



“ A CLINICAL AUDIT TO INVESTIGATE THE IMPACT OF COVID-19 ON THE QUALITY OF RECORD-KEEPING IN DENTAL UNDERGRADUATE RESTORATIVE CLINICS.”

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*“Great things are done by a series of small
things brought together.”*

- Vincent Van Gogh

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DECLARATION

"Except for the help listed in the Acknowledgements, the contents of this MSc dissertation are entirely my own work. This work has not previously been submitted, in part or in full, for a degree or diploma of this or any other University or Examining Board."

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ABSTRACT

Introduction:

Clinical dental records that are accurate and complete have the potential to be used for a variety of significant purposes, mainly for improving patient safety and treatment quality, but additionally acting as good evidence in litigatory cases. This audit was aimed at assessing the standard of record-keeping by undergraduate dental students attending restorative clinics at the Royal London Dental Hospital. The secondary aim of this project was to delineate any differences in record-keeping quality that the COVID-19 pandemic might have caused.

Methodology:

The audit compared two types of records, 45 paper-based records that were used before the coronavirus outbreak and 45 digital records used in the hospital since the pandemic. The quality was evaluated by assessing records for completeness of certain 'gold standard' entries/domains as per the United Kingdom national guidelines. Each record was scored for the presence or absence of 10 'domains', which were further divided into 32 'components'. Total scores and percentages of entries for each component were calculated in the records before and during the COVID-19 pandemic to find a difference.

Results:

Overall record-keeping by undergraduates fell evidently short of standards, even though 9 out of the 10 domains improved in completeness since the pandemic. Various problems seemed to arise with the paper records such as illegible handwriting, missing papers and inconvenience with storage and retrieval of files. Radiographic reporting improved greatly since the pandemic, whereas dental history recording was even lower than before.

Conclusions:

An overall failure to record basic components by undergraduates in the records was found. This is a critical issue in health care delivery; thus, awareness should be incorporated into the dental curriculum without delay. This study supports the use of clinical audit for quality assessment and improvement of dental records. Furthermore, innovative teaching and feedback-learning methods can prove to be extremely useful.

CHAPTER 1: LITERATURE REVIEW

1.1 INTRODUCTION

Patient management, care planning and improving safety of patients as well as the clinicians, in line with evidence-based guidance and legislation are crucial aspects of any healthcare profession as stated by the National Health Service, England (NHS). By paying attention to these details, we can achieve a superior overall standard of health care. Dentistry is shifting from the traditional primary treatment frontiers and in the direction of an increasingly comprehensive and focused care pathway approach. Such dental care and treatment should be designed in conjunction with each of the patients to meet their individual needs. Better information sharing is required for an integrated approach in patient-care, which in turn requires professionals and patients in any clinical setting to have safe access to freely moving clinical records (NHS, 2019).

Clinical dental records that are accurate and complete have the potential to be used for a variety of significant purposes, mainly improving patient safety and care effectiveness, facilitating effective communication between healthcare professionals as well as enabling quality of care assessments. Other interesting uses of records involve providing a database for dental research, assisting in the defense against malpractice claims and helping with victim identification through forensics (Tokede et. al, 2016). A programme for evaluating the quality of dental

care by examining patient's records and radiographs was developed by Friedman and Schoen (1972).

Thereby, the literature search for this review revolved around the topic of record keeping in dentistry which was traditionally done on paper but has recently moved towards a more digital approach, especially following the coronavirus outbreak. Related topics were also explored concerning with the key entries in a record, the ideal manner of record-keeping and the 'gold standards', the need for maintaining good quality of record-keeping procedures and the consequences if not appropriately carried out. Abundant articles exist on the databases and multiple studies have been conducted to check existing record-keeping standards. After searching and revising many online materials for this audit, 44 relevant articles have been used to provide the necessary information in this review and to locate the areas that are lacking and require further attention.

It can be determined from the existing literature that insufficient reliable literature has been published and the evidence of record-keeping practices in the UK is sparse. Therefore, with the help of this audit, the importance of clinical record-keeping has been discussed. Emphasis has been laid on the quality of dental records. Furthermore, many studies that compare the quality of records do not account for the methods used for record management. Instead, most consider paper-based record management as the gold standard (Stausberg et al., 2003). Hence, in this study an attempt has been made to shed light on the differences between paper and electronic systems, in view of the change in record-keeping technique caused due to COVID-19.

1.2 RECORD-KEEPING: A PROFESSIONAL DUTY OF CARE

Dental records are important legal documents of professional healthcare systems, and they form a vital part of providing an excellent standard of oral health care. Therefore, every dentist is bound, legally and ethically, to maintain dental records. Furthermore, according to the Faculty of General Dental Practitioners, United Kingdom [FGDP(UK), 2018], complete and accurate record-keeping is a recommendation of best practice. Hence, all dental professionals, whether operating under the NHS or privately, are obliged to maintain precise patient records of the care they provide to patients.

1.3 CLINICAL IMPORTANCE OF MAINTAINING RECORDS

A patient record contains a myriad of components, consisting of the history and details of the patient's assessment along with treatments recommended by the dentist for that particular patient, treatment alternatives and risks, as well as care provided. Records also include all communications between the clinician and the patient. It functions as an information sharing system amongst dentists, patients, and any other authorised third parties (AAPD, 2021). Therefore, recording of clinical notes is valuable in dentistry because thorough documentation is a central component of communication amongst professionals. Any healthcare expert's notes provide a glimpse into their thinking process. In addition to this, accurate

records are thought to be necessary for successful clinical judgments and as a result, better treatment outcomes (Kutesa and Frantz, 2016).

1.4 REQUIREMENTS OF RECORD-KEEPING

1.4.1 The GDC Standards

To ensure a consensus on record-keeping, countries establish national record-keeping guidelines. In the United Kingdom, the General Dental Council (GDC, 2013) imposes a professional duty to “maintain and protect patients’ information”, issued in the “Standards for the Dental Team” document, Principle Four. The criteria include maintaining “up to date, complete, clear, accurate and legible records” and storing them securely. Additionally, it is obligatory to keep the personal details of patients confidential but the patients themselves should be able to access their own dental records whenever required. The GDC standard 4.1 also mentions that records must be written “contemporaneously”, meaning an accurate record needs to be made at the time of the appointment or as soon as is feasible afterward. Registered dental professionals do not always have an understanding of this concept. Because the events would still be fresh in the writer's mind, contemporaneous notes tend to be more accurate. When keeping records takes longer than expected, a note should be made of the circumstances that led to the delay (Bridges, 2016). Visual-spatial memory and auditory memory make up the clinician's working memory, both of which are important for

performing dental procedures. Time delays can cause the memory to fade, which can lead to incomplete or inaccurate entries. The likelihood that more information will be forgotten increases with the length of the delay (D'Cruz and Rattan, 2018). In addition, the GDC (2013) "Standards for the Dental Team," Principle Three indicates the need to document a written consent and the discussions that take place between the patient and the clinician which lead to obtaining a valid consent, along with the patient's signature.

1.4.2 National 'good practice' guidelines

The FGDP's (2016) "Clinical Examination and Record-Keeping" guidelines include record-keeping recommendations for dentists. These recommendations are denoted either as 'Aspirational', 'Basic' or 'Conditional'. Aspirational means those representing the gold standard and a record would be considered complete only if these are present. Basic means the baseline information that needs to be collected unless the clinician can strongly justify otherwise, in which case the reason must be documented in the record. Conditional are those recommendations that are not relevant in every situation, but when applicable are considered as Basic. Moreover, it suggests procedures for storage and the need to archive records that are not active. For practices using computers for any part of the records, it mandates enrolment with the data protection registrar.

In accordance with the FGDP guidelines, the NHS (2019) has also developed a set of standards to ensure that dental records are kept in a consistent and

accurate manner. It lists out clear checkpoints and goals following a logical sequence, which are necessary to be completed for a record of high quality.

1.4.3 Constituents of a dental record

A dental record acts as a source of information for the dentist, the patient and other dental professionals. Ideally it comprises all information regarding patients' histories, comprehensive clinical examinations, treatment planning, informed consent, progress notes, correspondence, and consultations (AAPD, 2021). In 2000, The FGDP set out "Current Guidelines for General Dental Practice" stating that when a patient arrives at a dental practice, a record must be made containing information on patient's personal details, medical and dental history, examination of dentofacial area including oral hard and soft tissues and a sequenced treatment plan. At every subsequent visit, it is pertinent to record with a signature and the date, details of treatment provided, drugs administered, advice given, and prescriptions handed. It also expresses the need to record a valid consent at every necessary stage along with any treatment denied by the patient. Currently FGDP's previously mentioned 2016 guidance available on record-keeping is most suitable to dentists. Evidence regarding radiographs, photographs, study models, laboratory notes, referrals and payment history should also be contained in patient records.

An article is published in the British Dental Journal on the items deemed essential to be recorded according to the three appointment types in the NHS i.e., new

patient examination, recall appointments and emergency appointments. A prominent level of agreement between an expert group and participating dental practitioners was achieved using a Delphi approach, to create a template for each appointment type which illustrates details that are essential, aspirational, conditional, or not required (Newton et al., 2019).

The Care Quality Commission (CQC) lists out certain requirements that are mandatory in a record. In addition to the components of other guidelines, it mandates that if a radiograph is undertaken, then according to IR(ME)R 2000 regulations it must be present along with a record of the radiographic report, a justification for the radiograph and its quality assessment score (CQC, 2022). The guidance regarding appropriate radiographic reporting is unclear. The National Radiological Protection Board's (NRPB, 2001) instructions define the terms "clinical evaluation" and "full radiology report." Although the distinction is unclear, it could be understood as negative radiological results do not need to be legally recorded in a report.

1.4.4 Influence of COVID-19 on record-keeping standards

Following the advent of the coronavirus disease in 2019 (COVID-19), a number of changes have taken place in the field of dentistry. The significance of accurate record-keeping has been highlighted by the COVID-19 pandemic. Despite the restrictions on dental care in the brunt of a global pandemic, it does not change the requirement to adhere to the professional standards for record-keeping that

are upheld by Dental Councils. In fact, certain additional elements are added to the already existent record-keeping criteria. Prior to any examination, it is crucial to enquire about the patient's health in suffering any potential COVID-19 related symptoms. During the treatment, information regarding the personal protective equipment (PPE) worn by the dentist, the patient and the dental care providers should be documented in the clinical notes. Notes should reflect patients' experiences, the type of care given, and any potential impacts of restrictions and local regulations on treatment provided (Eggleton, 2020). A 10-point epidemiological screening questionnaire is recommended to classify the patients based on their individual risk assessment. "Very high risk" patients are those who interacted with COVID-19 positive individuals or travelled to any area with a substantial risk of infection in the previous 14 days. Those who encountered COVID-19 positive individuals or travelled to any high-risk area within the previous 14 days but did not exhibit flu-like symptoms should be treated the same. Patients who exhibit flu-like symptoms but who did not come into contact with COVID-19 positive patients should be categorised as "high risk" patients. All others with no symptoms or history of recent contact are considered to be of "unknown risk" (Gurzawska-Comis et al., 2020).

1.5 ASSESSMENT OF DENTAL RECORD-KEEPING

The foundation pillar of good dental practise is good record-keeping, and audits are an excellent way of carrying out quality assurance checks for records (British

Dental Association [BDA], n.d.). Based on current literature, every dental practice or institution may have separate protocols in place for note-taking and records management. Audits are a good way to keep a check of whether or not the standards and guidance are met in practice. The results of an audit and any consequent action plans could serve as foundation for future improvement. The CQC in the UK, as a part of its inspection, may review the practice's protocols for filling out dental records in accordance with the FGDP's good practice guidance. Thus an examination of dental records is conducted, only to evaluate the quality of record-keeping, not to judge the quality of care provided by the particular clinician. Being mindful of the sensitivity surrounding patient records and the duty of maintaining confidentiality, the CQC uses its authority to review a patient's dental records only when absolutely necessary, such as if there are any concerns that arise. Otherwise, reviewing of one or two records to confirm the information provided by dental team members and patients is sufficient (CQC, 2022).

1.5.1 Consequences of inadequate record-keeping

Even after the stress laid on importance of proper records in the profession, it is still found that inadequate record-keeping practices by dental practitioners are common. These have various drawbacks, and even though having complete and accurate clinical records does not guarantee that one will receive outstanding dental care, it does allow the practitioner to assess the level of care provided (Tokede et al., 2016). Despite hurdles like that of the coronavirus pandemic,

dentists must continue to keep accurate records of all patient care (Eggleton, 2020). Medico-legal problems can arise if documentation in patient notes is found to be deficient because it is considered as a breach of healthcare standards. This might result in a verdict of wrongdoing. Unfavourable legal judgments against dentists have often mentioned insufficient logging of patient care as a major contributing factor. When there is persistent evidence of poor record-keeping, it may be determined that there has been serious professional misconduct, which may result in deregistration of a health professional (Brown, 2015).

1.5.2 Global state of record-keeping

Worldwide, dental record-keeping reflects an overall low level of notation. Formal investigations in a number of countries, including the United States, Australia, and Scandinavia, show that clinical records frequently fail to meet the established benchmarks (Morgan, 2001). One study done in Finland assessed oral health record entries. When compared to the regional Finnish guidelines, record-keeping was found to be poor. Notes fell distinguishably short of standards in areas concerning records of an updated recent medical history, temporomandibular joint function, patient's bite, intraoral soft tissues, and intervals between checkups (Helminen et al., 2009). An Australian study revealed that in scenarios where a dental practitioner is questioned by a disciplinary body, dental records were commonly found scarce in establishing consent for treatment or details of the treatment undertaken (Brown, 2015).

1.5.3 State of record-keeping in the UK

Evidence of current record-keeping standards in the UK, when compared against the FGDP guidelines, have been found to be conditional. An assessment completed on 47 general dental practitioners in England and Wales for the existence of basic clinical entries in records showed poor quality, in line with other studies conducted worldwide. Many records lacked the most significant entries that could have impacted the provision of fundamental dental care. It was noted that there was no system in place to check record-keeping practises in these clinics. Another observation was that patients with treatments financed according to NHS scheme had a considerably lower occurrence of recording than patients whose treatment was privately funded. This could be attributed to time constraints caused by the need to provide rapid care in accordance with NHS regulations (Morgan, 2001). 184 Worcestershire dentists with NHS contracts were included in a collaborative clinical record-keeping audit with the goal of improving patient care quality. 30 random clinical records were audited by each dentist under eight domains and then graded. Grades of 1 and 2 were “Good” and “Adequate” respectively and grades 3 and 4 were “Inadequate” and “Poor”. Grades were recorded on data-collection sheets and analysed for frequency of each grade. Recording of soft tissues, periodontal status and radiographic review fell below Grade 2. The audit revealed a wide range of clinical record-keeping techniques among dentists (Cole and McMichael, 2009).

1.6 RECORD-KEEPING AT AN UNDERGRADUATE LEVEL

1.6.1 Implications of undergraduate record-keeping

A lack of information has also been revealed in a myriad of studies performed on undergraduate (UG) dental students, globally. Undergraduate educational institutions are the centers for imparting skills and knowledge to future dental professionals. If the records are accurate, students will comprehend the treatment plan and the justifications for it better (Pessian and Beckett, 2004). The benefit of instilling a good level of record-keeping knowledge at the UG level is that it will transform into efficient record-keeping in clinical practice (McAndrew et al., 2011). Therefore, proper training of students in record-keeping methods is an important competence and the attitude of students towards these procedures has a profound impact on the level of care delivered as well as on the future of dentistry.

1.6.2 Assessment of undergraduate record-keeping

To gauge the record-keeping pattern of undergraduate dental students, a few studies have been conducted in the past. An audit executed in the Guy's Hospital, London on 100 patient records completed by UG students revealed results that were far from being optimal. It was observed that a mention of the department where the patient was seen was the most frequently missing, followed by illegible signatures from both the demonstrator and the student, amongst other missing information. After presenting these results to 20 students and conducting a

teaching session, a re-audit was carried out. Most elements of record-keeping were found to have improved, except the updated medical history and the patient's most recent complaint (Pessian and Beckett, 2004).

To address the unsatisfactory state of dental records at students' clinics, another study was performed at Makerere College of Health Sciences in Uganda to obtain information from UG dental students on the factors that influence the quality of clinical notes and to obtain suggestions for improvement. In this cross-sectional study traditional handwritten records made by Year 4 and 5 students were examined. Three problems were established which were lack of sufficient space for note-writing because of poorly designed record forms, insufficient storage space along with an improper file retrieval system and an overall poor maintenance of records especially radiographs. Another interesting finding from this investigation was that of the students' attitude towards managing records, which was found to be questionable. The students were aware of the clinic's poor recordkeeping procedures, but they believed that others such as the staff or administration had a responsibility for maintaining accurate records. According to students, lecturers were expected to take the lead and it was assumed that the lecturers have a larger role to play in the process of keeping records. Thus, the results of this study determined the areas that needed to be addressed as part of teaching in the syllabus (Kutesa and Frantz, 2016).

1.6.3 Methods to improve undergraduate record-keeping standards

Kutesa and Frantz (2016) also expressed the necessity of a supervisor's guidance for students and the need for more training on record-keeping. With the ultimate goal of raising the standard of service provided by dental professionals, it is imperative that the faculty and undergraduate dental students are made aware of the factors that contribute to inadequate record-keeping. Furthermore, undergraduates have been identified as a source of knowledge that can offer constructive feedback to staff for enhancing the curriculum's content and structure. Additionally, it was discovered that the students were able to make suggestions that are practical and simple to carry out.

It was found that during the period of an audit, students changed their record-keeping practises a little after learning that their notes were being appraised in the audit process. Since the goal of an audit is to bring about positive change, this modification in behaviour was considered to be optimistic. It is imperative for such audits to be repeated at intervals so as to make further improvements as required, in the light of new findings. Furthermore, this audit suggests various techniques that can be used to teach and assess record-keeping skills of students before becoming qualified to practise independently as a dentist. Considerations must be made to incorporate a dedicated teaching session on record-keeping, emphasizing the advantages of accurate comprehensive records early on in the undergraduate course. Moreover, some true-life examples may be used for teaching and reflection purposes, like those of the issues that arise when records

are sub-optimally kept. Students who are already midway through an undergraduate course should also receive teaching sessions (Pessian and Beckett, 2004). It was portrayed by a systematic review conducted of the existing literature, that techniques such as clinical audits, lectures, tutorials, research assignments, case reports, record-keeping templates, and checklists of required record components were useful. In studies published to date, all such methods have been proved efficient in improvising record-keeping abilities of undergraduates. The use of record audits for teaching is the most widely used approach (Amos, Bearman and Palermo, 2015).

At the International Medical University School of Dentistry, Malaysia, an audit was conducted after a training provided to 4th and 5th Year students. A total of 100 records were audited as well as an email survey was conducted on views of students regarding the training. Results showed that the training assisted students in identifying their flaws, expanding their knowledge, and improving their record-keeping skills (Chong et al., 2014). The World Health Organization (WHO, 2011) also suggests that quality improvement methods be taught to students in order to prepare them for safe workplace behaviour. Chong et al. reported that clinical auditing as a means of a quality control tool, can support this goal. They mentioned that a yearly self-audit in accordance with established standards could cause substancial improvements in clinical record-keeping practises. Students who took part in the audit, made the suggestion that instructions about record-keeping should have been given initially when they were seeing patients for the first time. It was suggested that these audits would be helpful tools to enhance

education on record-keeping, in addition to record-keeping instruction earlier in the course. Students identified a few areas for improvement in the clinical audit curriculum, demonstrating a favourable outlook towards the importance of audit training.

1.7 COMPARISON OF PATIENT RECORD SYSTEMS

1.7.1 Traditional handwritten records

In the traditional method of note taking, records are written by hand on paper. Errors are frequent where illegible handwriting is found. These paper-based records have been used in the industry for several decades. The advantage lies in the cost-effectiveness of the system, hence reducing the burden on clinical funds. Moreover, the format is convenient to many clinicians as they find it easier to pull-up information from the file and have a look at the patient's history in one go (Records Management, 2022).

Aforementioned studies highlight some significant issues accompanying this style of record-keeping. Pessian and Beckett (2004) found that illegible signatures by both, students as well as staff members, were common and may cause issues in ethical and legal matters. In a different study, 85.7% of corrections made in handwritten records were deemed inappropriate, some of which had sentences that couldn't be read because they were so heavily blacked out. In a legal dispute,

a prosecutor's attorney could then claim that the clinician was hiding something (McAndrew et. al., 2011).

Another major drawback is the inconvenience associated with keeping physical paper-based records, requiring proper labelling and a high amount of storage space to facilitate retrieval. At times, the students either ended up filling new forms for the same patient or relying on the patients to tell them about their previous treatments (Kutesa and Frantz, 2016). Mentioned in NHS "Records Management Code of Practice" is the ideal time period for which records of a patient need to be preserved. The retention period for dental clinical care records is 15 years and dental finance related records is 2 years (NHSX, 2021). Moreover, paper records could be more susceptible to failures, human error-related loss of paper records, or natural disaster-related damage to paper records. The paper records require a fireproof cupboard or cabinet, where destruction, unofficial access and theft are avoided. In addition to all this, sharing of paper records entails looking for the record files, possibly in a big storage space, and then either scanning or sending copies (Records Management, 2022). Altogether this implies that there is a huge burden of requirements that practices must face for the storage of paper-based records. Students also found it difficult to write notes in the limited amount of space present in the paper records the disorganised manner in which the forms were designed. In accordance with recent technological advances, the ultimate solution to the problem of paper-based records is deemed to be an electronic patient record (EPR) system (Kutesa and Frantz, 2016).

1.7.2 Electronic healthcare management systems

Electronic systems are becoming a popular tool for patient records management and numerous examples exist in the dental as well as other related medical fields. It is vital that practitioners gain a thorough understanding of how to apply digital systems in patient care and record-keeping (Mauriello and Platin, 2001).

A study conducted with the goal of seeing how well an EPR system could help with the quality of clinical dentistry in a dental school setting achieved positive results. Restorative care after root canal therapy was accomplished in a complete and timely manner. In order to enhance patient follow-up, the institute also replaced using a paper recall system through postcards and began utilising an automated recall exam feature of the electronic system instead. The authors state that the usage of electronic systems in clinical education appears to be suitable and can be seen as a logical progression of the current trend toward increased influence of information technology throughout the dental curriculum (Shelley, Johnson and BeGole, 2007).

A study comparing handwritten and computer-generated records at the Cardiff Dental School, demonstrated that the use of computer software for dental record-keeping helped students adhere to legal and desirable guidelines for a clinical record to a much greater degree. Additionally, the software used for generating records by computers did not allow for exclusion of patient identification information and obviously, 100% of the records were legible (McAndrew et. al., 2011).

Overall, electronic systems help with saving time, maintaining accuracy and allow easy access to patient notes and easy sharing of information, not to forget the added benefit on the environment by saving paper (Difference Between Electronic Health Record with Paper Record, 2019).

During the outbreak of the coronavirus disease, an Italian institution of medicine in which all patient data is available through an EPR system, could successfully adopt an EPR-assisted phone follow-up for breast cancer survivor patients rather than the usual follow-up visit (Messina et al., 2020).

1.7.3 Current concerns related to electronic record systems

Electronic dental records can contribute to elevating the quality and efficiency of healthcare, provided they are used securely and with an understanding of the legal implications. In a study performed in Saudi Arabia, certain issues such as those of privacy, compliance, and expense were discovered to be hindering attitudes of healthcare providers towards Electronic Health Record (EHR) systems (Sayed, 2021).

Large healthcare institutions might have to spend huge amounts of money to purchase and install the EHR system. They come with extra expenses for long-term digital storage. Furthermore, thousands of medical records have been compromised in cyber security data breaches involving EHRs (Difference Between Electronic Health Record with Paper Record, 2019). Data protection

laws affect dental practice especially EHRs. As public organizations, NHS dental practices in the UK must appoint a data protection officer, who may be the practice manager or an associate (BDA, n.d.). Additionally, failure of standardisation causes incomplete record documentation and guidelines must be created by dental regulatory bodies which should specifically outline the standards for electronic records (Tokede et al., 2016).

Moreover, in an ever-growing environment of litigatory complaints, high quality record-keeping is becoming increasingly important, but it is time-consuming to write down accurate notes and cover all aspects of care. In order to save time, practitioners have begun to use copy-and-paste notes and templates with pre-completed entries, which are indeed handy but can have their own set of troubles. A study based on this, found frequent errors such as inadequate or inaccurate entries, inappropriate template used for clinical findings, persisting errors due to copy-pasted notes and so on (D'Cruz and Rattan, 2018).

1.8 COVID-19 AND DENTISTRY

1.8.1 Overall impact of the pandemic

As has been experienced by all, the COVID-19 pandemic has had a major impact on our world. With respect to dentistry in particular, there have been major clinical, legal and economic consequences faced by everyone involved in the field. Owing to the close positioning of the dentist and the patient during dental treatment and

the production of aerosols caused during certain procedures, dentistry is known to be a high-risk profession for occupational spread of viruses. Therefore, routine dental care was restricted or halted for a duration of time throughout the world. Even though dental professionals desired to treat their patients, they were concerned regarding the potential for viral transmission. Additionally, patients were hesitant for fear of infection, to seek oral healthcare wherever it was available. Hence there have been severe repercussions on the quality of patient care delivered during outbreaks and some likely long-term permanent changes (Coulthard et al., 2020).

For patients with symptoms, dentists in many countries implemented telephone and video consultations (Coulthard et al., 2020). In Canada, because of the limited availability of oral health care providers in person, the tele-dentistry tool was used at an unprecedented rate. A study was conducted to determine the possible outcomes of this in the future and it revealed that tele-dentistry can potentially make oral health care more effective, efficient, and environment friendly. It can act as a supplement to traditional dental practice, where some visits can always be held virtually. This can also help to diminish oral healthcare inequalities between rural and urban communities (Singhal et al., 2021).

1.8.2. Viral transmission in dental environments

Direct contact and airborne transmission are the two main ways in which the primary transmission of the coronavirus occurs. There is sufficient evidence to prove that COVID-19's causative coronavirus, SARS-CoV-2, can spread through the air in aerosol particles, as well as through larger droplets or surface deposits (Jarvis, 2020). In 2020, the WHO proclaimed that the right environmental conditions could allow coronaviruses to survive on surfaces for a long time. Another study stated, years before the COVID-19 pandemic hit, that uninfected people may contract the coronavirus through indirect transmission, from such contaminated surfaces. People can become infected by touching their eyes, nose, and mouth while in contact with surfaces that have been exposed to the virus (Hethcote, 2000).

1.8.3. Impact on record-keeping

In order to offer suggestions for handling hospital paperwork in a post-COVID-19 world, a study assessed the potential for paper-based forms to spread SARS-CoV-2 to staff. It was advised that electronic request forms should take the place of paper-based request forms and that these electronic requests should be capable of being printed. Sterilizing received documents would be an additional alternative to ensure their safety. The stability of SARS-CoV-2 on various surfaces

and the likelihood of COVID-19 transmission through paper both require further research (Hasan, Nafie and Abbadi, 2020).

During the global pandemic, the role of EPR systems had risen greatly. As a result, investments in telemedicine, digital technology, and information systems increased (Pryor et al., 2020). Besides that, teledentistry was acknowledged as a resource for dental professionals in patient care. For instance, general dentists could share patient records with dental specialists to get their opinion on cases and subsequently could make a decision to either perform treatment themselves or to refer. It was advised that during teledentistry appointments, the patient's location, method of identification, and technological tools used should all be noted in their medical records (Singhal et al., 2021).

Many hospital trusts and dental practices in the UK too have endorsed teledentistry in the pandemic. Risk assessment, triage, and management via telephone or video link were encouraged as standard operating procedures for urgent dental care systems. It has also proven to be extremely beneficial for shielding patients and clinicians by lowering the number of people who enter healthcare settings and thus lowering the risk of COVID-19 transmission (Menhadji and Oberai, 2020).

1.8.4. Further concerns related to electronic patient systems

Proper guidelines in terms of methods of convention, data handling, informed consent and maintaining ethical standards of care while using electronic systems have not been developed. Teledentistry, which entails a blend of dentistry and electronic information via telecommunication technology, was endorsed throughout the pandemic. Although most authorities validated teledentistry for triaging dental emergencies and screening patients with COVID-19 for symptoms, barely half of them established any specific guidance regarding it (Singhal et al., 2021). With multiple clinicians working remotely and on personal devices, the duty of confidentiality was brought into question too. Many clinicians are unaware of how their legal and ethical obligations apply to the use of personal devices, thus putting patient data and records at risk (Menhadji and Oberai, 2020). The use of WhatsApp in health care has grown, particularly since the COVID-19 pandemic, but there is a need to protect electronic patient information. There exists a general lack of understanding or concern about breaking existing privacy and security laws and there are no clear mechanisms for keeping track of WhatsApp content or storing data (Morris, Scott and Mars, 2021).

Reinforcing the GDC (2013) standards regarding this, it is always critical to keep patients' information secure, whether the records are kept on paper or electronically. The General Dental Council in collaboration with other healthcare regulators have now published safeguards for patients accessing healthcare remotely (GDC, n.d.).

1.9 CONCLUSION

Record-keeping is an extremely vital element of provision of dental care. In a clinical dental setting, sticking to the format of handwriting or typing entries into patient records may cause continued problems of poor record-keeping. Newer technologies like digital dental radiography and photography, as well as audio-recording of patient interactions have been suggested. These may provide a solution to record-keeping issues but the evidence regarding these is still very limited (Brown, 2015).

A search into the existing literature has revealed that in current years, electronic dental records have gained increasing popularity due to various advantages over paper-based records. Many dental schools and institutions have adapted to these electronic methods increasingly during the period of the COVID-19 pandemic. Regrettably, factors such as lack of universally accepted record-keeping standards, incomplete documentation practises, and inhospitable EHR user interfaces have persistently contributed to poor dental patient record-keeping (Tokede et al., 2016). As shown by various studies, positive changes in record-keeping can be achieved by creating awareness among dental clinicians and students on its importance and legal implications and by conducting proper undergraduate level training in record-keeping competencies.

CHAPTER 2: METHODOLOGY

2.1. INTRODUCTION

From the review of literature, it was established that no audit has been done previously, that compares the standards of undergraduate dental record-keeping, before and after the changes due to COVID-19 started manifesting in dentistry. Nonetheless, similar studies have been carried out whose methods could be transcribed with certain modifications. Thus, existing methods were reformed in the best possible way to be suitable for this project.

2.2. STUDY AIM, OBJECTIVES AND OUTLINE

The main aim of this audit was to assess the impact of COVID-19 on the completeness and therefore the quality of record keeping maintained by undergraduate dental students in the Restorative department of Barts and the London School of Dentistry.

Various objectives of this audit were:

- To quantify the current quality of record-keeping maintained by undergraduates.

- To identify, if any, the differences in record-keeping caused by the COVID-19 pandemic.
- To raise the bar for accurate record-keeping, in order to improve the quality of patient care.
- To understand the importance of complete record-keeping for clinical governance and medicolegal reasons.

The basic outline consisted of evaluating the entries filled by undergraduate dental students, to check for completeness of dental records, both before and after the introduction of the COVID-19 virus. The dental notes of patients seen by the students belonging to any year of study and attending restorative clinics, were investigated. The audit examined the out-patient records of patients who visited the screening clinics held in the month of March 2021, during the brunt of the pandemic, as well as those who were seen before the pandemic between April 2015 and March 2020.

2.3. BACKGROUND

Previously, in this dental hospital, a physical alphabetical filing system for patient records existed and the notes were all paper-based and handwritten. Separate papers from different appointments of a patient, were punched and placed together in a file belonging to that individual patient. Screening form templates

were also available, which were pre-printed on paper with blank spaces to fill the details into the records using ink. Different template formats existed over the years, although they only slightly differed in their components.

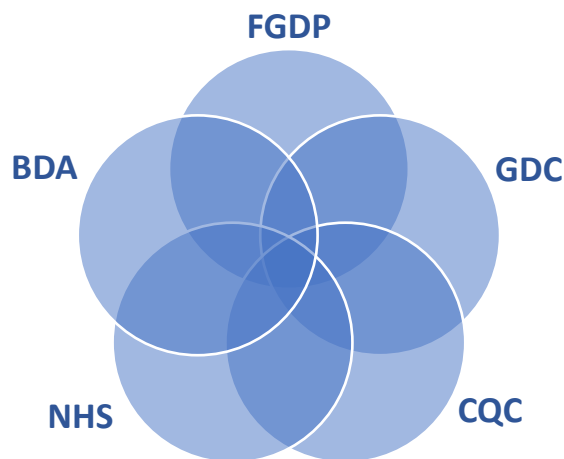
After the advent of the coronavirus, the authorities in the hospital decided to transform the entire system electronically in the light of the new infection prevention and control protocols and to address the need to minimise contact between individuals. Undergraduate clinics were closed during the pandemic, from March 2020 to March 2021 as a result of the nation-wide lockdown. During this period, the course coordinators worked unanimously to convert to the system of digital records, and new electronic templates for the same were created in January 2021. Guidance emails were sent to all staff members and undergraduate students, containing information on the use of the electronic NHS commissioner requested services (CRS) patient portal network. Templates were circulated for the ease of implementing the new patient record system, based on the British Dental Association guidance for a record keeping template for face-to-face appointments during COVID (BDA, 2020). The emails also contained the process of verification of the undergraduate records by the supervising clinicians. It is a two-step process in which first the student has to request a verification for the record from their digital account and then the supervisor has to electronically verify and sign the record.

2.4. STUDY DESIGN

This audit is a retrospective one, as information to carry out the project was collected from past dental records. Data was collected during the months of June-July 2021. The methodology was quantitative and was formulated in a way that it could be reproducible.

2.5. SETTING A STANDARD

Figure 2.1: UK guidelines for record-keeping



UK national guidelines published by professional bodies that govern clinical dentistry in the country, contributed to providing beneficial information regarding standards for keeping clinical patient records (Fig. 2.1). Documents like “Clinical Examination and Record-Keeping (2016)” and “Standards in Dentistry (2018)”

published by the Faculty of General Dental Practice (UK) and “Standard for the dental team (2013)” published by the General Dental Council were useful. Furthermore, the Care Quality Commission’s (2022) “Dental Care Records” guidance for dental care providers was helpful in outlining the standards for documentation of dental radiographs in the notes. The “Record keeping guidance” by the British Dental Association (2020) was also used to look at additional requirements of record-keeping after the introduction of the novel coronavirus. Following recommendations from these documents, the standards for this audit were conjugated against nationally agreed standards. In consistence with the above guidelines, record entries that have been considered “gold” standards in a patient’s dental record are listed in Table 1.

The primary standard decided for this audit was that 100% of dental records must contain all these constituents of basic clinical and legal importance. All entries must be clear, complete and signed by the student as well as the supervisor.

The secondary standard decided was that there must be no difference before and during the period of COVID-19, in the quality and completeness of the records as per the primary standard. Records during both the time periods should meet the 100% mark, although some additional components need to be recorded in relation to COVID.

Table 1: Necessary basic constituents of a dental record	
RECORD ENTRIES	MINIMUM EVALUATION CRITERIA
Patient identification details	Medical Record number (MRN) must be present on screening form and patient's personal details which include, name, gender, date of birth (DOB) and address.
COVID status	Patient's recent COVID-19 history must be recorded in the digital records (during and after COVID pandemic).
PPE	Details of the Personal Protective Equipment worn by the dentist, assistant or other staff should be noted.
Medical History	Existing medical conditions including any known allergies, present or past medications of relevance, hospitalisation or surgeries undergone, etc. should be recorded. Includes relevant family history. Medical history form must be signed by the patient.
Social History	Must include dietary habits, alcohol consumption, present or past smoking status and other factors that affect dental health such as recreational drugs, tobacco or betel nut chewing, stress, etc.
Dental History	Patient's dental complaints, history of complaints and past dental history including past experience with dentists and level of anxiety.
Extraoral examination	Any abnormalities detected in examination of the temporomandibular joint, muscles of mastication, head and neck lymph nodes, facial symmetry, lips and so on should be mentioned.

Intraoral examination	Includes oral hygiene status, soft tissue findings (including gingival appearance), periodontal assessment (Basic Periodontal Examination, plaque and calculus), Hard Tissue Charting (HTC) and basic occlusion.
Radiographs	If taken must include justification and quality assessment.
Diagnoses	Diagnoses of patient's condition including caries risk must be recorded.
Treatment Plan	The proposed treatment plan which should ideally be sequenced according to good practice guidelines.
Evidence of Consent	Consent is the patient's agreement to treatment and in the scope of this audit is limited to expressed consent. Information discussed with the patient regarding treatment options including no treatment, risks, benefits, treatments denied by patient, other counselling and advice must all be recorded.
Student's name	Name of the undergraduate student who has undertaken patient's screening should be written in the record along with the date and sign.
Supervisor's name and signature	Name of the supervisor along with a written signature in the paper-records and a verified electronic signature in the digital records must be present.

4.6. SELECTION CRITERIA

Records of patients above 18 years and attending out-patient clinics in the Restorative Department were looked at. Amongst these, only records of those patients that were screened by the 3rd, 4th and 5th year undergraduate students completing their Bachelor's degree in Dental Surgery were evaluated. Additionally, records completed by the dental hygiene and dental therapy undergraduates working in the Restorative department were also included. In certain records, more than one screening form was present from older appointments. In such a case, the most recent entry was looked at.

4.7. SAMPLE SIZE DETERMINATION

For electronic records, the total number of new patient screenings were enumerated, that took place in the first month following the resumption of clinical postings for undergraduate students, which was in March 2021. This number was found to be 67. The sample size was estimated using an online sample size calculator (Calculator.net). Calculation was done considering a confidence level of 95% and a margin of error of 8.5%. Hence a sample size of 45 was achieved. This means that a minimum of 45 records are needed to have a 95 percent probability that the real value will be within ± 8.5 percent of the audited value. For the purpose of comparison, a same number of paper-based records were selected. Therefore, in this audit, a total of 90 records were analysed i.e., 45

during-COVID electronic or digital records (D) and 45 pre-COVID hard copies or paper-based records (P) were embodied as samples.

4.8. SAMPLING METHOD

Probability sampling techniques help to eliminate sampling bias as every member of the population sampling frame has an equal chance of being selected. A non-probability sample selection was avoided so as to allow a random and a more diversified sample that would make a strong statistical inference. The method of sampling was applied differently to the two kinds of records.

For the digital records, 'systematic sampling' was used. In this method, every element of the sample frame is listed in an order, and instead of randomly selecting, samples are chosen at regular intervals. Here, 45 records had to be selected out of 67. Therefore, firstly the screening clinic patients were all arranged in an ascending order of the date and time of their appointment. If the date and time of appointments of two or more patients was overlapping, an alphabetical order was applied to the patients' surnames. Next, for elimination, every third patient's clinical notes were excluded from the sample to achieve the required sample size of $n(D)=45$.

For sampling of the paper-based records, 'stratified sampling' was used to achieve the sample size. This method involves dividing the population into subgroups called 'strata' based on some similar characteristics and then samples are selected from each stratum. Paper records are kept in a lock-protected unit in

the Royal London Dental Hospital. Each patient's notes are compiled together in a paper file and the files are alphabetically arranged in open shelves according to the patients' last names. Two patients' records from each letter of the alphabet were randomly chosen, except from 'Q', 'U', 'V', 'W', 'X', 'Y' and 'Z' where one record from each was selected since lesser patient records were present with surnames beginning with these alphabets. From the section under the letter 'A,' two patient record files were chosen but one was discarded as it was unclear as to whether or not the screening was carried out by an undergraduate student. Instead, one of the remaining files was found to have two separate screening and medical history forms, recorded during two different years and by two different students. Both of these notes were included as two separate constituents of a sample. This actually gave a notable finding which is discussed later on in this audit. Therefore, once again a sample of $n(P)=45$ patient records was obtained.

Ideally, the sample size determination and the sampling techniques should have been the same for both pre-COVID and during COVID records. A limitation was that this was not possible due to differences in the storage and retrieval systems of digital and paper notes. Moreover, the stratified sampling technique used for the paper records was not fully ideal. To achieve a stratified sample, the number of records to be chosen from each alphabet (strata) should be calculated based on the proportion of that strata amongst the total records present. This would have been extremely complex to carry out and would probably not have made a significant difference in the randomization of the samples in this particular audit.

4.9. PILOT STUDY

First a pilot data collection was done, with a sample size of n=3 for pre COVID paper records and n=3 for during COVID digital records. The criteria against which the records for this pilot study would be evaluated were mapped out. Presence and absence of entries were marked as 'Yes' and 'No' respectively. A 'comments' section was added to list out any additional findings. A copy of the data sheet used to collect this raw data is depicted in Appendix 1. The pilot data was collected with the intention of examining the feasibility and accuracy of the intended approach on a smaller scale before applying the same to the whole set of 90 records. After conducting this data collection, a few changes were made to the evaluation criteria and the tabular form of the data collection sheet.

4.10. AUDIT DESIGN AND FINAL DATA COLLECTION

The final framework of the audit was delineated as per the criteria in Table 1. Separate criteria are mentioned for judgement of each component. Each clinical record was marked for the presence or absence of these clinical details using numerical scores. A total of 10 "domains" divided into 32 "components" and 6 "sub-components" formed on the basis of Table 1 were assessed. A list is provided in Table 2. A score of '1' was entered for every entry that was appropriately recorded in the notes. A score of '0' was entered for every entry that was missing in the notes. Copies of the final data sheets with all the entries are present in Appendix 2.

Table 2: Evaluation standards used for records in this audit		
DOMAINS	COMPONENTS	SUB-COMPONENTS
Patient Identification	MRN	-
	Name	-
	Gender	-
	Date of birth	-
	Address	-
COVID-19 parameters	COVID history of the patient	-
	PPE worn by clinicians	-
Medical History (MH)	Known Allergies	-
	Existing Medical conditions	-
	Medications	-
	Hospitalisation/Surgery	-
	Family History	-
	Patient's signature on MH form	-
Social History	Dietary habits	-
	Alcohol consumption	-
	Smoking status	-
	Others	-
Dental History	Patient's complaints	-
	History of patient's complaints	-
	Past Dental History	-

Patient Examination	Extraoral Examination	-
	Intraoral Examination	Oral hygiene
		Soft tissues
		Periodontal
		HTC
		Occlusion
Radiographs	Justification	-
	Quality	-
	Report	-
Diagnoses	Differential diagnoses	-
	Definitive diagnoses	-
Treatment	Treatment Plan	Phases of treatment
	Consent	-
Verification	Student's name & date	-
	Supervising clinician's name	-
	Supervising clinician's signature	-

The patient identification details in paper records were checked for specifically in the restorative screening forms only and were marked '0' if not present. This was done due to the possibility of losing record note papers from the file and hence making it impossible to relocate incase identification details are absent. Where some components of the record were not applicable in certain cases, scores of '1'

were documented for example if radiographs were not required in a particular patient or consent for treatment was not valid because of no treatment provided. Alternatively, where entries were present but incomplete, they were scored '0' like in the case of radiographic reports where only findings pertaining to the problem were noted and not a full report. Although national guidelines for radiographic reporting are unclear, this decision was based on the teaching regarding this given to undergraduate students in this university and the expected quality of such a report.

Entries that were present in the record and were unclear or untidy but could be read with some difficulties were not marked down. However, entries that were present but were excessively inappropriate very given a '0' score. This situation was mostly faced in the handwritten paper notes where certain entries were illegible and were marked '0'. If entries were obviously left blank in because of no relevant findings but not reported negatively, neither crossed out (x) or cut off (-), a score of '0' was given because such records are not 'complete.' A notable number of missing entries in paper records corresponded to missing sections in the templates and these were marked '0' as well. A separate note of this was made against the particular record.

For the digital records, supervisor's signature was marked '1' only if the document had been electronically verified by the supervisor. In certain records, the request for verification was made by the student but not completed by the supervisor. These were scored '0' and additional notes of these were made.

Ethical approval was not required for this project as the data was collected anonymously while confidentiality of all the details in the records was maintained. Only the presence or absence of entries in the record were accounted for and there was no disclosure of any specific patient information.

4.11. DATA ANALYSIS

The data was tabulated into columns representing the individual components considered essential in a record and rows representing the serial number of the record. Scores were entered in two separate tables, one for 'P' and one for 'D'. The total score of each column was calculated for both 'P' and 'D' tables. This gave the sum of complete entries recorded according to the standards, amongst a total of 45, for each of the 37 components for 'P' and 'D' records separately.

The percentages of the complete entries of each component of the record were calculated individually for 'P' and 'D' records using the following formulae,

Percentage of complete entries recorded for a component in 'P'

$$= \frac{\text{Sum of individual scores for that component}}{\text{Total number of 'P'}}$$

Percentage of complete entries recorded for a component in 'D'

$$= \frac{\text{Sum of individual scores for that component}}{\text{Total number of 'D'}}$$

Furthermore, the average percentage of complete entries for all components under each domain and the difference in these averages between 'P' and 'D' was calculated as,

(Average % of complete 'D' enteries in a particular domain

– Average % of complete 'P' entries in that same domain)

A summary of this was arranged onto a Microsoft Excel document (Appendix 3) and figures were plotted to draw findings.

4.12. DIFFICULTIES

The main challenge faced in this audit was during the data collection procedure. The digital records were relatively easy to access, whereas the retrieval of the paper-based records was extremely time-consuming. Firstly, there was no system where the appointment schedule before the use of the CRS system could be inspected retrospectively. Because of this, it was difficult to limit the sample frame to patients seen within one month as done for the digital records. The initial plan was to preferably evaluate records in the month December 2019/January 2020, which was before the changes due to COVID-19 started being manifested in clinics. However, due to lack of a proper database or sources to access the previous documentation, the sampling process had to be compromised.

Secondly, the process to retrieve the paper files was very challenging and tedious. After multiple communications with the administration as well as records team,

permission was granted to access the room in which hard copies of all previous records are stored. With the kind help of a member of staff, the 45 paper records were fetched with great hassle. Additionally, care had to be taken so as not to damage, tear or lose any papers during data collection. The files had to be kept in a confidential but at the same time an accessible place in the hospital.

CHAPTER 3: RESULTS

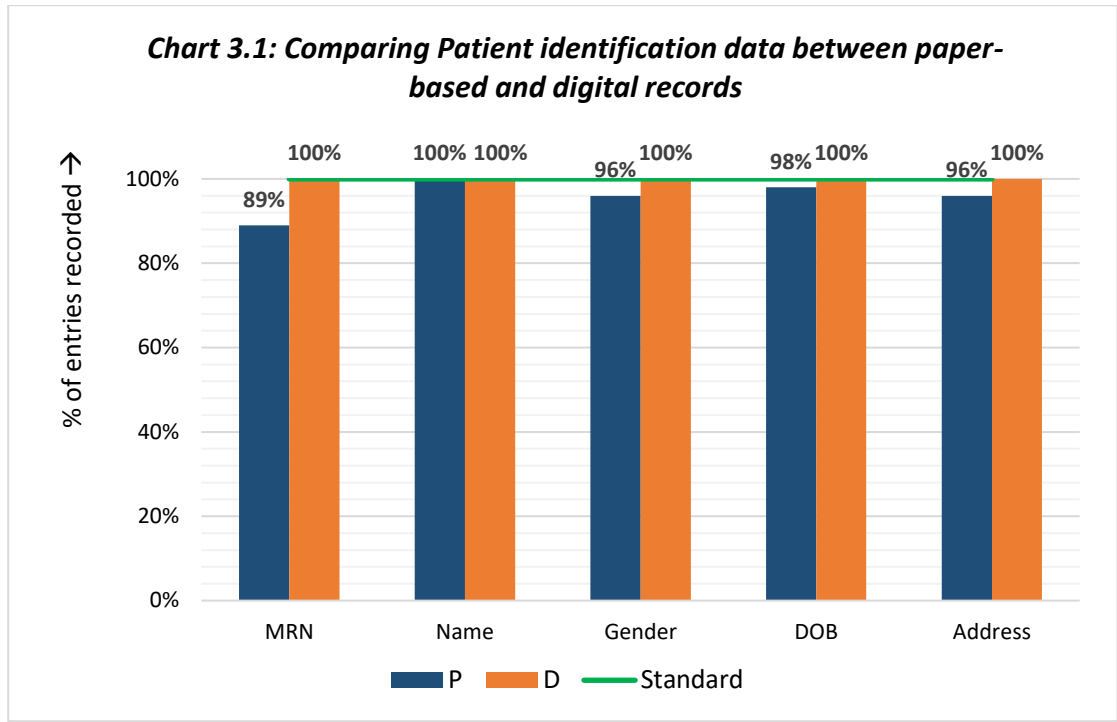
3.1. INTRODUCTION

The following results are the outcome of the analysis of data from the Excel sheets attached as Appendices. Various components of the records were intentionally evaluated separately so as to make it easier to identify the exact areas that are lacking. Most of the results obtained have been best depicted in the form of bar charts, illustrating where data is attaining the standards or where clear deviations from the standards exist as well as drawing comparisons between hard copy and digital notes.

3.2. DATA FINDINGS

7 out of the 45 paper-based notes were either very untidily written or the handwriting was extremely difficult to read. In spite of that, they were still included in the evaluation. Therefore, a certain amount of bias towards the undergraduate students was present with respect to these records although this is quite a paradox in an audit to evaluate the quality of record-keeping. Two out of the 45 paper-based records had loose papers in the file including the screening form, which were not put in place into the file.

3.2.1. PATIENT IDENTIFICATION DOMAIN



The components pertaining to this particular domain were present in all 45 (100%) digital records, fulfilling every criterion, as seen in the bar graph 3.1. In the paper records, patient's DOB was found in 44 (98%) records, while gender and address were found in 43 (96%) records. MRNs in paper records were present in only 40 (89%) records.

3.2.2. RECORD OF COVID-19 PARAMETERS IN DIGITAL RECORDS

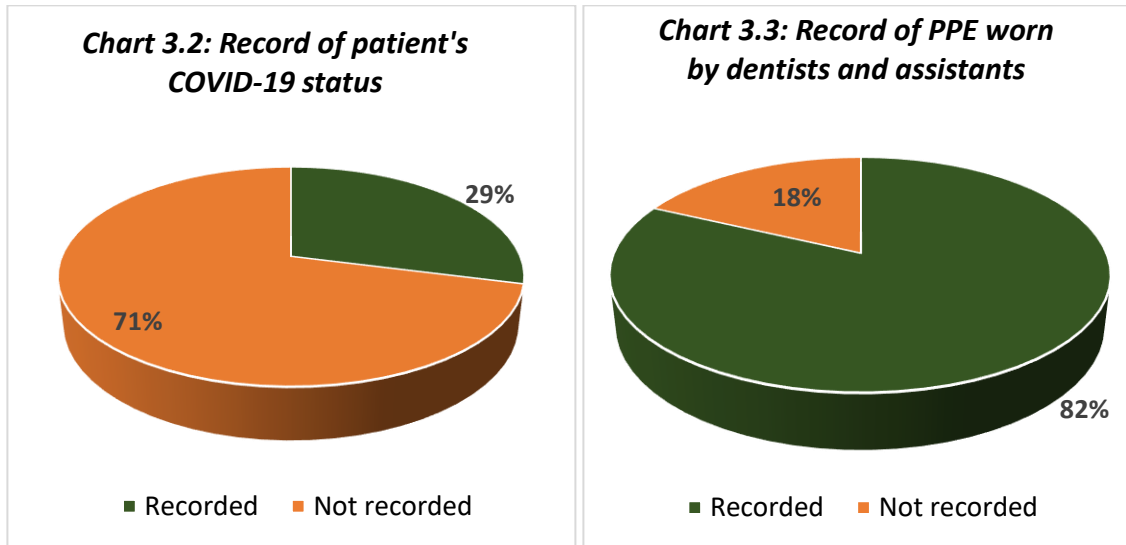
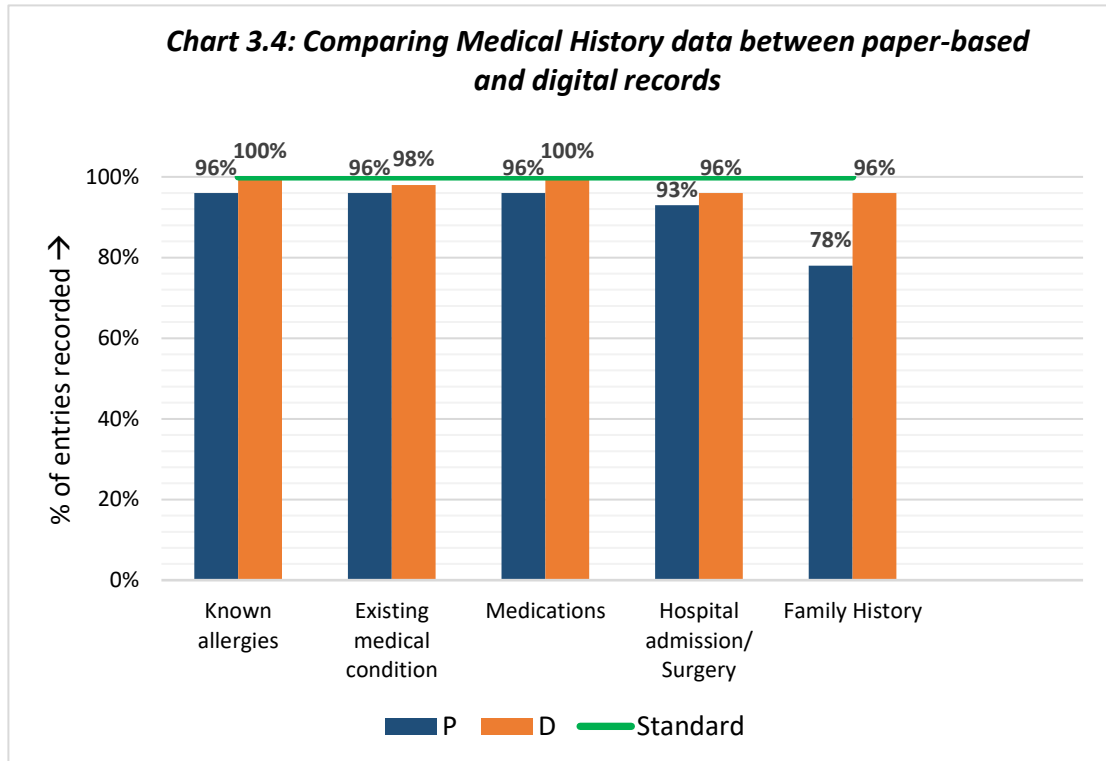


Table 3: Number and percentages of COVID-19 parameter entries in digital records				
	COVID-19 Status		PPE worn during appointment	
	Recorded	Not recorded	Recorded	Not recorded
Number of records	13	32	37	8
Percentage of records	29%	71%	82%	18%

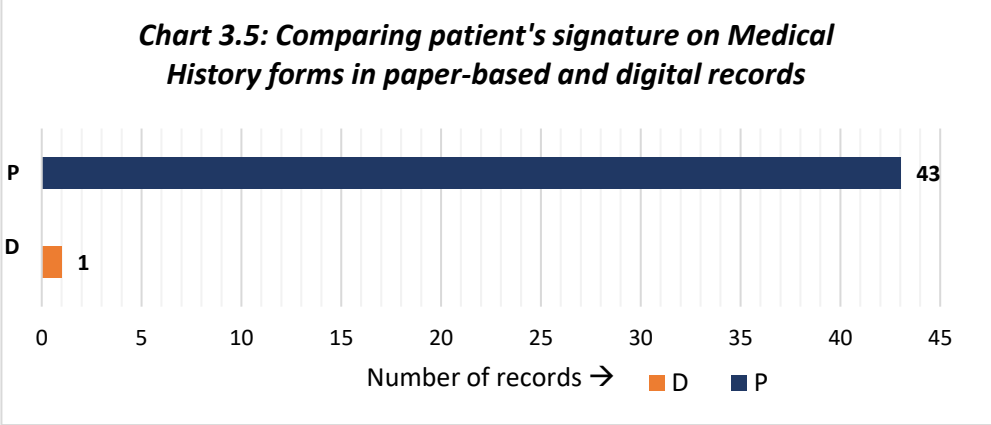
The record of COVID status and PPE was obviously found to be 0% in the pre-COVID paper records. Although, as depicted by the above pie charts (Chart 3.2 & 3.3), record of the patient's recent COVID-19 history was present only in 13 (29%) of the 45 digital notes, whereas a record of the PPE worn by dentists, dental

assistants or other dental care providers during an appointment was noted in 37 (82%) notes.

3.2.3. MEDICAL HISTORY DOMAIN

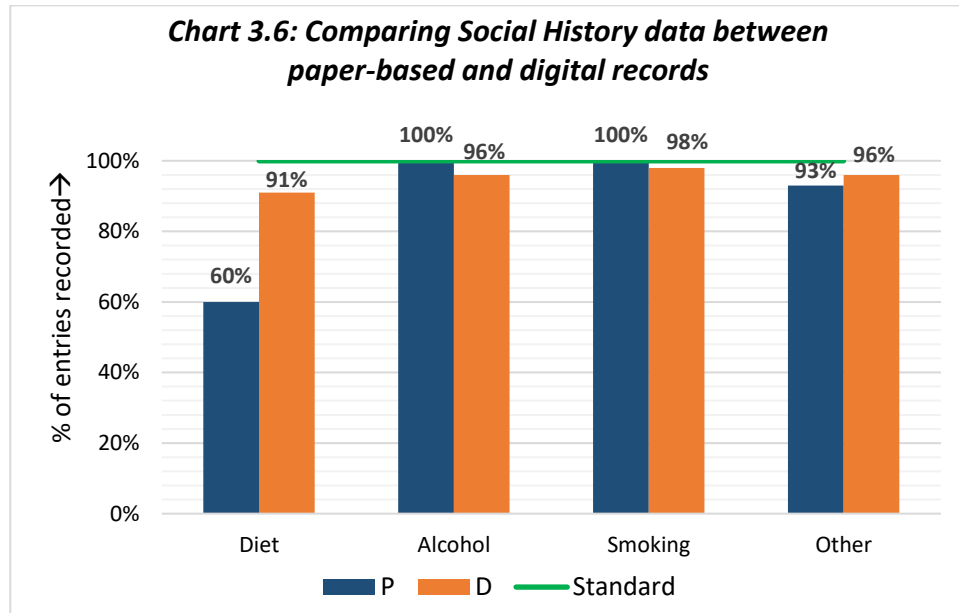


Plotting of the five components of medical history revealed that the average recording for this domain was above 90%, both before and during COVID (Chart 3.4). A comparatively higher number of entries was achieved in the digital records. Relevant family history was recorded in the least number of records in both i.e., in 35 (78%) paper-based and 43 (96%) digital records.



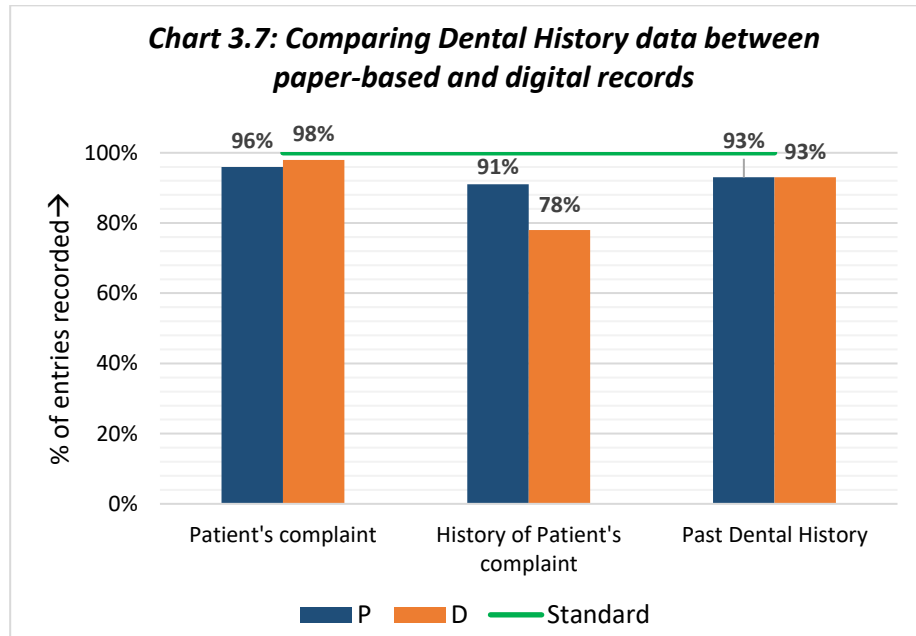
On visualizing Chart 3.5, a significant difference can be seen that is portrayed by 1 out of 45 (2%) digital opposing 43 out of 45 (96%) hard copy medical histories signed by the patient. The one digital record that is depicted above contained the patient's signature in the scanned copy of a handwritten medical history form.

3.2.4. SOCIAL HISTORY DOMAIN



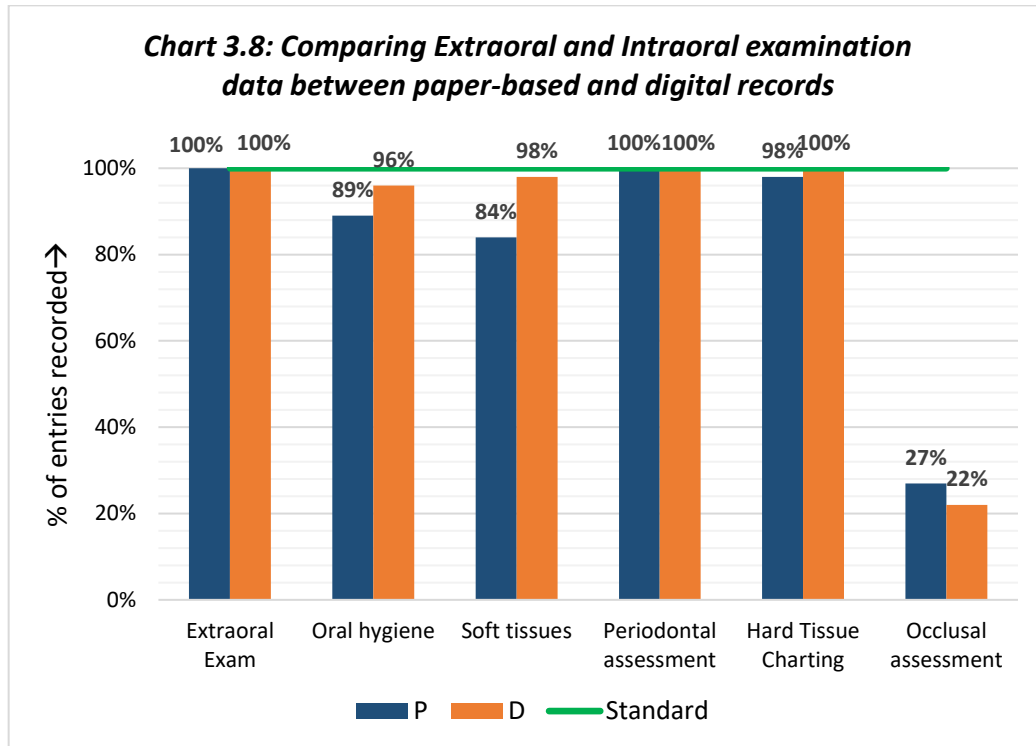
Although, record of patient's diet was the most missing social history entry in both, it was distinctively lower in the paper notes (27 out of 45 i.e., 60%) than the digital notes (41 out of 45 i.e., 91%). The recording of alcohol and smoking components of patient's social history were acquired in 43 (96%) and 44 (98%) digital records while previously, hard copies had 45 (100%) complete entries. Other details must include other habits, record of personal life and stress levels which were present in 42 (93%) paper records and 43 (96%) digital records (Chart 3.6).

3.2.5. DENTAL HISTORY DOMAIN



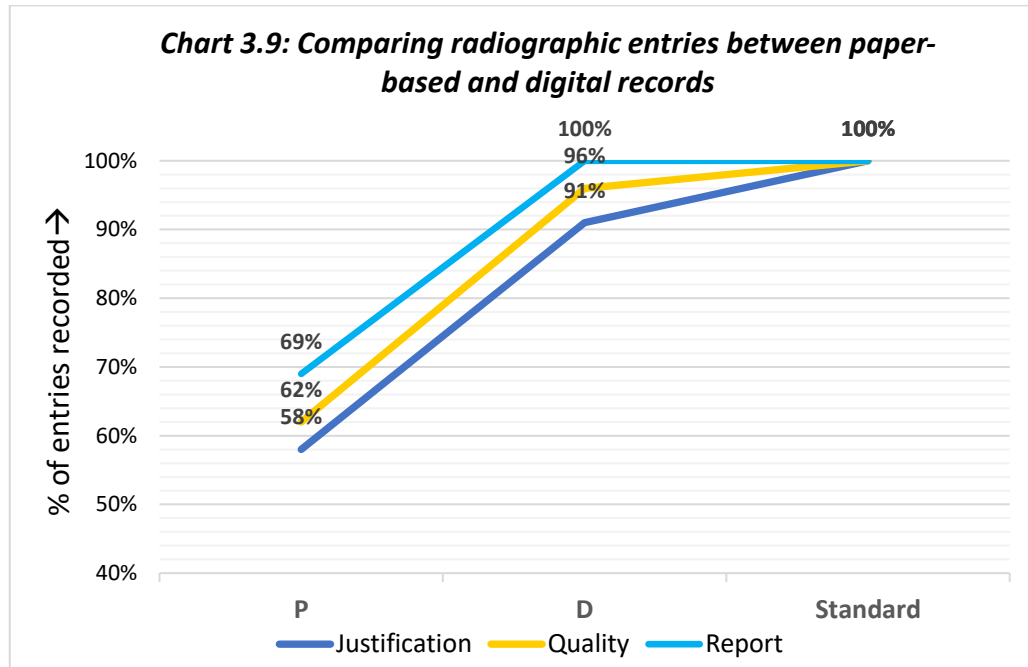
As deduced from the graph in Fig 3.7, dental history recording fell notably short of standards. Patient's complaints were registered in 44 (98%) paper and 43 (96%) digital records. The major deviation from standard was seen in history of patient's complaint that was missed in 10 (22%) of digital records. 4 (8%) of hard copies had this information missing too. Past dental history records fell short by 7% in all the records.

3.2.6. EXAMINATION FINDINGS



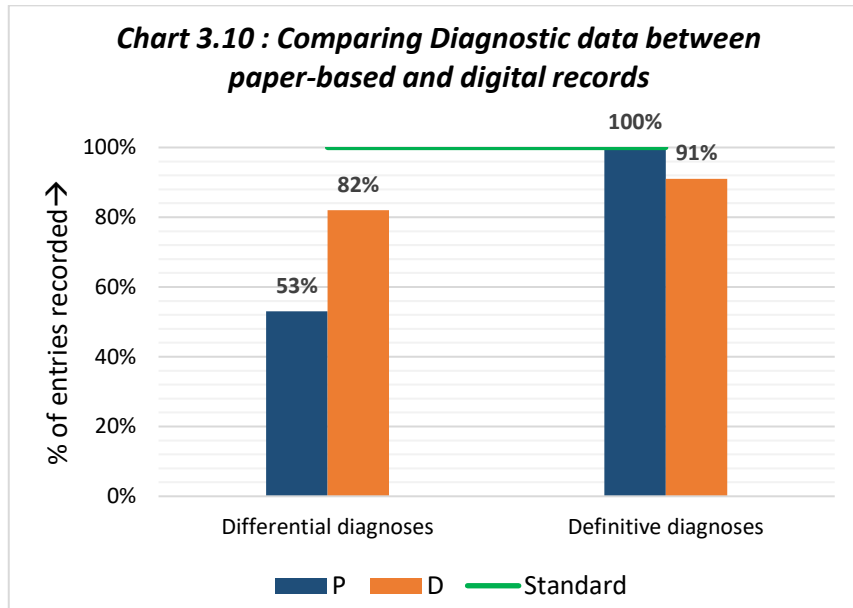
The recording of Extraoral examinations accomplished the 100% standard in all 90 records. With respect to the recording of Intraoral examinations, a variation was seen with some components achieving the standard and others undergoing a downfall. Record of patient's oral hygiene status and soft tissue examination including gingiva was discovered in 40 and 38 paper records, respectively (above 80% but not more than 90%), while it was found in 43 and 44 digital records, respectively (above 90%). Hard tissue charting had an overall good score above 90%. The most commonly missing record seen was of basic occlusion, falling below 30% in paper (12 out of 45) as well as digital (10 out of 45) records (Chart 3.8).

3.2.7. RADIOGRAPHIC FINDINGS



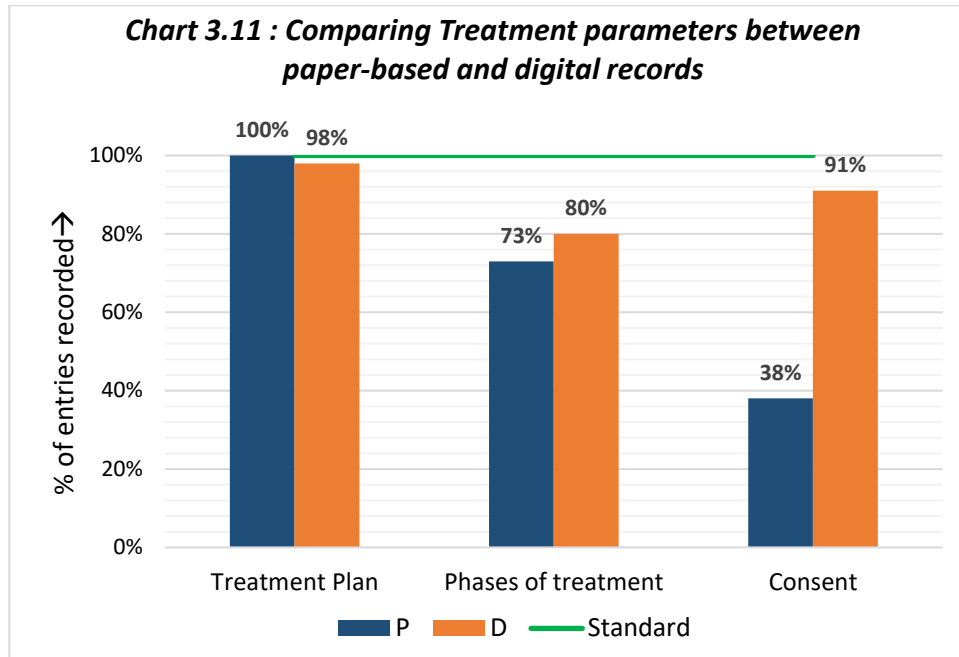
The improvement in recording of essential radiographic parameters is evident from the line graph in Chart 3.9. Better recording was seen in all three areas of radiographic record-keeping with the use of digital records. From being observed in 26-31 (55-70%) paper records, all components were entered in above 40 (90%) electronic notes with radiographic reporting achieving 100% recording.

3.2.8. DIAGNOSIS DOMAIN

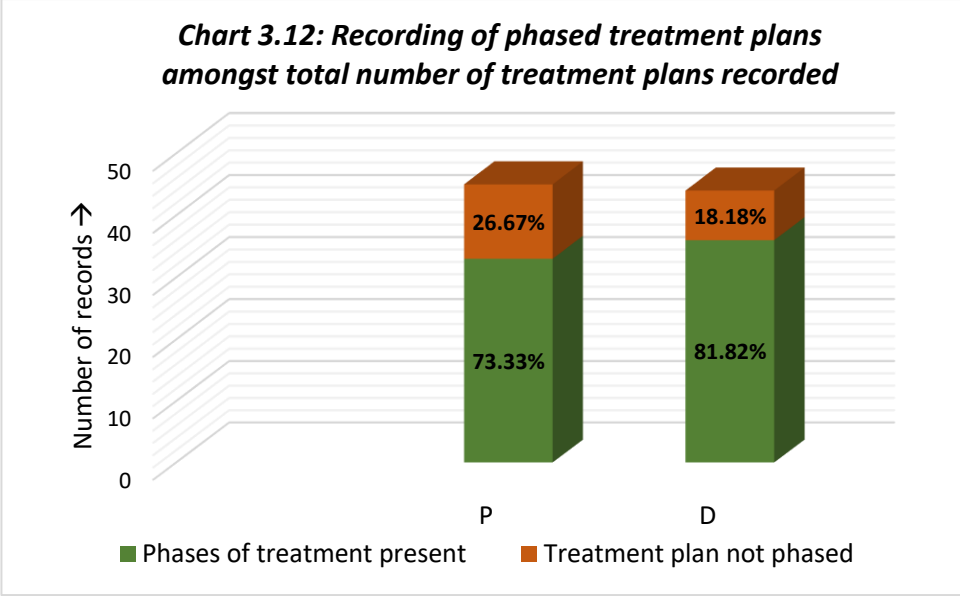


An important finding in Chart 3.10 is that the recording of differential diagnoses fell way below the standard in both kinds of records. The recording of differential diagnoses was found to be existing in only 24 (53%) hard copies while its number rose to 37 (82%) in digital records. Conversely, the recording of definitive diagnosis fell down from its 100% (45 paper records) standard to 91% (41 digital records).

3.2.9. TREATMENT DOMAIN

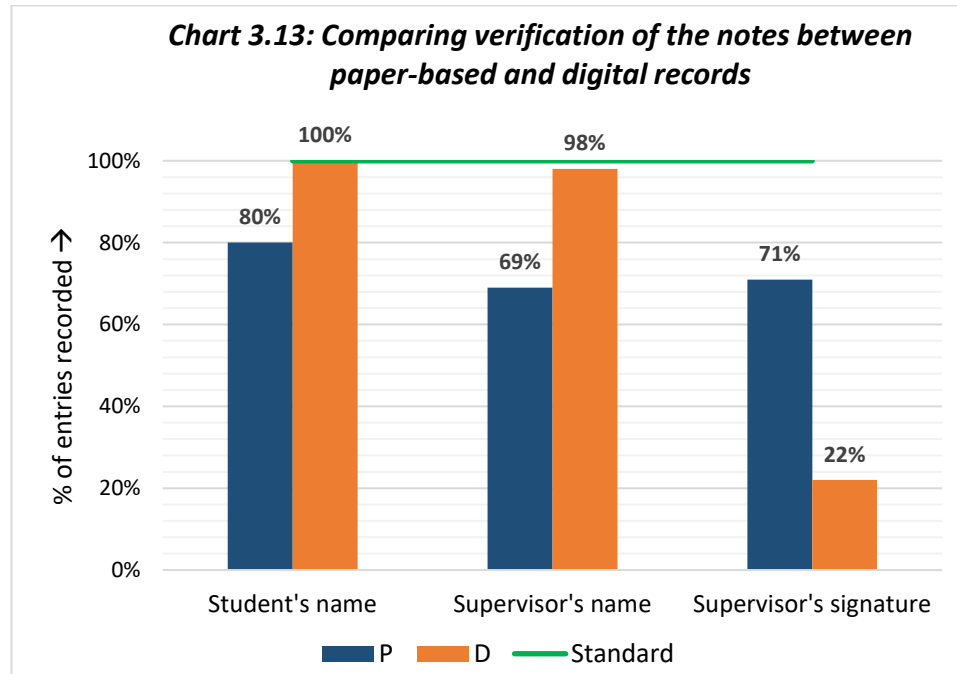


On picturing Chart 3.11, the recording of the proposed treatment plan can be seen to reach the standard in both the hard copy as well as digital records. Although a slight cutback of 2% is visible in digital notes, it was found that in one record only the treatment that was carried out on the day was mentioned and not the entire plan. Out of these, a phased treatment was seen in only 33 (73%) paper notes and 36 (80%) digital notes. Record of the discussion with the patient and patient's expressed consent was seen in only in 17 (38%) hard copies but it steeply increased to 41 (91%) digital records.



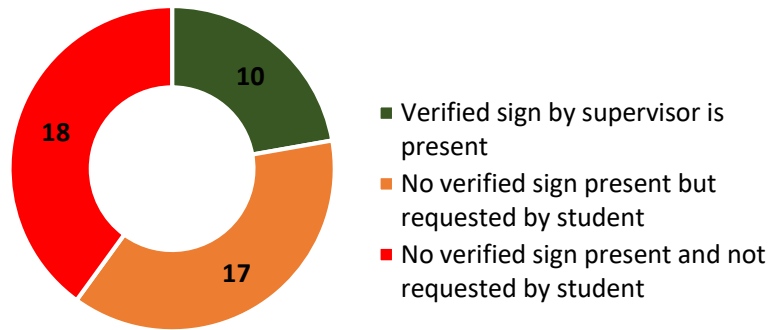
The above Chart 3.12 demonstrates the exact proportion of treatment plans that were recorded sequentially as per the phases in guidelines and the templates. This was seen in 33 out of 45 hard copies and 36 out of 44 digital records.

3.2.10. VERIFICATION AND SIGNATURE DOMAIN



The undergraduate student and the supervising clinician's name were present in 45 (100%) and 44 (98%) digital records, respectively. These components were previously found missing and showed in only 36 (80%) and 31 (69%) paper records, respectively. Two students' names were recorded but were not dated and contributed to the missing numbers. The supervisor's signature was seen prominently lacking in the paper records (32 out of 45) but an unacceptably lower percentage of signatures i.e. 22% (10 out of 45) was seen in digital records (Chart 3.13).

Chart 3.14: Number of verified supervisor's signatures present, absent and requested by students in digital records



The method of signing of the record by the supervising clinician is different for handwritten paper records and electronic digital records. Chart 3.14 shows the proportion of electronic verified signatures present that is 10. Out of the 35 that were absent, only 17 had been requested by the student.

3.2.11. CORRELATION OF MISSING ENTRIES AND TEMPLATES

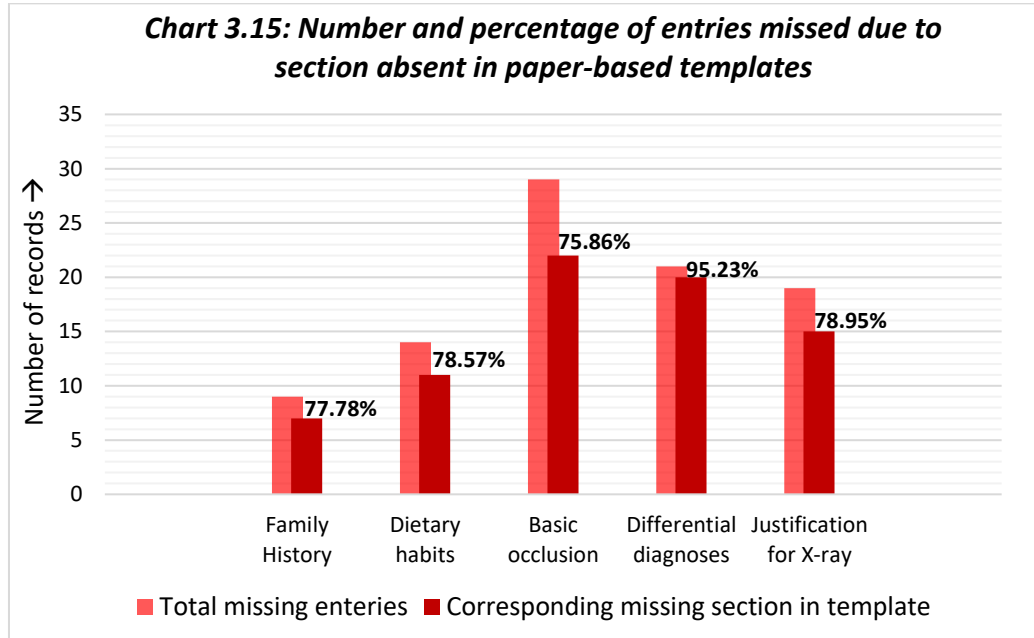


Chart 3.15 shows that a huge proportion of the missing data relates to those particular sections being absent sections in the templates. 7 of 9 missing entries of family histories, 11 of 14 missing entries of diet, 22 out of 29 occlusion notes, 20 out of 21 differential diagnoses and 15 of 19 radiographic justifications were seemingly missing due to this cause. No such issue with the digital template was found.

3.3. SUMMARY OF RESULTS

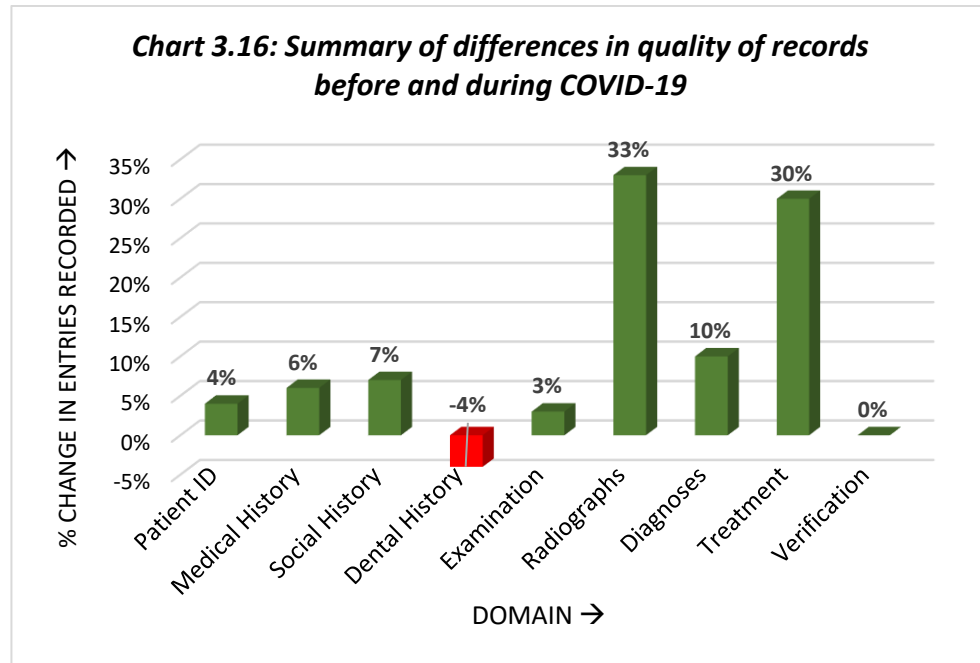


Chart 3.16 concludes the overall result of this audit. The percentage of entries in all domains were lower in the records before COVID-19, except one. Recording of patient's dental history was revealed to be plummeted by 4%.

CHAPTER 4: DISCUSSION

Due to being a very rudimentary topic in dentistry, record keeping is often ignored not only by dental students but also by well experienced dentists working in hospitals as well as small-scale practices. The importance of accurate record keeping has been emphasized in abundance in the literature review section of this audit. In spite of that, this basic competence is forgotten by many, amongst all the other complex fields of learning that dentistry entails.

De Jong and Dunning (1970) reported a technique for quality assessment that involved reviewing patient's records, and they discovered that the statistical outcomes had a strong correlation with the quality of treatment provided. According to Phaneuf (1976), an audit schedule evaluates patient records in a retrospective method of quality control. Marshall and Francis (1995) later introduced an enhanced quality assessment method for evaluating standards in general dental practice and discovered differences in record keeping standards between NHS, mixed, and private practices.

This particular audit was unique in correlating record-keeping standards to COVID-19. The study was conducted retrospectively, hence eliminating the Hawthorne effect. An unbiased sample of student records was evaluated as students did not consciously keep better records.

Certain components in a record are considered to be 'Aspirational' recommendations, which although not completely essential, are necessary for completeness (FGDP, 2016). In other words, only if they are present will a record be of high-quality to achieve "gold" standards. Furthermore, a gold standard would be to include not only positive but also the negative findings. It is important to remember that if something isn't recorded, it is as good as it didn't happen. Also, in the case of pre-printed templates, blank spaces instead of negative reporting could provide space for non-authorized alterations in the record. This would be considered illegal and is also against the contemporaneous standards of record-keeping.

The results presented that there exists a definite difference between the quality of record-keeping by the undergraduates, before and after the undergraduate clinics were closed due to COVID-19. The main impact of the pandemic on dental record-keeping was identified in the changes that occurred in the type of record management system, owing to an attempt to shift to a lower contact involving electronic approach. In this regard, COVID-19 can be considered to be a confounding factor which triggered the change in the records system and thus resulted in changing the quality of records. The average trend seen in the above charts (3.1-3.13 & 3.16) is leaning towards a higher quality of record-keeping in the digital records used during COVID. This is partially in line with McAndrew et al.'s (2011) study, which on comparing record entries against statutory regulations in record keeping, found that the compliance rate of students when using computer-generated records was higher than the paper-generated ones. This can

be explained by the technically savvy recent generations of populations. A study hypothesized that, the cause for the dental records of younger dentists being more complete as compared to other age groups, could be related to the use of digital records (Dierickx et al., 2006).

Major problems were surfaced during the appraisal of paper records relating to retrieval from storage, illegibility, and missing papers. Kutesa and Frantz (2016) and Pessian and Beckett (2004) in their individual studies, also highlight the inconveniences that accompany the usage of physical hard copies. Papers could be missing due to improper filing or tearing of the papers, hence causing them to fall out of the file. Having said that, there are also chances of corruption of notes in paper records. It is presumably easier to modify, hide or destroy them as compared to records on a digital database especially in case of criminal or litigatory matters. All the above issues are addressed by the utilisation of a computer-based system which would ensure advanced convenience and safety. And although they too carry the risk of getting hacked, these systems are developed to be entirely password protected. Each individual who is authorized to access the electronic database, does so using login credentials that are private and unique. Users are given the ability to upload and “lock” files when completed. The CRS software used for electronic records has a feature which displays the registered account names that were used to access each record. In addition it has a record for every action taken, for example, ‘modified by,’ ‘registered by,’ etc. followed by the name, date and time, thus greatly reducing the hazards of being

meddled with. Only assigned CRS staff is permitted to delete or unlock patient file folders.

One hundred percent of the digital records contained all components under the domain of Patient Identification as compared to a 96% in hard copies. With the use of a software, the possibility of missing patient demographics is nullified. This observation is also consistent with McAndrew et al.'s (2011) finding. In the initial pilot study, the name, DOB and address were considered as a "3-point check" to identify the right patient. This is in accordance with the 'Basic' record recommendations by the FGDP (2016). Before the final data collection, the MRN and gender were added as well since these are key identifying features too. Although the MRN is not a patient demographic, it is an important identity in the hospital and if unknown then difficulties may arise if some notes need to be traced. During data collection, most of the missing information in the paper-based restorative screening forms was found elsewhere in the patient's file like forms from other departments or other appointments. However, because of discovering files with loose papers, all patient's demographics in the paper records were assessed for presence, particularly on the departmental screening form.

The COVID-19 related notes were found to be poorly short in the dental records after the reopening of the undergraduate clinics. The pandemic has left some permanent marks on various disciplines in the world, and while dental record keeping guidelines in the country remain essentially the same, there is an increased importance of note-taking in dealing with the coronavirus. It can be inherently expected that patients will be disappointed when they are only able to

access limited services at the dental clinic. Some may even raise complaints. In such an event, the dental record becomes the main piece of evidence to show the recorded conversations with the patient and to prove that the patient's problems were best managed while obeying protocols and restrictions at the time (Eggleton, 2020). Notes of patient's risk assessment and the PPE worn by staff were considered in this audit as the minimal requirement. The BDA (2020) guidelines state that information on the type of Aerosol Generating Procedure used such as turbine or 3-way syringe and the COVID-19 related precautions during appointments, such as mouthwash or decontamination of the dental chair between appointments must be recorded. The COVID-19 history of the patient was relevant in 45 records but present in only 13. This could be because the coronavirus related screening of the patient is done at the reception before entering the clinic. Nevertheless, a note of this needs to be made on the patient's record or a COVID-screening questionnaire could be scanned and attached onto the digital record.

Medical history recording was 6% higher in digital records. This could be attributed to the fact that in the hard copy records, one patient's medical history form could not be located in the file, and one patient's form was present, but the medical history was not updated and signed, so, both of these contributed to the missing entries. One record of hospitalization or surgery was illegible and marked '0' while nine forms had a missing family history as the section was not present in the template. Having said this, in two other records the family histories were missing in the template, however, were still recorded. Another interesting finding in the

paper records where two different medical history forms were compared for the same patient was that a history of sedation 20 years ago was recorded by one student while was missed by the other. This is an important and relevant piece of information and such a finding questions the accuracy of record-keeping by the students which is beyond the scope of this audit. In the electronic records, only 2 forms had missing medical record details which also correlated to the electronic templates not being used by those students.

In comparing digital records with those before COVID, most parameters showed an overall increase in completeness, including record of medical and social history, examination, diagnoses and treatment. Yet we cannot ignore the fact that the recording of most components fell short of the standard. The average scores for dental history deteriorated by 4%. A similar study on undergraduate records found that 26% records had missing patient's complaint (Pessian and Beckett, 2004). However, in this audit the history of complaint majorly contributed to the reduced scores which was recorded in 92% hard copies and decreased to 78% in digital records. Past dental history was present in 93% of the records, but it was observed that no effort was made by students to investigate the patient's experience with the dentist or level of dental anxiety. To prevent this lack of information, a 'New patient attitude questionnaire' (FGDP, 2016) can be given to the patient to complete and can later be scanned onto the patient's notes.

The records contained comparatively good information on examination details. Missing information does not necessarily mean the examination was not carried out; it could be a result of no findings detected hence not recorded. But as

mentioned earlier in the discussion, this itself is against the rules of record-keeping. Periodontal assessment was completely done in all 90 records. In contrast, McFall et al's (1988) reported that general practitioners were not adequately recording clinical periodontal findings, resulting in insufficient information to evaluate changes in periodontal status over time. Occlusal assessment was recorded in only 12 paper and 10 digital records. This is shockingly deviating from the FGDP (2016) guidance.

The most remarkable improvement was seen in radiographic recording, closely achieving the gold standard. In the paper notes, 10 records had only findings and not a proper report hence marked absent. Moreover, there was an apparent decrease in number of radiographs taken during COVID as compared to before and out of 45 patients of digital records, 8 did not undergo any X-rays. These factors could be a source of bias in this particular result.

It is considered good practice to record the treatment plan sequentially along with a mention of the individual treatment costs (FGDP, 2016). Although it achieved the 100% standard, the evaluation of treatment plan was biased towards the students because phases and costs were not considered. However, in calculating the final difference in this domain due to COVID-19 changes, only phased treatment plans were considered. Evidence of consent is crucial in a record even though the procedure may require only expressed consent. One study found that out of 52 malpractice claims, informed consent was absent in 40 records (Lopez-Nicolas et al., 2007). In this audit, discussions relating to the consent process

were recorded in only 38% records before COVID and increased to 91% in digital records.

Reflecting upon the signage of records, patients' signature on their medical histories is a statutory requirement. With the switch to the digital system, there was no replacement technique used for this in the clinics. The solution would be to install systems for digital signatures via touchpads which would also ease the process of student and supervisor's signatures on record. A cheaper option would be to scan a signed paper-medical history form onto the record, which was indeed found in one of the digital records. Student and supervisor's signatures were frequently found missing in the hard copies. With the use of digital records, students' identifications were present in all records but verified signatures by their supervisors were seen only in 22% records. While students are the most frequent users of the CRS system, faculty members may be less technically competent than students, posing challenges to adoption. Therefore, training sessions for students as well as staff would be ideal.

Another theme that arose here is the impact of record templates on missing information. This finding indicates that students are exceedingly dependent on the templates, although in some cases it was found that the student had entered the information even when the template did not contain it. Keeping of records is the responsibility of the clinician, therefore, templates cannot be blamed for missing information. Having established that, record-keeping usually happens in a very fast-paced environment and can be difficult for inexperienced dental professionals. Templates are meant to provide support to students in filling

records, hence need to be accurate. Other suggestions have been made by authors in the past, to improve the ease of record-keeping. One simple solution is to have a third party, like an adequately trained dental nurse, to record procedures and discussions in real time. Further, with the increasing popularity of digital dentistry, an advanced technique is a voice recognition software that transcribes as the dentist speaks. Currently such a periodontal pocket charting software is in use, although there is little research evidence of its clinical effectiveness (DCruz, 2018).

4.1. FUTURE RECOMMENDATIONS

Based on the facts displayed in this audit, there is a scope for improvement and the following practicable recommendations could be used to achieve success:

- Development of local record-keeping policies in the hospital and templates fulfilling the criteria laid out by such policies should be considered.
- Undergraduate learning aimed at record-keeping and its implications should be instilled in the early years of curriculum and revised from time-to-time. Dedicated teaching and real-life examples should be used to ensure a better understanding amongst students. Scenario-based practical exercises can be implemented.
- The results of audits such as this one, should be conveyed to the students so that they can precisely identify the areas that need improvement.

- Discussions and seminars must be arranged not only involving students, but also clinical staff and tutors, to discuss problems and suggestions.

4.2. THE AUDIT CYCLE

Mentioned earlier in this audit project is only a part of the entire audit cycle. Continuation of the steps according to Figure 2 must be conducted until 100% of the digital records follow the standards and later to assure that the standard is maintained amongst the new student groups. Furthermore, other audits on undergraduate record-keeping, for example an audit investigating the accuracy of the components and not just the completeness can be carried out.

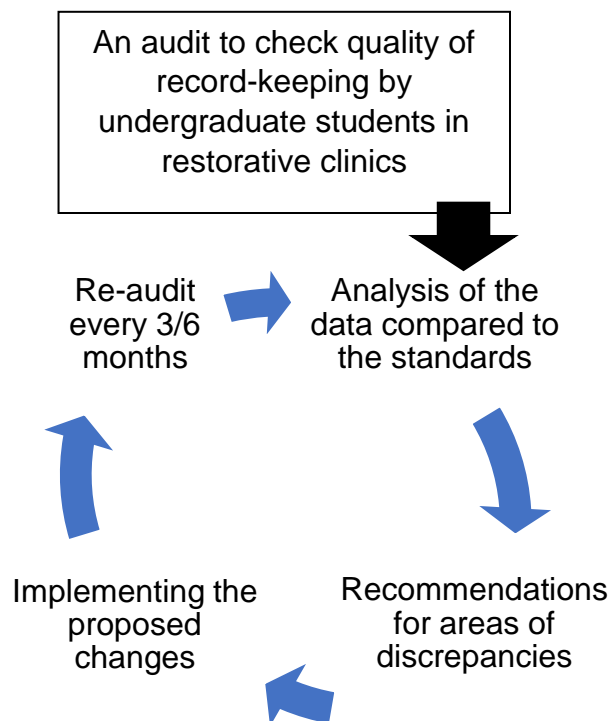


Figure 4.1: The proposed Audit cycle

4.3. LIMITATIONS OF THE PROJECT

- The major drawback in conducting this audit was the unideal sampling method due to lack of a united record system to connect the paper and digital records. Evaluation of the same patient's paper and digital notes parallely would have provided with a more accurate comparison. Unfortunately, the CRS system does not link to previous notes of the patient. Such inconsistencies between a patient's electronic and paper-based medical records can cause significant issues for people working in the field.
- An ideal methodology for this audit would have been a comparison of the transition done by the same students. Owing to the long period of time for which the UG clinics were non-functional, there was no single student population available which had used both the systems of record-keeping. This inadequate comparison of the same individuals is typical of other studies related to this topic.
- In the United Kingdom, little straightforward information on clinical record keeping standards has been published. The NHS organises inspections on a regional basis, but there is no central data accumulation. There are several guidelines and standards in place. For this audit, only the most fundamental and appropriate components were considered. Although the NHS has reached an agreement on what items are considered essential, clinicians' personal opinions may differ.

- This audit does not inspect the “contemporaneous” aspect of record-keeping by the undergraduates which is an important standard according to the GDC.
- The plan for this audit was to additionally classify the record-keeping quality, according to demographics of the undergraduate students such as gender of the student and year of study to identify patterns. This could not be implemented because of the lack of available information regarding this in the records.

CONCLUSION

Taking the observations from this audit into account, it can be concluded that although the novel coronavirus may not have directly affected the quality of the record-keeping procedure done by undergraduates, there was some correlation seen. The COVID-19 pandemic led to a major transformation in the record keeping system in the hospital. This in turn led to changes in the overall quality of record-keeping, following the discontinued use of paper-based records. Therefore, COVID-19 indirectly effected in a better quality of notes. Although very few, but there were some aspects in which the hard copy notes showed a better standard of records. Despite these findings, an overall failure to record basic components in the records is seen.

Patient safety and care quality are critical issues in health care delivery, thus, should be incorporated early on into the dental curriculum. This study supports the use of clinical audit for quality assessment of dental records. Future studies need to investigate the use of audits as a learning tool for record-keeping amongst students and for improving clinical practice.

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ABBREVIATIONS

ABBREVIATION	FULL FORM
AAPD	American Academy of Paediatric Dentistry
Add	Patient's address entered in the screening form/electronic record
Alc	Alcohol consumption is recorded in notes
All	Record of any known allergies of the patient in notes
BDA	British Dental Association
Con	Patient's consent for treatment and a note of discussion related to it in notes
COV st	Patient's recent COVID-19 history is recorded in notes
COV	Record of additional information in relation to COVID-19 in notes
COVID-19	Coronavirus disease first reported in 2019
CQC	Care Quality Commission
CRS	Commissioner Requested Services
D	Digital (electronic) records
DD	Differential diagnoses are recorded in the patient notes
Def D	Definitive diagnoses of patient's condition is recorded in notes
DH	Dental History record of the patient in notes
Diag	Diagnostic record of the patient in notes
DOB	Patient's date of birth is entered in the screening form/electronic record
Dt	Dietary habits are recorded in notes
Emc	Record of any existing medical conditions in notes
Eo E	Record of extraoral examination is present in notes
EPR	Electronic Patient Record
FGDP	Faculty of General Dental Practitioners
FH	Record of relevant family history in notes
GDC	General Dental Council
Gen	Patient's gender is entered in the screening form/electronic record
HER	Electronic Health Record
HOPC	History of patient's complaint is recorded in notes
Hos/Sur	Record of any hospitalisation or surgery undergone by the patient in notes
HTC	Dental Hard Tissue Charting is recorded in notes
Io E	Record of intraoral examination in patient's notes
IR(ME)R	Ionising Radiation (Medical Exposure) Regulations

Jus	Justification for taking the radiograph is recorded in notes
Med	Record of present medications that the patient is on or past medications of relevance in notes
MH	Medical History record of the patient in notes
MRN	Medical Record Number is present in the screening form/electronic record
Name	Patient's name is entered in the screening form/electronic record
NHS	National Health Service
No	Serial number of record
NRBP	National Radiological Protection Board
Occ	Basic occlusal assessment is recorded in notes
OH	Oral hygiene status is recorded in notes
Oth	Recreational drugs, occupation, personal life, stress and relevant information is entered in notes
P	Paper-based (physical/ hard copy) records
PC	Patient's complaint is recorded in notes
PDH	Past dental history is recorded in notes
Perio	Periodontal assessment findings are recorded in notes
PI	Patient identification details recorded in notes
PPE	Details of the Personal Protective Equipment worn by the dentist/other staff is recorded in notes
PPE	Personal Protective Equipment
Pt sign	Patient's signature is present on the medical history form
Qua	Quality of the radiograph taken is recorded in notes
Rad	Record of radiographs taken in patient's notes
Rep	Radiograph report of the X-ray image taken is recorded in notes
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
SH	Social History record of the patient in notes
Smo	Smoking status(current/past) is recorded in notes
ST	Soft tissue findings including gingival appearance are recorded in notes
Stu N	Undergraduate student's name is entered in notes
Sup N	Supervising clinician's name is entered in notes
Sup S	Supervising consultant's signature is present in notes
TP ph	Treatment plan in notes is written in sequential phases as per guidelines
TP	Treatment plan to be executed is recorded in notes
Trt	Treatment record of patient in notes
UG	Undergraduate
UK	United Kingdom
Ver	Verification details of patient's record by clinician & verifier's identification
WHO	World Health Organisation

APPENDICES

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Appendix 1

RECORD NO	Personal details			Med. history			Dental hist.			Social hist.			Extraoral exam									
	a	b	c	a	b	c	d	e	a	b	c	a	b	c	a	b	c					
comments																						
	Intraoral Examination			Radiographs			Investigations			Diagnosis			Treatment Plan			Student name sign			Supervisor sign date			
	a	b	c	d	e	f	a	b	c													
comments																						
RECORD NO	Personal details			Med. history			Dental hist.			Social hist.			Extraoral exam									
	a	b	c	a	b	c	d	e	a	b	c	a	b	c	a	b	c					
comments																						
	Intraoral Examination			Radiographs			Investigations			Diagnosis			Treatment Plan			Student name sign			Supervisor sign date			
	a	b	c	d	e	f	a	b	c													
comments																						
RECORD NO	Personal details			Med. history			Dental hist.			Social hist.			Extraoral exam									
	a	b	c	a	b	c	d	e	a	b	c	a	b	c	a	b	c					
comments																						
	Intraoral Examination			Radiographs			Investigations			Diagnosis			Treatment Plan			Student name sign			Supervisor sign date			
	a	b	c	d	e	f	a	b	c													
comments																						

