ICU

MANAGEMENT & PRACTICE

INTENSIVE CARE - EMERGENCY MEDICINE - ANAESTHESIOLOGY

VOLUME 21 - ISSUE 1 - 2021

SPECIAL SUPPLEMENT
Sedation in Critically-Ill COVID-19 Patients

20 Lessons from 2020

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Mouth Care Challenges and the Use of the COVID-19 Oral Grading System

Identifying Risk Factors for Extubation in Patients with COVID-19

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This paper describes the experiences of the Speech and Language Therapy (SLT) service at Nightingale Hospital, adapting to changing demands, which included upper airway challenges associated with extubation and oral management in patients with COVID-19.

Background

The London Nightingale Hospital was set up in response to the COVID-19 pandemic to provide critical care for patients requiring intubation and ventilation. Its workforce comprised of redeployed medical, nursing and allied health clinicians, including Speech and Language Therapists (SLT), from a range of settings.

Clinical Situation

Speech and Language Therapists (SLTs) provide assessment and management of patients with speech, voice or swallowing difficulties post-extubation, with or without tracheostomy. In this setting of predominantly intubated patients, SLTs utilised their expertise to focus on oral care practices and delivery of oral care training. Reports of trauma and swelling to the lips and tongue, as well as challenges with dryness, secretions and mouth opening led to the development of the COVID Oral Grading System (COGS). Swelling, mucosa, trauma, infection and jaw mobility were scored on an individualised scale and repeated daily. The COGS helped identify the presence and severity of oral deficits observed in COVID-19.

Discussion

The COGS enabled systematic, structured assessment and monitoring of the oral cavity and upper airway of patients with COVID-19. Common deficits such as tongue swelling, and unmanaged oral secretions were identified as risk factors for complications peri and post-extubation. The systematic assessment tool was useful to measure outcomes of mouth care regimes and inform aspects of pre-extubation decision-making. It also provided a template for clinicians to increase their knowledge and understanding of this patient group to disseminate and share.

Background and Clinical Context

The London Nightingale Hospital

The London Nightingale Hospital was established in April 2020 within a purpose-built conference facility in East London, rapidly set up in response to the COVID-19 pandemic. Its primary objective was to support London's NHS critical care network with additional capacity of up to 4,000 beds providing care for intubated and ventilated patients during the first wave of the pandemic.

The hospital workforce was comprised of medical, nursing, and allied health clinicians from a broad range of clinical backgrounds, who were deployed to the Nightingale at short notice. This workforce was agile and adaptable, took on new clinical roles as well as a central role in leadership and guideline development. The organisational culture encouraged sharing and dissemination of skills across professional groups. Clinical decision-making was collaborative within a flat and supportive hierarchy.

To establish robust clinical governance and standardise practice, Standard Operating Procedures (SOPs) were put in place for every aspect of care, which were reviewed weekly. This included a criteria checklist for extubation which outlined markers for ventilation and airway clearance as well as a guide to mouth care, cleaning and decontamination.

Admissions to NHS Nightingale London

Patients admitted to the Nightingale Hospital had a primary diagnosis of COVID-19

Minimum standard:	Tools
ORAL ASSESSMENT Four hourly mouth checks Look for coating, ulcers or blood in mouth	Pen torch Visual mouthcare chart
ORAL HYGIENE Twice daily tooth brushing: Clean teeth gently using a toothbrush and small amount of toothpaste, wet toothbrush to wipe away paste and suction any residue	Toothbrush and toothpaste Water Suction (or suction toothbrush)
ORAL MOISTURISATION Moisten the mouth and lips at regular intervals, using a water-based gel	Mouthcare applicator or sponge Artificial saliva gel
ORAL DECONTAMINATION If chlorhexidine gel is prescribed, this should be used 4 times a day at a separate time to teeth cleaning. Apply gel onto a sponge and wipe across the tongue, cheeks and palate. AVOID putting this on the teeth and DO NOT suction or wash away.	Corsodyl gel 1% Chlorhexidine Mouthcare applicator

Table 1. Mouthcare Standard Operating Procedure

and single organ failure (i.e. lungs), that required ongoing intubation and ventilation. These patients were received from their admitting NHS hospital after a 48 hour period of cardiovascular stability. The anticipated patient pathway was to provide respiratory interventions during the acute phase of illness to optimise recovery. Once patients demonstrated improved respiratory function, they were identified for ventilator weaning with subsequent sedation hold and preparation for extubation. At that time, ventilatory needs for patients with COVID-19 were expected to be for only a few weeks before resolution of symptoms allowed extubation. For some, a short period of rehabilitation was expected prior to returning to the local hospital. This planned patient flow would allow for increased capacity of care to meet the anticipated need at that time. The Nightingale Hospital was not set-up to manage additional complications such as the need for ECMO or tracheostomy, so those patients had to be repatriated to their local hospital for ongoing care.

Allied Health Profession Roles

A team of allied health professionals formed an essential part of the rehabilitation team at NHS Nightingale. Physiotherapists were involved in proning and respiratory management; Occupational Therapists supported positioning, self-care and cognitive management; Dietitians ensured nutritional needs were optimised and Speech and Language Therapists (SLTs) managed mouthcare, swallowing and communication issues, especially post-extubation (Brodsky et al. 2018; McRae et al. 2019).

Although SLTs are seldom involved in the care of sedated and intubated patients, their advanced understanding of upper airway anatomy, bulbar function, and oral secretion management helped to establish a valuable role in patients with COVID-19 in critical care. A planned extubation was typically led by an intensive-care consultant, an operating department practitioner (ODP) and/or an anaesthetist who have combined skills in upper airway anatomy, intubation and ventilation. Assumptions are made about normal upper airway patency in the absence of contrary evidence. Patients who are intubated for respiratory support, are expected to be extubated without complication following recovery from the acute episode.

Invasive Ventilation in COVID-19

The primary aim of intubation in the COVID-19 patient was to enhance transpulmonary pressure, open collapsed alveoli, improve oxygen debt and provide the opportunity for lungs to heal (Meng et al. 2020). The requirement for invasive intubation not only exposes the patient to procedure-related trauma but also enhanced risk of cross-infection to the healthcare team from potential aerosolisation. For these reasons, careful attention needs directing to pre-extubation assessments to minimise the risk of further trauma and cross-infection caused by multiple intubations.

The Challenges of Extubation

Extubation decisions can often be relatively straightforward once the initial cause of respiratory failure has resolved

	Scale	Focus
Swelling	**0 → 3**	Status of lip and tongue swelling
Mucosa	**-3 → +3**	Level of oral dryness or excessive secretions
Trauma	**0 →3**	Level of trauma to oral cavity to include lips, tongue and palate
Infection	**0 → 2**	Evidence of infection or coating inside the oral cavity
Jaw mobility	**0 → 2**	Degree of jaw opening or movement

Table 2. Summary of COVID Oral Grading System (COGS)

and consciousness has returned to normal (Rotheray et al., 2012). In patients who require extended periods of intubation (four days or more), attention should be paid to risk of laryngeal trauma which may compromise the upper airway enough to necessitate re-intubation (Wittekamp et al. 2009; Esteller et al. 2005; Thomas et al. 1995; Whited 1983; Whited 1984; Kasantos et al.1983). Laryngeal oedema is reported in up to 55% of patients following tracheal extubation (Zhou et al. 2011; Brodsky et al. 2018). In neurological populations, additional attention needs to be paid to the upper airway where muscle activity, oral secretion load, cognition and arousal levels may impact the success of an extubation (Nguyen et al. 2006; Coplin et al. 2000).

For patients with COVID-19 who required intubation for ventilatory needs it was unknown whether they would experience any focal laryngeal impairments. They often required excessively prolonged intubation due to the risks of aerosolisation and cross-infection to healthcare practitioners through placement of surgical tracheostomy. Consensus guidelines were developed to guide the safe extubation of patients with COVID-19 and reduce the risks of failed extubation and re-intubation (Cook et al. 2000).

In this paper we describe the experiences of the SLT service at Nightingale Hospital, adapting to changing demands, which included upper airway challenges associated with extubation and oral management in this patient group.

Mouthcare Challenges in Intubated Patients With COVID-19

As a new SLT service delivering to a novel patient group who were predominantly intubated, the SLTs utilised their skills to support oral care practices and delivery of oral care training. Staff had limited experience and confidence in mouthcare delivery and the use of specific products, such as chlorhexidine, so a new Standard Operating Procedure split the mouthcare tasks into separate components to address oral assessment, hygiene, moisturisation and decontamination **(Table 1)**.

Reports of trauma to lips and tongue were identified in those patients with COVID-19 who required regular proning whilst intubated. This had an impact on the level and approach to oral care. In response, the SLT team developed a clinical tool to assess oral presentations, which helped to identify daily trends, deliver tailored management and training. This also helped to contribute to multidisciplinary discussions about upper airway structural issues and their potential risk for extubation.

The COVID Oral Grading System (COGS) drew on themes identified by SLT and healthcare staff around the status of oral mucosa and limited mouth opening. A summary is provided in **Table 2**. Its principles are based on existing published assessment tools, specifically the Yale Residue Scale (Neubauer et al. 2015) which uses image-based assessment and The Modified Barium Swallow Impairment Profile (Martin-Harris et al. 2008) which recognises the imprecision that arises from scoring all assessment components on the same size scale. Existing tools such as the oral rehabilitation therapy outcome measure scale (Enderby and John 2015) was not considered to have face validity in this patient population.

The COGS aimed to identify the presence and severity of characteristics observed in patients with COVID-19 including swelling, mucosa, trauma, infection and jaw mobility. Swelling, trauma and infection are scored on a 4-point scale. Mucosa is scored on a 7-point scale with negative scores to represent dryness and positive to represent excessive wetness or secretions. Jaw mobility

Oral presentations	Possible clinical implication
Swelling of the tongue and lips	• Poor oral and/or oropharyngeal airway patency post-extubation • Greater re-intubation complexity • Oro-pharyngeal dysphagia
Unmanaged oral secretions (saliva)	• Pooled oral secretions in pharynx sitting above cuff • Absent or ineffective swallow • Aspiration risk during and post-extubation
Dry oral mucosa	• Systemic dryness • Increased risk of oral infection • Increased risk of trauma
Infection	• Increased risk of ventilator acquired pneumonia (VAP) • Increased requirement for polypharmacy
Trauma of the lips and tongue caused by presence of endotracheal tube (ETT) Trauma of the tongue due to biting	• Development of infection • Aspiration of fresh blood • Implications on speech and swallowing post-extubation
Jaw clamping	• Inability to conduct oral hygiene • Difficulty in voiding oral or oro-pharyngeal secretions before or after extubation

Table 3. Oral presentations and potential clinical implications of the COVID-19 patient cohort

is measured on a 3-point scale to improve clinical relevance and inter-rater reliability. The COGS was administered to five patients to assess for redundancy and sufficiency in the themes presented. No additional themes were identified, and clinicians felt all existing themes held clinical value and could be used to support treatment plans and decision-making.

The COVID Oral Grading System (COGS)

The COGS was used by the SLTs on a daily basis with all patients to help identify specific impairments of the tongue and oral mucosa, and provide direction towards treatment needs. In those patients receiving treatment, an improvement in oral grading scores was identified after 2-3 days. Using the tool helped to highlight potential implications for patients who were being considered for extubation in the proceeding days. Patients with worse scores (greater than or equal to 2) on swelling or mucosa were discussed with the multidisciplinary team with recommendations to manage clinical risk peri and post-extubation.

Demographic Data

The patient group consisted of 54 patients. 9 (17%) were female. Median age was 61 years, range 35-78 years. 76% of the population were from a non-white background. All were able to live without assistance prior to admission. This cohort arrived at The Nightingale Hospital after an average of 3.9 days intubated (range 1-15 days). 72% of patients were proned for up to 16 hours per day for a period of their Nightingale admission. **Table 3** shows the range of oral presentations identified in this cohort, presented alongside potential clinical implications.

Upper airway swelling (COGS swelling scale ≥ 2) and an excess of oropharyngeal secretions (COGS mucosa scale ≥ 2) were considered the most relevant to those under consideration for extubation. A swelling score ≥ 2 would lead to recommendations and prompts for the treating team to include:

- Implementation of measures to assess for laryngeal/pharyngeal swelling whilst the tube is still in place (e.g. cuff leak test).
- Preparation of post-extubation equipment to augment the upper airway if required (for example, facial CPAP to provide continuous positive airway pressure and/or re-intubation equipment).
- Consideration of interventions to reduce swelling prior to extubation (for example, prescription of dexamethasone or increase in reflux medications).
- Optimisation of patient positioning to minimise tongue contact to posterior pharyngeal wall.
- Awaiting improved consciousness level to optimise the chance of the patient augmenting their own airway and adjusting posturally.

SWELLING

	Score	Description	Considerations
	**0**	No evidence of lip or tongue swelling.	• Continue routine mouth care and moisturisation.
	**1**	Some evidence of tongue or lip swelling – not enough to cause oral airflow issues.	• Continue routine mouth care and moisturisation. • Consider cause of swelling & possible interventions.
	**2**	Marked evidence of lip or tongue swelling with concern for oral airflow.	• Continue routine mouth care and moisturisation. • Consider cause of swelling & possible interventions. • Alert ITU/anaesthetic team if patient is being considered for extubation.
	**3**	Severe evidence of tongue or lip swelling with extreme concern for oral airflow.	• Continue routine mouth care and moisturisation. • Consider cause of swelling & possible interventions. • Alert ITU/anaesthetic team if patient is being considered for extubation – support tracheostomy rather than extubation.
	U	Unable to score	

Image Credit: 1-2 iStock; 3 Mouthcare Matters; 4 Michelle Lunn

A mucosa scale of ≥ 3 would result in one or several of the recommendations below:

• Speech and Language Therapy and Physiotherapy to assess swallow and cough response prior to extubation to establish likelihood of patients being able to manage their own secretions post-extubation. Measuring of secretions voided from above-cuff suction port hour to hour to understand possible load of oral secretions resting in the pharynx.

• Voiding secretions from mouth, oropharynx and above-cuff suction port immediately prior to extubation.

• Ensuring upright positioning of the patient during extubation to minimise risk of aspiration and optimise cough attempts.

• Physiotherapy presence at the extubation to provide pre, peri and post suction and post-extubation cough augmentation if needed.

• Ensure optimal consciousness level to give the best possible chance of the patient managing their own secretions.

Pre-extubation, during the sedation hold, the SLT was also able to provide simple assessment of communication and cognition (including attention and responsiveness to instruction) and put recommendations in place for the team to use post-extubation to optimise likelihood of the patient following medical instructions. Those unable to follow the instructions required for post-extubation treatment (such as the instruction to open the mouth and cough) would be identified as potentially at risk of airway difficulties post-extubation. Patients who were clamping the mouth closed were also identified as being a post-extubation airway as well as mouth-care risk.

The mucosa, trauma and infection scales were considered the most relevant to those requiring ongoing invasive ventilation. Those with very dry oral mucosa were provided with moisturising gels and assessed for any

MUCOSA

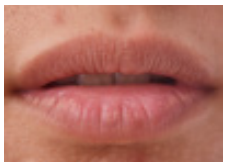
	Score	Description	Considerations
	**-3**	Extremely dry with cracked mucosa and solid secretions that need soaking	• Check overall hydration and fluid balance. • Check not over-using Corsodyl or other drying agents. • Definite need for oral soaking and then gels.
	**-2**	Partially dry but some cracking and perhaps some thick, sticky secretions	• Check overall hydration and fluid balance. • Check not over-using Corsodyl or other drying agents. • Definite need for oral gels.
	**-1**	Slightly dry but quickly recoverable with moisture balm	• Vaseline or gel at lips.
	**0**	Normal mucosal appearance, neither dry nor wet	• Continue usual mouth care.
	**1**	Slightly wet mouth with small amounts of loose secretions fully contained in the mouth when upright or semi-supine.	• Continue usual mouth care. • Gentle oral suction or swabbing.
	**2**	Partially wet mouth with moderate amounts of loose secretions mostly contained in the mouth when semi-supine	• Continue usual mouth care. • Gentle oral suction or swabbing – remember to suction into lingual sulci. • Consider posture & positioning as well as above cuff clearance via suction port.
	**3**	Extremely wet mouth and tongue with notable loss of loose secretions at the lips	• Continue usual mouth care. • Gentle oral suction including sulci. • Consider posture & positioning as well as above cuff clearance via suction port (especially in those due to extubation).

Image Credit: 1-2 Mouthcare Matters; 3-4 iStock; 5 Robert Adds; 6-7 ©James Friedman

TRAUMA

	Score	Description	Considerations
	**0**	No evidence of trauma to the oral cavity	• Continue usual mouth care
	**1**	Slight trauma to the oral cavity	• Continue usual mouth care • Medical review for prescription of Corsodyl / Chlorhexidine • Investigate and try to treat cause of trauma
	**2**	Notable trauma to the oral cavity	• Continue usual mouth care • Medical review for prescription of Corsodyl / Chlorhexidine • Caution when suctioning (avoid over-suctioning) • Investigate and try to treat cause of trauma
	**3**	Substantial trauma to the oral cavity	• Continue usual mouth care • Medical review for prescription of Corsodyl / Chlorhexidine • Investigate and try to treat cause of trauma

Identify site of trauma: - Lips (commissure/main body, left/right, upper/lower) - Tongue (anterior/posterior, lateral/blade) - Palate (soft/hard)

Image Credit: 1-2 iStock; 3-4 Mouthcare Matters

treatable causes of dryness such as over-use of decontamination gels (e.g. chlorhexidine) and negative fluid balance. Trauma was more common than infection in our cohort, most associated with pressure sores from endotracheal tube (ETT) ties at the lips with some inner cheek and tongue biting. Infection was difficult to score in a number of patients due to restrictions in accessing the oral cavity either due to tongue swelling, jaw movement and ETT presence.

Discussion

Clinical Presentations and Implications for Patient Management

Our experience at the Nightingale Hospital has highlighted unique challenges in managing the oral and upper airway of patients with COVID-19. Oral swelling was a consistent issue that has been described in only one previous case study reporting complications in the management of a ventilated patient with acute respiratory distress syndrome (ARDS) due to tongue swelling, thought to be a reactive response to anti-viral drug treatment (Scott et al. 2010). Laryngeal oedema has been reported in up to 55% of patients following tracheal extubation (Zhou et al. 2011), however this could not be evaluated directly with our patient group due to restrictions for nasendoscopy use. Observed swelling of tongue and lips was strong evidence of widespread oedema. An anaphylactic response to research trials of tocilizumab targeting cytokine release syndrome could be relevant in this population but unlikely to be the only cause (Park et al. 2020). Swelling response to sedative drugs as well as prolonged inactivity of the tongue could be additional causative factors as well as a direct result of the multi-organ inflammatory response to the virus itself (Roberts et al. 2020). Other considerations include impaired venous drainage from high levels of positive pressure ventilation required in this population as well as fluid overload. Facial oedema as a direct result of proning (Messerole et al. 2002) should also be considered though poor resolution of swelling on return to supine is suggestive

INFECTION

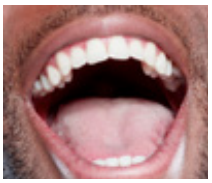
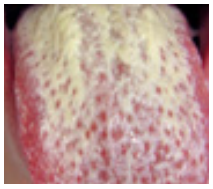
	Score	Description	Considerations
	**0**	No evidence of infection or coating within the oral cavity or lips	• Continue with mouth care
	**1**	Evidence of oral coating that may be suggestive of infection	• Gentle oral brushing • Continue with mouth care • Consider prescription of topical treatment eg: Nystatin
	**2**	Definite coating and/ or evidence of infection within the oral cavity	• Gentle oral brushing • Continue with mouth care • Consider prescription of systemic treatment eg: Fluconazole
	U	Unable to score	

Image Credit: 1-2 iStock; 3 Mouthcare Matters

JAW MOVEMENT

	Score	Description	Considerations
	**0**	Soft jaw with easy opening and access to mouth and/ or able to manipulate jaw open by several millimetres	Consider interventions to maintain range of jaw movement.
	**1**	Jaw movement restricted. Requires manipulation to open a few millimetres. Difficulty accessing mouth.	Be mindful of ET tube placement whilst manipulating the jaw. Consider assistance to stabilise ET tube.
	**2**	Complete restriction of the jaw with no movement on manipulation. Unable to access mouth.	Consider risk of trauma to oral cavity from jaw clenching.

Image Credit: 1-3 iStock

of other aetiologies. This clinical presentation was similar to that reported in facial lymphoedema, following head and neck cancer management. Swelling responses to localised trauma from prolonged intubation as well as over-use of oral decontamination products such as chlorhexidine were also identified as possible irritants and contributors which required specialist input from the tissue viability nurses for dressing and advice of ETT fixation.

Use of the COVID Oral Grading System

The COGS has proven a useful clinical tool for assessment of patient need as well as a training tool for staff new to working in the COVID-19 critical care environment. The mucosa scale has been useful to alert staff to oral secretion load of a patient prior to extubation as well as oral care needs to treat dryness by moisturisation and hydration. The system has also supported healthcare staff to consider risk of avoidable trauma from suction equipment and pre-emptively manage risk of ventilator acquired infection with oral care and decontamination. Prescription of routine chlorhexidine for decontamination should however be appraised carefully considering emerging evidence to suggest failure to prevent ventilator acquired pneumonia and perhaps contribute to excess mortality in certain patient groups (Klompas et al. 2014; Price et al. 2014).

When used alongside a sedation scale such as the Richmond Agitation-Sedation Scale (Sessler et al. 2002) and simple communication assessment, the COGS can contribute to a holistic pre-extubation checklist in this complex patient group.

Implications & Recommendations for Practice

In this patient group we have been required to look beyond the reason for intubation in order to manage the decision to extubate to minimise risk of trauma and avoidable aerosolisation risks associated with re-intubation. Whilst the post-extubation challenges seen in other patient groups still apply, we should also take into account the challenges that are unique to the COVID group which are brought about by the virus itself as well as necessary management of long periods of ventilation and sedation, post-ITU syndromes and central nervous system. We have highlighted the added value of a systematic oral assessment, such as the COGS, which can be used as part of the pre-extubation decision-making process. Further development of this clinical tool may help manage risk of secondary complications in COVID-19 and cross-contamination to the health care team.

Conflict of Interest

None. ■

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