The 3 P’s model enhancing patient safety during the COVID-19 pandemic

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Abstract
Aim: The Local Safety Standards for Invasive Procedures must now consider additional features to address patient and staff safety in light of COVID19.

Material and Methods: The 3 P’s model encompasses an evidence-based approach to preparation, protection and prevention, for safety of patients and healthcare staff. A literature review was performed (keywords ‘dental’ or ‘dentistry’ and ‘COVID19’ or ‘Coronavirus’ and ‘LocSSIPs’ or ‘Local Safety Standards for Invasive Procedures’). Guidance, institutional publications and original research were considered. Limits were applied (2015 onward, English only).

Conclusion: The model ensures a systematic framework to aid communication among colleagues, provide and support the opportunity for learning, implement best practice guidance, monitor effectiveness of protocols and above all reduce the risk of viral transmission.

KEYWORDS
patient safety, COVID-19, coronavirus, LocSSIP

CLINICAL RELEVANCE
Scientific rationale for study
Patient safety is paramount. As the practice of dentistry finds itself working within a new normal, measures for patient safety encompass not only its original values for the prevention of never events and wrong site surgery but also reduction in viral transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), now called Coronavirus disease (COVID19). Local Safety Standards of Invasive Procedures (LocSSIPs) must now include features to address and ensure no patient comes to harm and that clinicians (and other team members) are also protected.

Principal findings
Guidance is evolving for management of patients, situations and environments during the coronavirus pandemic. This article provides a framework for safe working practices for use by dental clinicians in a primary care or outpatient setting. The 3 P’s model considers preparation, protection and prevention as a systematic approach for use by all clinicians. It will ensure a standardised level of care to reduce the risk of viral transmission and cross contamination as well as incorporate information to monitor effectiveness of protocols or contact tracing if required. More importantly it guarantees and records vital communication among colleagues. Here, we consider evidence-based recommendations for personal protective equipment, hand washing, detailed patient evaluation, mouth rinsing before dental procedures, and disinfection of the clinic. This enhanced LocSSIPs checklist is used to safeguard against inappropriate face-to-face interactions during this time and promote a culture of continual learning to further reinforce and validate future action plans.

Practical implications
It is now more important than ever that we consider the safety of our patients, but also the value in protection for ourselves and team members. The model is flexible and adaptable, so will ensure that as we continue to work under
stresses and frustrations, we can continue to care for our patients despite the conflicts we face. It is this concept of patient safety as paramount that will ultimately lead to the best care.

INTRODUCTION

Local Safety Standards for Invasive Procedures (LocSSIPs) are based on the high-level safety principles identified in the National Surgical Safety for Invasive Procedures (NatSSIPs). Wrong tooth extractions are classified as a never event, accounting for 25% of wrong-site surgery. Never events can have profound implications for patients, staff, departments as well as the Trust. In order to provide excellent patient service, safety is of paramount importance and lies at the centre of delivering a safe and effective oral surgery service. LocSSIPs are crucial for enhancing patient safety and should therefore be used as an integral part of treatment by every clinician.

The outbreak of the SARS-Cov-2 (severe acute respiratory syndrome coronavirus 2) was declared a public health emergency of international concern on 30th January 2020 by the World Health Organisation (WHO). Human-to-human transmission of SARS-Cov-2, which causes coronavirus disease (COVID-19), is confirmed in 53.7 million cases and at the time of writing has caused 1.3 million deaths globally. This includes 7000 healthcare workers (HCWs) globally with 649 in the UK, including dental clinicians.

As dentists and oral health professionals, we are not immune to the Coronavirus. The first case of a dentist testing positive for COVID-19 was reported on 23rd January 2020 at the Department of Preventive Dentistry in the Wuhan University Dental Hospital. Eventually, the transmission of disease to eight other oral healthcare professionals was identified. The New York Times published a schematic diagram which depicts dental professionals as the 'workers who face the greatest risk of Coronavirus'.

We should follow guidance as prescribed in evidence-based literature and continue to perform hand hygiene as well as other measures that will reduce the spread of COVID-19. As we work under increasingly pressurised situations, the enormity of our tasks can lead to frustration, stress and a breakdown in communication with colleagues. It is in these situations that we are more likely to make mistakes and increase the risk of patient harm. The risk of viral transmission can be attributed to the unique nature of dental interventions, which include aerosol generating procedures (AGPs), handling of sharps and proximity of the provider to the patient’s oropharyngeal region. In addition, if adequate precautions are not taken, the practice of dentistry can potentially expose patients to cross contamination. For this reason, we have implemented important modifications to our LocSSIPs protocol by dividing the procedure into ‘The 3Ps’ as follows:

1. Preparation
2. Protection
3. Prevention

In this article, we describe our experience in treating dental patients and the systematic approach utilised to facilitate safety, address perioperative factors and reduce the risk of viral transmission during this fatal coronavirus pandemic.

PREPARATION

Team huddle

All department personnel meet to discuss the daily proceedings each morning. This includes updates on Trust policy or clinical guidance, staff absences (due to illness or redeployment), booked patients (including likely procedures) and addresses quantity of personal protective equipment (PPE) available. This “team huddle” is led by a team member using the huddle form (Figure 1).

In the huddle the following responsibilities are appointed:

- Coordinator
- Triage team
- Circulating nurses (“runners”)
- Cleaners
- Clinicians providing treatment or assisting (taking into account PPE numbers, allocation of appropriate fit tested masks to clinicians and level of skill required for treatments).

Improved communication in this way can aid integration of new staff from other areas (due to a diminished workforce) and promote teamwork, ensuring that working practices occur at a safe standard.

Team briefing

This occurs after the huddle with members involved in assessing and treating the patient. Staffing within the treatment room is minimal with only necessary personnel to limit use of PPE and reduce risk of viral transmission.

For each patient, the following is discussed in detail:

- Degree of urgency – emergent, urgent/essential, non-urgent, advice and self-care
- Patient medical history
  a. Relevant comorbidities or complications
  b. Allergies
  c. Antibiotic prophylaxis
  d. Pregnancy status
- COVID-19 infection risk (presence of symptoms, history of COVID-19, shielded/vulnerable, asymptomatic)
- Working diagnosis and planned procedure (including site and side)
- Imaging available
- Equipment requirements

These details will be available from remote triage with the patient before attendance for face-to-face care.
Team members should understand their roles, are encouraged to ask questions, seek clarification or raise concerns about any aspect of patient care or the planned procedure at this time, which can be increasingly difficult once donned in PPE. This further validates the need for improved LocSSIPs procedures. In these difficult times, we should aim to provide support where it is needed and empower staff to voice concerns as a form of maintaining good practice and prevention of near miss situations.

The role of simulation in these circumstances can be important in testing for preparedness of protocols and procedures recommended, allowing training to take place in the clinical environment. This can be used to improve reliability and safety in high-risk or stressful environments. It can improve clinical skills, teamwork, patient safety and behaviours to ensure there are no potential compromises, allow for streamlining of processes and preparation of operating in unfamiliar environments with additional PPE. 

**Clinic room set-up**

Treatment rooms allocated for use offer a direct route of entry and exit to and from the department to reduce risk of contamination of other clinical areas. All unnecessary items are removed from the clinical room to reduce the risk of contamination and facilitate post-operative cleaning. Equipment is prepared and disinfected. All built in items are covered with drapes and plastic coverings to reduce the risk of indirect transmission via contaminated hands, surfaces and objects.

A whiteboard is labelled with the patient’s name, hospital number, date of birth and planned procedure. Tooth notation is standardised in palmer notation. Documentation is kept outside the treatment room. The runner remains outside the treatment room to obtain any additional equipment that maybe required during the patient visit. This avoids waste and contamination of equipment, with use of single-use equipment where possible.

**Patient flow**

Patients are advised to attend appointments alone (if possible) at the allocated time and no earlier. Escorts if required for young children or special care patients should be from the same household. All patients (and escorts) are given a face mask on entry to the hospital site and offered alcohol-based hand sanitiser.
Covid-19 status of the patient (and escort) is confirmed at remote triage stage and on arrival to the department (and at each subsequent appointment if required) with the use of a COVID screening questionnaire (Figure 2). Patients are escorted immediately via a one-way system to ensure zoning, to the clinical room by the runner, where clinicians will be prepared (donned). If required, they may be seated in the waiting room being mindful of social distancing measures.

Runners must wear appropriate PPE (fluid repellent visor, fluid resistant surgical mask, apron and gloves). The patient uses alcohol-based hand gel before

| Have you tested positive for COVID-19 in the last 7 days? | YES | NO |
|--------------------------------------------------------|-----|----|
| Are you waiting for a COVID-19 test or result?         | YES | NO |
| Do you have a new or continuous cough?                 | YES | NO |
| Do you have a high temperature of fever?               | YES | NO |
| Do you have loss or change in sense of smell or taste? | YES | NO |
| Do you live with someone who has either tested positive for COVID-19 or had symptoms of COVID19 in the last 14 days? | YES | NO |
| Have you been notified by NHS Test and Trace in the last 14 days that you are a contact or a person who has tested positive for COVID-19 and you do not live with that person? | YES | NO |

2. If a patient is a child (<16 years old) please also ask:

| New sores/blisters on hands or feet? | YES | NO |
|-------------------------------------|-----|----|
| Have you had diarrhoea or vomiting in the last 7 days? | YES | NO |

If yes to any of the above questions **transfer management to clinician**

3. Is the patient or anyone in their household shielding? | YES | NO |

If yes and not discussed at huddle **advise the clinical team**

4. Advise due to changes in protocols that extra/alternative treatments may not be offered within the same appointment.

Tick to indicate this has been offered

**Staff Name:**

**Date:**

FIGURE 2 COVID-19 screening questionnaire
entering the surgery, which has been proven to reduce viral transmission.\textsuperscript{9}

Clinically vulnerable patients as identified by the shielded patient list\textsuperscript{10}, if attend early or delayed on discharge, are kept in a segregated waiting room that is disinfected thoroughly at the start of the day and after each patient has left. This is standard protocol for all patients. Where there is treatment required for a known COVID-19-positive patient, surgical procedures are delayed until after the potential incubation period of 14 days, where initial management is based on AAA (advice, analgesia and antibiotics). In cases of maxillofacial emergencies where there is a risk to the airway, a ‘PARA’ approach is undertaken.\textsuperscript{11} This involves use of appropriate PPE, triage remotely if appropriate to Avoid unnecessary patient contact or exposure, Restriction of emergency exposure to the fewest appropriately experienced staff as possible and Abbreviate so treatment duration is efficient and kept to a minimum.

**PROTECTION**

**PPE**

In line with Public Health England Guidance\textsuperscript{12} (see Figure 3), clinician and surgical assistant perform hand hygiene using the surgical hand antisepsis technique with chlorhexidine gluconate scrub. The oral surgery teams don PPE (Figure 4) that comprises a fit-tested single-use Filtering Face Piece (FFP3) mask, disposable gloves, long-sleeved disposable fluid repellent gown, visor and surgical cap. Fit testing is performed with a calibrated machine and should staff fail on FFP3 masks, either half face respirators or hood is supplied. FFP3 respirators are shown to have an efficiency of 94%-96%, compared with 85%-86% tie-on surgical masks.\textsuperscript{13} It is advisable that untested patients be considered infected even if asymptomatic. Donning is performed with the surgical assistant to confirm donning and doffing procedures are followed correctly. Training of staff to use PPE is essential. In a study, it was found 90% of staff did not use the correct doffing sequence or technique, where staff had to be reminded to avoid touching the eyes or face as this can lead to self-contamination.\textsuperscript{14} A survey of physicians found that 15% had not received training prior to use of PPE.\textsuperscript{15} Ineffectiveness of PPE can contribute to transmission of COVID-19. HCWs should be trained in when to use PPE, which PPE is appropriate in each scenario, how to don and doff themselves to prevent contamination as well as how to discard and disinfect equipment. This should be outlined appropriately in policies and procedures.\textsuperscript{16,17}

Doffing of PPE is performed in the surgery except for masks and visors. These are removed outside of the clinical surgery and once removed is immediately followed by hand hygiene.

**FIGURE 3** COVID-19 risk category and appropriate PPE
Assessment and verification of procedure

Access to treatment rooms is restricted to experienced staff with the necessary skill mix. The patient is asked to rinse pre-operatively for 1 minute with 1% peroxyl mouthwash. This alongside povidone mouth rinse has been shown to have non-specific virucidal activity against Coronavirus.

A detailed history (patient complaints, medical, dental and social history) is confirmed with the patient and a thorough clinical examination is conducted. Relevant radiographic imaging from the referring practitioner will be made available electronically. Where this is not possible, digital orthopantograms are preferred imaging modalities to allow complete treatment planning where appropriate and avoid gag reflexes which would otherwise stimulate coughing. Diagnosis and treatment plan are confirmed with the patient. Written informed consent is obtained (verbal consent gained during prior video consultation and where necessary consent forms are sent electronically or via post to the patient for completion prior to attendance). All record keeping is performed on the whiteboard and transferred to clinical notes outside of the procedure area post-treatment.

Figure 4. Oral surgery clinician and assistant in appropriate PPE
Consent forms are removed from the procedure area by the runner before treatment commences.

Both clinical staff check the surgical site using the displayed treatment plan on the white board. The radiograph should be displayed, and verbal counting of the dentition should be confirmed with the assistant in line with LocSSIPs protocol.20

Research has highlighted that the cell receptor for COVID-19 is highly expressed in the oral cavity, making this surgical area a high-risk transmitter site for COVID-19.9 Therefore, need for treatment is risk assessed and if required is performed by an experienced clinician to minimise the need of a surgical drill that would produce an AGP.

Post-procedure the patient exits the room, is provided with a face mask and uses alcohol hand gel. Further appointments, if required, are made via telephone, email or post to avoid patients congregating in communal areas.

**PREVENTION**

Disinfection

Fallow times are dependent on the ventilation rate of the clinical area measured in number of air changes per hour (ACH). Ventilation by natural or artificial means is a requirement for all enclosed workspaces, and current healthcare guidance recommends that AGPs should not be undertaken in a room that has no natural or mechanical ventilation. The Scottish Dental Clinical Effectiveness Programme (SDCEP)21 recommends a maximum of 30-minute fallow time where ACH are unknown (but includes risk mitigation with high volume suction and use of rubber dam, where this is not possible fallow time increases to 60 minutes). This is reduced to 10-15 minutes fallow time when there are 10ACH or more. It should be noted that fallow time commences at the end of aerosol generation. Door signage can be used to alert staff of fallow time end (when safe to re-enter surgery).

Following an AGP (the release of airborne particle <5 microns from respiratory tract of an individual) surface disinfection with sodium hypochlorite (0.1%-0.5%)22,23 is recommended. AGPs include use of high-speed electric motor (>60,000 rpm), ultrasonic scalers, piezo surgery, 3-in-1 (air and water combined) and air polishers. This includes use of surgical high-speed drill for surgical extractions which require the same level of PPE as for any AGP24, where a surgical hand piece may produce aerosol dependent on its use.25 For non-AGPs, the treatment area can be decontaminated immediately after patient departure. The HCW that is responsible for disinfection and cleaning of the treatment environment (which may include the floor) should wear appropriate PPE (visor, fluid repellent surgical mask, apron and gloves).25

The waiting area is disinfected every 2 hours and confirmed on a visible checklist.

**DISCUSSION**

The Surgical Never Events Taskforce 2014 report advocates the use of standardised documentation to harmonise the way adverse incidents are reported; and prioritise training and education as a team in patient safety and human factors.26 Templates acts as visual prompts to all team members encouraging all steps and checks to be undertaken in enhancing patient safety. Our experience has allowed us to implement critical steps to make dental procedures safer for everyone involved, framing the LocSSIPs process into three distinct domains. We recognise that guidelines cannot cover all possible circumstances and professional judgment must be exercised to make decisions surrounding whether the risk of viral spread outweigh the benefits in deciding to treat a dental patient. Equally, we must accept that triage of emergency patients often via remote communications can have its flaws and clinicians must be able to respond and adapt to the challenges of the current situation. LocSSIPS must be fluid and adaptable to reflect this new normal working, as diagnoses evolve and augment when the patient presents in the clinic.

In implementing and developing protocols for treatment of patients during the Coronavirus pandemic, it also is crucial to accommodate rapidly changing situations. This involves continuous review of implemented strategies and disseminating information to allow for feedback from staff.
With the rapid rollout and unknown long-term implications of vaccination, dentists will have to adopt a proactive and preventive approach as a protocol to ensure containment of viral spread and longevity of working practices. The ‘3Ps’ approach to LocSSIPs aims to increase patient safety but also safety of staff members. Future considerations when normal practice resumes may need to include infra-red screening of raised temperatures (patients and staff), COVID-19 health questionnaires, scheduling potential COVID or high-risk patients at the end of the day and rapid testing for elective dental procedures under general anaesthetic.

Staff are at increased risk from coronavirus. Employers should have management strategies in place to safeguard the health of their staff and minimise the risk of infection. This will include undertaking risk assessments and recording discussions with staff members and agreed actions. Staff identified risk factors include age, gender, certain medical conditions, ethnicity and risk profile of family members that share a household with the staff. Higher-risk groups include Black, Asian and Minority Ethnic (BAME) staff and pregnant women who should have appropriate measures in place to reduce exposure and support safe working. They may require support from Occupational Health and to be redeployed to lower-risk roles. In the eventuality of suspected COVID-19 in staff, measures are in place for COVID-19 swab test via absent management services and staff are expected to isolate in line with government guidance.

Until then, there will continue to be some dental emergencies that require immediate treatment and fail to respond to medical treatment. There is a need to avoid patient attendance at emergency departments to manage acute infections relating to dental causes and negate the need for intensive care beds for those with life threatening dental emergencies, while we continue to overcome this pandemic. Dental clinics will need to be at the forefront in managing these patients and doing so safely. A protocol and checklist allow us to mount an effective response to COVID-19 and align with preparedness strategies ensuring that it is safe to proceed with treatment for clinicians and patients. It is not only prudent for the health of staff, but also services as a whole, so that the department can remain functional by ensuring effective communication systems are consistently utilised.

**CHALLENGES IN DENTISTRY**

- Clear and effective communication among dental practices, secondary care and patients especially in the management of patient access to dental care.
- The role of technology in the provision of diagnosis and to streamline patient pathways.
- The need for increased emphasis on prevention and minimally invasive dentistry.
- Effective use of chair-side support for treatment delivery including allocation of workforce and resources to support the clinician.
- Training in risk mitigation techniques, for example, use of rubber dam and further research into effectiveness of procedural and environmental mitigation, for example, dental suction, rubber dam and air cleaners.
- The physical and psychological impacts on the dental team, including mental health, well-being and inclusivity.
- Specialist technical support for improvements in ventilation.
- The presence and infectivity of coronaviruses in saliva, their viability and transmissibility, including via AGPs, requires further research to be made available in the public domain.
- The practicality of testing, including point of care testing, in primary and secondary care dentistry.
- The design and build of new dental facilities including financial implications of improving ventilation requirements and other infection control measures.

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**CONFLICT OF INTEREST**

There are no conflicts of interest and no financial support has been received to support this publication.

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