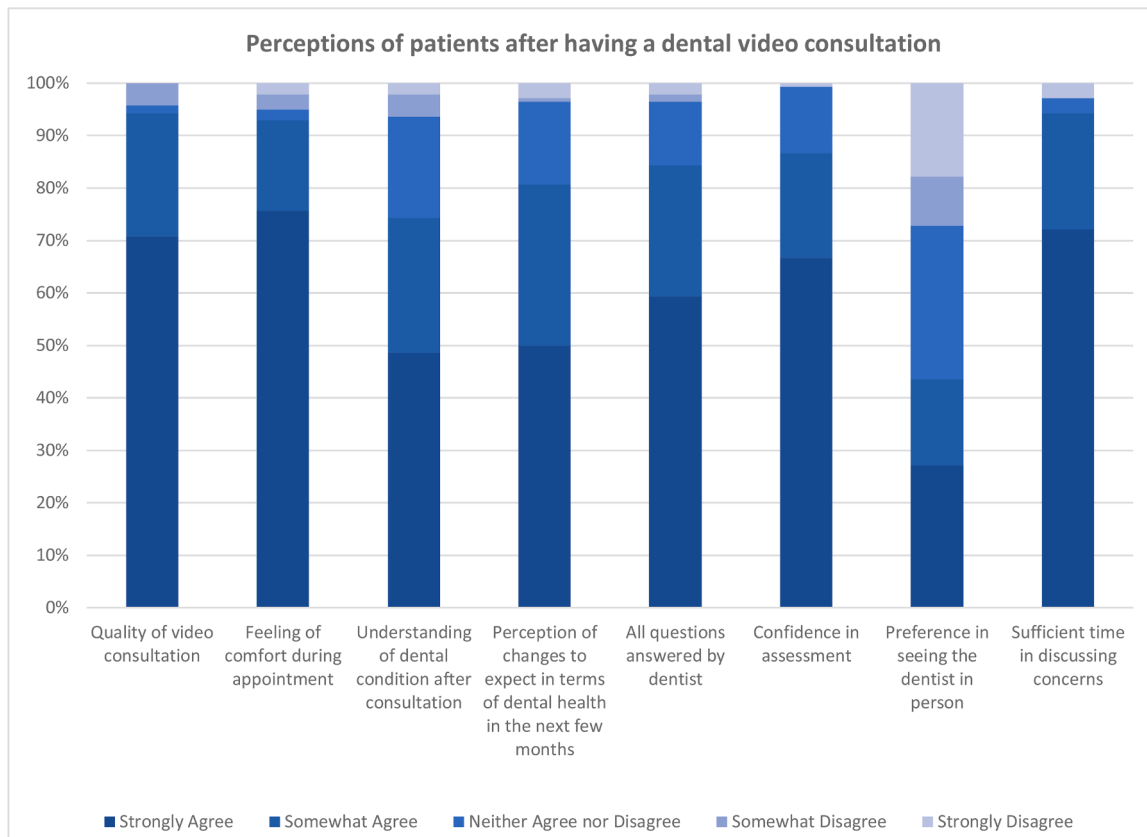


Fig. 3. Participants responses regarding attitudes and feelings towards the video consultation. (N=140)

person were quite varied, with 29.3% neither agreeing nor disagreeing with this statement. Finally, the majority of patients (72.1%) strongly agreed that they had enough time to discuss their concerns.

Fig. 4 shows that prior to the video consultation, 53.6% of participants were not anxious at all about the consultation, with only 5.8% of participants very anxious. When asked about their anxiety levels again after the consultation, the percentage of respondents who were not anxious at all towards future video consultations rose to 73.6%.

Fig 5. displays the perception of helpfulness of the video consultation prior to it being carried out and then once again after the consultation was completed. The percentage of respondents agreeing that the consultation would be extremely helpful (32.6%) and somewhat helpful

(44.8%) improved after the consultation (55.0% and 32.1% respectively). Nearly four percent of the sample thought that the consultation was extremely unhelpful.

The majority of patient respondents (79.3%) stated that they would recommend the video consultation to others, while 3.6% would definitely not (data not reported in tables/figures). Fifty-five-point-eight percent of respondents were extremely satisfied with the service, while 1.4% were extremely dissatisfied (data not reported in tables/figures). No statistically significant differences in any of the patient responses were detected by age group (< 45 years old vs. 45–85 years old) and gender.

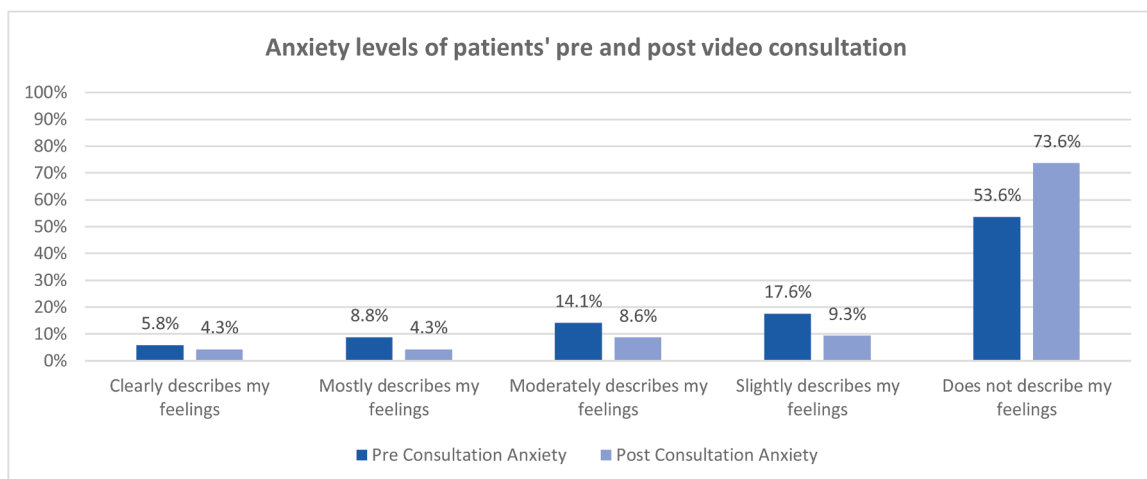


Fig. 4. Participants responses regarding anxiety levels before the consultation, and their anxiety levels towards future video consultations. (N=140)

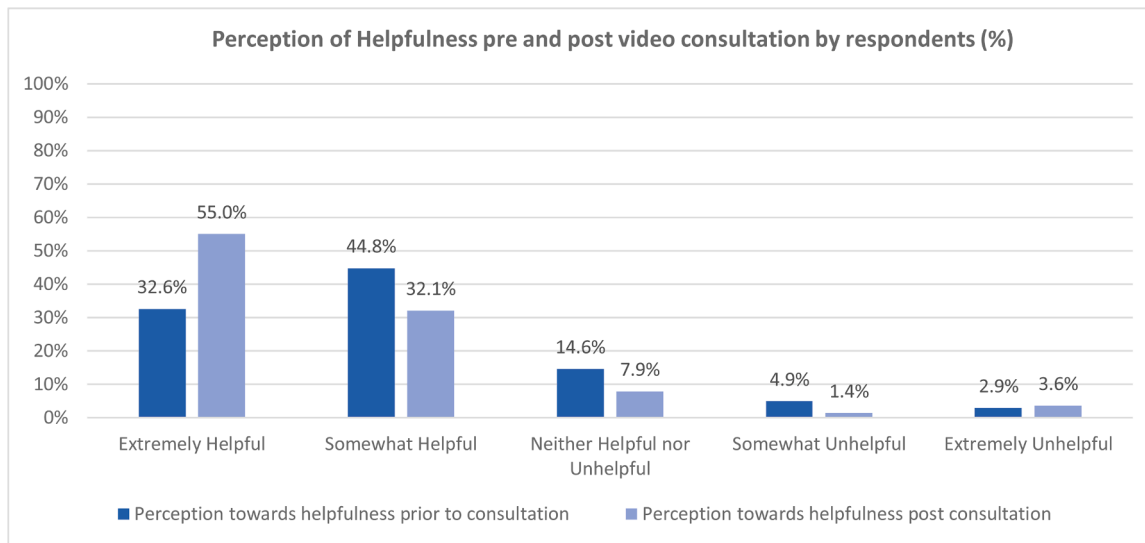


Fig. 5. Participants responses regarding their perceptions of helpfulness towards video consultations, pre- and post-consultation. (N=140)

6.4. Outcome of video consultation

Eighty-five percent of video consultations resulted in the next appointment being a face-to-face assessment, while 8.3% of patients were discharged and 2.5% were booked for another follow-up video consultation. In 3.8% of cases the outcome was recorded as 'other', such as being booked in for a biopsy.

6.5. Differences between dentists and dental students

Table 1 displays the average perceived confidence and competence levels of both dentists and dental students before and after carrying out video consultations measured by a visual analogue scale (VAS). Percentages and standard deviations are reported. The dentists scored significantly higher in terms of competence and confidence levels than the dental students. The average confidence levels of dental students prior to the consultation were 60.7%, which then increased to 74.4% after the consultation. In a similar fashion, the average perceived pre-consultation competence level of dental students averaged 60.4%, which then rose to 74.7% post-consultation.

6.6. Attitudes of different dental departments

Fig. 6 reports attitudes of clinicians divided by department. Statistically significant differences were detected for perception of ease and helpfulness by department (p = 0.028 and 0.001 at Pearson chi-square respectively).

The discipline with highest score for "most helpful" was Dental Sleep Medicine (97.1% pre-consultation and 94.2% post-consultation). This

Table 1

Average perceived confidence and competence levels of both dentists and dental students before and after performing video consultations measured by a visual analogue scale (VAS).

Question		Dentist	Dental students	ANOVA p=
Confidence	Pre-consultation	87.6% ± 16.7%	60.7% ± 16.7%	< 0.001
	Post-consultation	88.1% ± 15.1%	74.4% ± 11.9%	
Competence	Pre-consultation	89.2% ± 14.9%	60.5% ± 16.9%	< 0.001
	Post-consultation	89.6% ± 13.7%	74.7% ± 10.1%	

was closely followed by the Orthodontic department, with 95.8% of clinicians finding the video consultation helpful for treating their patients. However, the perception of helpfulness in the Orthodontic department was reduced by 16.7% post consultation. The Restorative department found the consultations the least helpful, with 76.9% of clinicians believing it would not be helpful prior to the consultation. However, this was then reduced 30.8% as they found it more helpful post consultation.

In terms of difficulty and ease of carrying out the video consultations, the department who reported that they found it easiest was Dental Sleep Medicine with 94.2% and 88.6% of clinicians deeming it to have been easy pre- and post-consultation respectively. The level of difficulty of the consultations were closely matched between the other departments including Periodontology, Restorative, Oral Medicine and the Orthodontic department (percentages of clinicians finding the consultations difficult ranging from 15.4–23.1% across all the departments). Periodontology and Restorative departments perceived future consultations to be easier after carrying out a video consultation.

7. Discussion

Tele-dentistry is a novel method of health service delivery which enables to triage patients and contact follow-up patients [11], as well as to give advice and reassurance when necessary. To our knowledge this is the first study which evaluates perceptions of patients and clinicians before and after a tele-dentistry encounter in a range of dental departments. Our results show positive and promising results for the future of Teledentistry as both patients and dentists alike seem to find merits in this service. As the fight with COVID-19 continues, we find that lockdowns and cancellation of routine practices are becoming a more regular occurrence so perhaps tele-dentistry could represent one of our answers.

The results presented here show that the majority of patients were very satisfied using tele-dentistry in the five domains which were explored: ease and comprehensiveness of the video consultation, perceived helpfulness, anxiety and patient satisfaction. This was supported by qualitative statements like "I am satisfied with the video consultation. It is quite good, it saves time and it is very convenient as I look after my mother and it's hard for me to get out the house, overall, I'm very pleased".

As people tend to be working from home, and travelling into the cities less, online appointments are a solution to a busy work schedule and to help maintain social distancing in hospitals. Patients are also able to access healthcare earlier, receive specialist care, minimise time off

Differing attitudes of dental departments regarding helpfulness and difficulty of the video consultations (%)

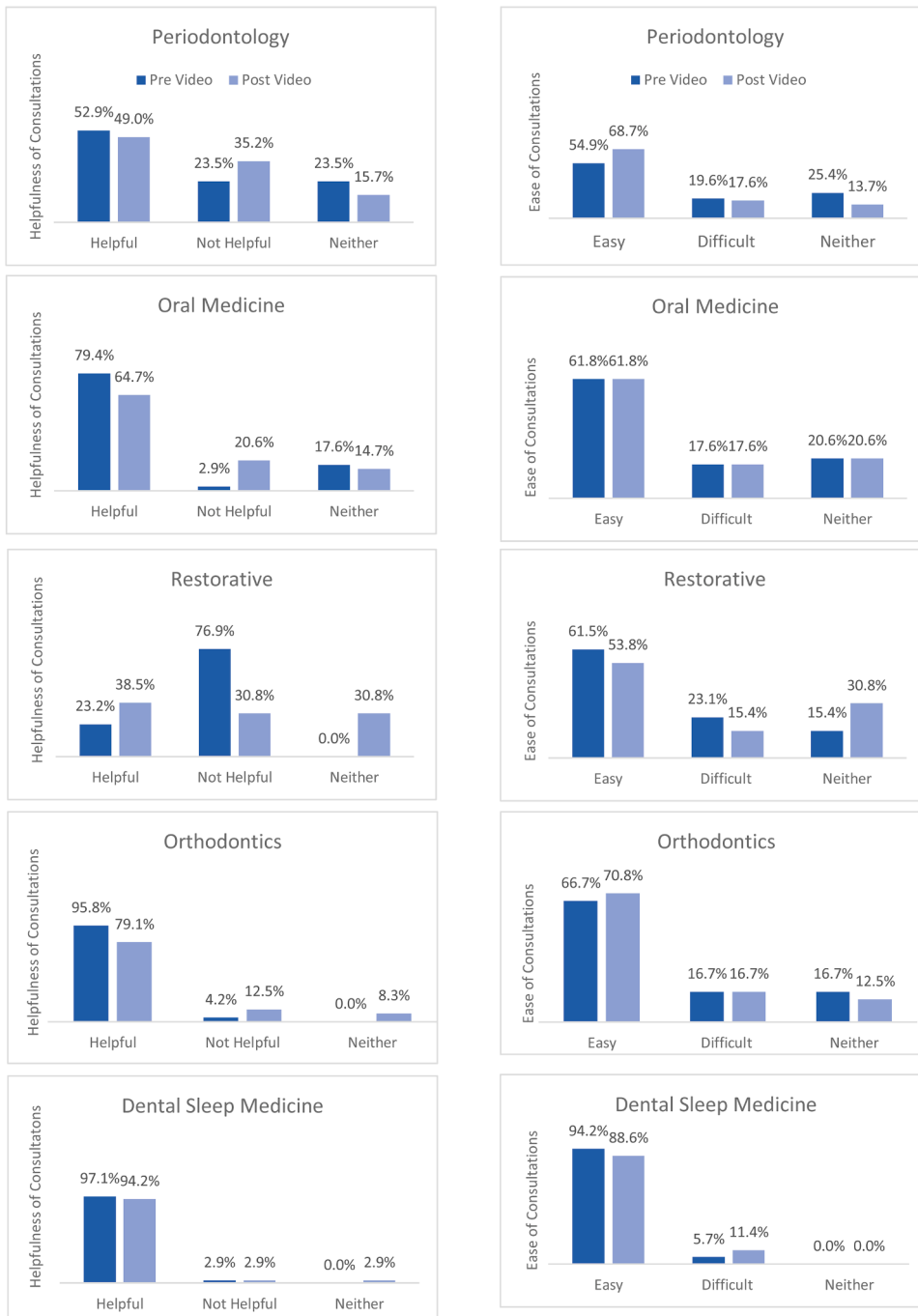


Fig. 6. Attitudes towards perceived difficulty pre- and post-video consultation by clinicians from varying departments. Responses were grouped extremely helpful/somewhat helpful to helpful, extremely unhelpful/somewhat unhelpful to not helpful, extremely easy/somewhat easy to easy and extremely difficult/somewhat difficult to difficult. (N = 157)

work and reduce travel over long distance to receive consultations [12]. Moreover, for clinicians, it has the potential to triage referrals [13] and reduce long waiting lists [14]. Tele-dentistry has also proven to be more cost-effective than real-time and in person clinical consultation in dentistry [15,16]. Tele-dentistry in this context included only scheduled, and no emergency, appointments. We now understand that not every situation is an emergency in dentistry and some need can be managed at home such as supportive periodontal therapy. By giving patients reassurance, oral hygiene instructions and a follow-up video consultation to review the issue, it is possible to reduce number of appointments requiring face-to-face contact. The results regarding whether the

patients prefer to see a dentist in person were quite varied with, 29.3% neither agreeing nor disagreeing with this statement. This is perhaps due to the nature of the patient’s conditions or their personal circumstances.

The majority of patients (73.6%) reported feeling no anxiety towards future video consultations after having had one. This confirms a 20% increase in respondents feeling less anxiety towards future video consultations. Similarly, with perception of helpfulness, there was an increase from 32.6 to 55% as participants reported they found the consultation extremely helpful. This suggests that after having had a video consultation for the first time, anxieties can be reduced.

Our results also investigated attitudes of dentists and dental students

which fall into four main domains: perceived difficulty and helpfulness of the video consultations and confidence and competence of the clinician. Our results clearly show that dentists and students alike feel more confident and competent after having carried out a video consultation. The majority of clinicians also find them helpful and easy to perform.

Clinicians in Dental sleep medicine found the video consultations to be most helpful and easy to carry out. The nature of their work is triaging sleep apnoea patients and finding out whether a mandibular device may be useful for them. Tele-dentistry works very well here as, after having the initial consultation over video, the patient can then be booked in straight for construction of the mandibular device and similarly reviewed over video as a follow-up appointment. The periodontology department has more varied results in terms of helpfulness and perceived difficulty of the consultation and this could be whether it was a new patient or a follow up patient. Most periodontal clinicians found the tele-dentistry platform beneficial and expressed that the presence of available radiographs and periodontal charts from previous appointments or new referrals very useful. There were some comments expressing that more information in the referral letter would have been useful.

The restorative department found the tele-dentistry to be less helpful and more difficult. This could be because of more complex, multi-factorial cases which require special investigations in person to come up with perhaps multiple diagnoses. However, it was interesting to notice how the perceived usefulness by restorative clinicians considerably increased in the post-consultation survey. The majority of clinicians in oral medicine found the video consultations to be helpful and easy and expressed by comments suggesting that the patients were able to be triaged in terms of urgency of the referral.

Poor network services and wireless signal coverage, which can occur due to problems with the network services and coverage or because of home indoor and outdoor obstruction, are barriers to tele-medicine. These factors reduce connection speed and impact on the quality of the consultations [17] and in turn patient's satisfaction and acceptance of tele-dentistry. In our study, there were some technical issues that should be highlighted and addressed moving forward. These difficulties were mentioned by patients who were not very satisfied with their tele-dentistry experience. We suggest a short animation to be made on the NHS website showing patients how to attend any tele-dentistry consultation.

Limitations of this study include the fact that there were incomplete data, owing to a high number of patients who did not follow-up with a post-consultation survey after the initial survey was completed (N=65), which may produce bias. However, no differences in age, gender, department and outcome of visit were detected between patients who filled or did not fill the post-consultation survey. Completing the survey prior to their consultation may have also introduced bias for the patients. However, this was mitigated by the fact that patients filled the survey independently from the clinician at their homes. Finally, we were only able to get 15 dental students to take part in the study. This was perhaps due to the fact that for the majority of this time period, dental students have been asked to stay at home and study from online platforms. The strengths of this study include the reasonably large sample size, the recording of opinions for both dentists and patients and the involvement of five different specialities involved in this project. We also explored attitudes and perceptions of patients' and dentists' before and after the video consultations providing us information on expectations and also information on attitudes regarding future video consultations. A further limitation was that we only accessed one dental hospital so results may not generalize to other environments.

We are not aware of any comparable study which would help us evaluate the satisfaction and acceptability data we have presented. Anecdotally, however, we would, expect that if participants had no views over the acceptability of and satisfaction with video consultations then we would expect agreement around 50% of the time. Percentages below that would suggest dislike, statements above would suggest

endorsement. In the absence of comparable data upon which we can benchmark our results, we suggest that these data are seen in the spirit in which they were intended – that is, as descriptive data of a service evaluation provided at times of COVID.

The evidence about tele-dentistry is still quite limited [18,19] and research on the potential benefits of online consultations in dentistry is still needed [20]. Our study has established that patients and dentists found the tele-dentistry platform useful. We propose further research is needed, including randomized control trials looking at the efficacy tele-dentistry in the different departments and testing whether in some circumstances (e.g. dental sleep medicine or periodontology during supportive care) video consultations can be considered a valid alternative to face-to-face visits Patient satisfaction and cost-effectiveness could also be explored in this context.

## 8. Conclusions

This study shows that tele-dentistry may be a valid option to help service providers and dental patients, as it seems to be well accepted by both patients and dentists. The majority of survey participants expressed positive views towards tele-dentistry across all domains including ease and comprehensiveness of the video consultation, perceived helpfulness and anxiety and satisfaction of the patient. Dentists appear to be competent and confident to carry out these video consultations and find them to be helpful and easy to complete. We conclude that tele-dentistry can be a suitable alternative to increase access to healthcare services to patients and save resources during the COVID-19 pandemic and possibly beyond. Healthcare providers should consider adapting patient pathways and utilizing tele-medicine as an alternative method of consultation in the light of social distancing and lockdown measures.

## CRedit authorship contribution statement

**Payvand Menhadji:** Data curation, Formal analysis, Writing – review & editing. **Rupal Patel:** Funding acquisition, Visualization, Data curation, Writing – review & editing. **Koula Asimakopoulou:** Funding acquisition, Visualization, Data curation, Writing – review & editing. **Barry Quinn:** Funding acquisition, Visualization, Data curation, Writing – review & editing. **Golfam Khoshkhounejad:** Data curation, Writing – review & editing. **Pegah Pasha:** Funding acquisition, Visualization, Data curation, Writing – review & editing. **Ruben Garcia Sanchez:** Funding acquisition, Visualization, Data curation, Writing – review & editing. **Mark Ide:** Funding acquisition, Visualization, Data curation, Writing – review & editing. **Poonam Kalsi:** Funding acquisition, Visualization, Data curation, Writing – review & editing. **Luigi Nibali:** Conceptualization, Funding acquisition, Data curation, Visualization, Formal analysis, Writing – review & editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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