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# Impacts of lockdown during the SARS-CoV-2 pandemic on patients presenting with cervicofacial infection of odontogenic origin: a comparative study

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## Abstract

The SARS-CoV-2 pandemic caused unprecedented disruption to primary and secondary healthcare services. Our aim was to explore whether the pandemic had had any impact on patients presenting with cervicofacial infections (CFI) of odontogenic origin to secondary care and management. Comparative analysis was carried out evaluating prospective and retrospective consecutively admitted patients with a diagnosis of CFI of odontogenic origin in the COVID-19 lockdown period from 15 March to 15 June 2020 and pre-COVID-19 during the same period of the previous year. Data included patients' demographics, comorbidities, systemic inflammatory response syndrome (SIRS) status on admission, clinical features, prior treatment in primary care, source of referral, SARS-COV-2 antigen status, treatment received in secondary care, intraoperative findings, and whether escalation of the level of care was required. Across both cohorts there were one hundred and twenty-five (125) patients admitted with CFI of odontogenic origin, with a 33% reduction ( $n=75$  (2019) vs  $n=50$  (2020)) in number of patients admitted during COVID-19 lockdown. There was no difference between the cohorts in terms of age ( $p=0.192$ ), gender ( $p=0.609$ ) or major comorbidities ( $p=0.654$ ). Proportionally more patients in the COVID-19 group presented with SIRS ( $p=0.004$ ). This group of patients persisted with symptoms for longer before presenting to secondary care ( $p=0.003$ ), more delay from hospital admission to surgical intervention ( $p<0.005$ ) and had longer hospital stays ( $p=0.001$ ). More patients required extraoral surgical drainage during COVID-19 ( $p=0.056$ ). This study suggests that the COVID-19 lockdown has had adverse effects on the presentation of CFI of odontogenic origin and its management within a Regional Acute Maxillofacial Service. Commissioners and clinicians should endeavour to plan for adequate primary and secondary care provision during any future local lockdowns to ensure that patient care is optimised.

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## Introduction

On the 31 December 2019 a case of pneumonia of unknown cause was reported to the World Health Organisation (WHO) in China. What followed was an escalation of events with a rapidly spreading deadly virus which was identified as SARS-CoV-2.<sup>1</sup> As mortality and incidence of COVID-19

(Coronavirus Disease 2019) increased in the far-east, the virus spread internationally and on the 11 March 2020 the WHO declared the disease a pandemic.<sup>2</sup> A rapid increase in incidence and mortality in the United Kingdom led to 'lockdown' measures being implemented on 26 March 2020 to contain this disease.<sup>3</sup>

Primary care facilities were rapidly scaled back to the provision of essential treatment following the announcement of lockdown. NHS England issued advice to all primary dental practices by announcing cessation of all routine, non-urgent

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dental care services,<sup>4</sup> with practices collaborating to form a remote ‘urgent care service’. The aim of this service was to provide telephone triage advice, analgesia, or remote prescribing where applicable.<sup>4</sup> Dentists were advised to refer patients to their local ‘Urgent Dental Care services (UDCs)’.

Operative dentistry is classed within the group of aerosol generating procedures (AGPs) with a risk of SARS-CoV-2 transmission and therefore appropriate personal protective equipment (PPE) must be donned by clinicians.<sup>5</sup> During the pandemic, PPE shortages had been documented and reported.<sup>6</sup> This reduced the ability of UDCs to obtain adequate PPE supplies, which hindered their ability to deliver essential urgent treatment. Furthermore, despite advice, patients have struggled to access to UDCs, with some centres receiving an average of 200 telephone calls a day from those unable to find alternatives for treatment.<sup>7</sup>

Cervicofacial infection (CFI) of odontogenic origin is a recognised complication of untreated dental infection. Patients present with a spectrum of severity, and most require surgical intervention in combination with antimicrobial therapy whilst a minority can be successfully managed more conservatively. A significant but small number of patients may require more invasive treatment or even emergency immediate treatment of life-threatening CFI, such as a surgical airway.<sup>8</sup> Reduced access to primary care may lead to a delay in treatment and subsequently risk poorer outcomes for patients.<sup>9</sup> Recent implementation of ‘local lockdowns’ which will form part of the government’s future strategy makes it imperative that we understand how this may affect patients presenting with CFI of odontogenic origin.<sup>10</sup>

## Material and methods

Prospective data were collected on all consecutive patients admitted to Leeds Teaching Hospitals NHS Trust with a diagnosis of CFI of odontogenic origin during the COVID-19 lockdown between 16 March 2020 to 15 June 2020, as part of a service evaluation initiative in response to the changes that the COVID-19 pandemic has brought to the provision of acute maxillofacial services within the trust. Retrospective data was collected from electronic health records within the Patient Pathway Manager Plus (PPM+) system between the same dates in 2019 to account for any seasonal variation in clinical throughput. This allowed for comparative analysis between the COVID-19 affected duration with a pre-COVID-19 cohort of patients (16 March 2019 – 15 June 2019). Data was recorded and stored on a secure hospital server on a Microsoft Excel spreadsheet.

Variables included basic demographic data, systemic inflammatory response syndrome (SIRS) status, presenting clinical features, treatment in primary care (if provided), referral source, time from admission to surgery, treatment received in secondary care, intraoperative findings, whether there was any escalation of care to high dependency or

intensive care and length of hospital stay. Data on patient comorbidities were subcategorised: cardiovascular and/or ischaemic heart disease, diabetes, hypertension, or respiratory disease. SARS-CoV-2 virus status of patients in the COVID-19 cohort was recorded from oropharyngeal and nasopharyngeal swabs for antigen testing on admission, where this was carried out.

## Statistical analysis

Analysis was carried out using SPSS (SPSS version 26, IBM). Non-parametric data were analysed using the Mann Whitney U test, binomial data using the Chi squared test and normally distributed non-categorical data using the Student’s *t*-test. The analytic method used for differences between the two groups was dependent upon on the variable and skew of the data. Significance level was set at  $p < 0.05$  and confidence intervals at 95%. Further sub-group analysis on patients with multi-(neck) space involvement was conducted to explore the correlation between length of hospital stay and severity of CFI. In addition to this, risk factors for requiring extraoral surgical drainage were identified using univariate binary logistic regression analysis with receiver operating curve (ROC) analysis to identify the diagnostic value of individual variables.

## Results

Throughout both periods there were 125 recorded episodes of admission for CFI of odontogenic origin. Sixty-percent ( $n=75$ ) pre-COVID-19 and 40% ( $n=50$ ) during COVID-19 lockdown with 33.3% decrease between the two periods. There were no significant differences in the number of patients with significant comorbidities between the cohorts of patients (Table 1).

Gender was balanced between the groups. Basic demographic data showed no significant differences in age ( $p=0.192$ ) (Table 1). In the COVID-19 lockdown cohort 2% ( $n=1$ ) had confirmed SARS-CoV-2 positive swab status, 68% ( $n=34$ ) tested negative and not all patients fulfilled criteria for a COVID-19 swab and subsequently 30% ( $n=15$ ) had no result recorded.

Comparative analysis showed that there was a significant difference ( $p = 0.004$ ) in the number of patients with SIRS prior to their operation in the COVID-19 lockdown group ( $n=18$ ) when compared with the pre COVID-19 group ( $n=6$ ) (Table 1).

Patients persisted with their symptoms significantly ( $p < 0.05$ ) longer prior to admission and presented later during COVID-19. Patients admitted during the COVID-19 period have significantly longer periods of inpatient admission ( $p < 0.05$ ) compared with those pre-COVID-19 (Table 1). Patients waited significantly longer for their operation from the time of hospital admission ( $p < 0.005$ ) during COVID-19. Although not statistically significant ( $p=0.162$ ), patients

Table 1

Comparative analysis of patients presenting with cervicofacial infections of odontogenic origin before and during COVID-19 lockdown. Data are No. (%) unless otherwise stated.

Variable	Pre-COVID-19 (n=75) (March 2019 – June 2019)	COVID-19 (n=50) (March 2020 – June 2020)	p value
Age (years):			
Mean (SD)	33.63 (19.5)	29.10 (17.9)	0.192*
Range	3-80	3-71	
Gender:			0.609**
Male	38	23	
Female	37	27	
SIRS +ve	9 (8.2)	18 (16.4)	0.004**
Duration of symptoms (days):			
Mean (SD)	3.56 (3.05)	6.92 (6.92)	<0.005***
Range	1 -14	1-30	
Length of admission (days):			0.002***
Mean (SD)	1.79 (1.13)	2.38 (1.29)	
Range	1-6	1-6	
Time to theatre (days):			
Mean (SD)	0.23 (0.484)	0.88 (0.627)	<0.005***
Range	0-2	0-3	
Extraoral drainage (%)	9 (7.4)	13 (10.7)	0.056**
Multi-space involvement (%)	10 (8.3)	14 (11.6)	0.059**
Self-referral to emergency department (%)	39 (73)	37 (60)	0.162**
Cardiovascular/ischaemic heart disease n=13 (%)	7 (54.4)	6 (46.2)	0.632**
Diabetes n=16 (%)	8 (50)	8 (50)	0.382**
Hypertension n=13 (%)	7 (54.4)	6 (46.2)	0.632**
Respiratory disease n=14 (%)	9 (64.3)	5 (35.7)	0.728**

\* Student's T-Test.

\*\* Chi squared.

\*\*\* Mann-Whitney U Test.

were more likely to self-refer to the emergency department during COVID-19 (n=36 (73%)) than pre-COVID-19 (n=45 (60%)). There were no differences between the groups with referral patterns: from general medical practitioners – pre-COVID-19 (n=11 (15%)) compared to during COVID-19 (n=5 (11%)) (p=0.558) and from general dental practitioners – pre-COVID-19 (n=19 (25%)) and during COVID-19 lockdown (n=9(16%)) (p=0.264).

More patients with had multi-(neck) space involvement during COVID-19 lockdown (n=14 (11.6%)) than pre-COVID-19 (n=11 (9.1%)) (p=0.059), thus more patients required extraoral surgical drainage for management of CFI during COVID-19 lockdown (n=13 (10.7%)) than pre-COVID-19 (n=9 (7.4%)) (p=0.056). Binary logistic regression analysis on the subgroup requiring extraoral surgical drainage (Table 2) (n=22) revealed that multi-space involvement was significantly (p<0.005) correlated with requiring extraoral surgical drainage (OR 69.7, CI(95%); 17.86-272.33). Patients with single space involvement were significantly less likely to require extraoral surgical drainage (p<0.005 OR 0.17, CI (95%); 0.004-0.640). ROC analysis demonstrated that multi-(neck) space involvement was a reliable predictor (AUC: 0.854) for the requirement of extraoral surgical drainage. Across both cohorts, patients who required extraoral drainage had significantly longer periods of hospital stay (n=24 mean 2.96 days, SD 1.36) compared to patients who required intraoral drainage alone (n=94 mean 1.81 days, SD 1.08) (p<0.005).

There were no significant differences (p>0.05) in the any of the presenting features recorded about patients between the two groups (Table 3). However further analysis showed that patients were far more likely to present with a combination of  $\geq 3$  symptoms of serious CFI (n=7) (trismus, odynophagia/dysphagia, stridor, difficulty breathing, or any other airway symptom) of CFI within the COVID-19 cohort (n=5 (71.4%)) than pre-COVID-19 (n=2 (28.6%)). There were no significant differences between the groups with regard to escalation of care to high dependency or intensive care (p=0.776), return to theatre (p=0.802), postoperative infection (p=0.802) or readmission within 30 days of hospital discharge (p=0.794).

## Discussion

This comparative study showed that during the COVID-19 lockdown patients persisted with symptoms of CFI of odontogenic origin longer and presented later compared to patients in the pre-COVID-19 era. Studies have shown that patients who do not seek treatment early in CFIs risk a deterioration of their clinical condition.<sup>9,11–13</sup> Chen et al showed in their analysis of 214 patients that delay in treatment was a factor in those who developed life-threatening deep neck infections.<sup>11</sup> It is imperative that ease of access to essential primary care dental services be maintained to prevent delayed presentations to hospital, with future lockdowns forming part

Table 2

Binary logistic regression analysis for patients with cervicofacial infections of odontogenic origin requiring extraoral drainage (across the entire study cohort).

Variable	Odds ratio (95% Confidence Interval)	p value	AUC
Multi-space involvement	69.7 (17.86 to 272.33)	<0.005	0.854
Single-space involvement	0.17 (0.004 to 0.640)	<0.005	0.161

AUC = area under the curve.

Table 3

Presenting features of patients with cervicofacial infections of odontogenic origin before and during COVID-19 lockdown. Data are No. (%).

Variable	Pre-COVID-19 (n = 75) (March' 19 – June' 19)	COVID-19 (n = 50) (March' 20 – June' 20)	p value
Trismus	35 (57)	29 (61)	0.650*
Dysphagia or odynophagia	18 (32.7)	13 (28.2)	0.628*
Difficulty breathing or stridor	2 (3.7)	3 (6.5)	0.519*
Voice changes	4 (7.4)	3 (6.5)	0.863*
Any other airway symptom	3 (5.4)	2 (4.3)	0.798*

\* Chi squared.

of the government strategy in the management of COVID-19 outbreaks.

Furthermore, other studies have shown how limiting access to essential primary medical/dental services leads to an increase demand on secondary care.<sup>12</sup> Salomon et al found that patients with limited access to primary healthcare were significantly more likely (OR = 1.48; 95% CI, 1.13-1.94), to require incision and drainage upon admission and had longer hospital admissions (p=0.004) than those with adequate access.<sup>12</sup> An increase in patients requiring secondary care treatment leads to higher costs, stretching resources in hospitals which could potentially be deployed in the management COVID-19 and ultimately be of further detriment from a health economics perspective.

Our study did not find significant differences (p > 0.05) in presenting symptoms between the two groups of patients with regard to the following: trismus, stridor/difficulty breathing, odynophagia/dysphagia, or any other airway symptoms. This potentially raises the question about the sensitivity of telephone consultations alone in screening for the severity of CFI in patients to ascertain who needs more urgent attention and/or treatment. Consideration needs be given to developing virtual consultations to include video conferencing with patients where possible, as this aspect of healthcare becomes more widely utilised. Research has shown that trismus is the most common finding in CFI,<sup>14</sup> which is also reflected in our study (Table 3). Further analysis of our study shows that proportionally more patients presented with ≥3 symptoms of serious CFI during COVID-19 lockdown which reflected the later presentation of these patients.

Service evaluation conducted by the Maxillofacial Trainee Research Collaborative (MTReC) pre-COVID-19 demonstrated disparity amongst clinicians regarding optimal management for CFI<sup>15</sup> in UK maxillofacial units. The experience is unprecedented during a pandemic and units may adopt a more conservative approach including the use of steroids of which is currently a topic of much debate and research.<sup>16</sup> This is being evaluated by the BAOMS COVID OMFS Trauma and Dental Infection service evaluation initiative, the outcomes of

which will further inform practice in this crucial subspecialty within our specialty.

The reason for the longer inpatient admissions in the COVID-19 group of patients is likely to be multifactorial; severity of disease at presentation is likely to be one of the contributing factors. Another factor that could have contributed to longer inpatient stay was the time to surgery from hospital admission. Patients waited for their operation for significantly longer periods (p < 0.005) during COVID-19 lockdown than pre COVID-19. The reason for this is likely multi-factorial with services during COVID-19 heavily modified, with limited theatre capacity, additional infection prevention and control measures imposed by the COVID-19 pandemic having its impact of theatre turnaround times and the time required for the processing of COVID-19 swabs. In addition to this, proportionally more patients required extraoral drainage during COVID-19 and subgroup analysis on this cohort of patients found that those requiring extraoral drainage had significantly (p < 0.005) longer periods of stay. The initial lockdown period delays in transporting samples to the lab along with shortages of essential reagent meant the turnaround time often exceeded 48 hours.<sup>17</sup> It is likely that this contributed to delays to surgical intervention when patients have safe airways, due to delays in establishing SARS-CoV-2 antigen status. This was perhaps an indicator of the impact that COVID-19 would have on future surgical practice as in accordance with hospital policies, all patients who are admitted and require elective/non-life or limb threatening surgery must undergo a SARS-CoV-2 swab prior to their operation.

Patient care pathways have been lengthened across the UK due to the need to ascertain the COVID-19 status to ensure that infection prevention and control measures are observed safely. A recent major international collaborative study of 1128 adults with COVID-19 who underwent surgery found an overall post-operative 30 day mortality at 23.8%.<sup>18</sup> Further sub-group analysis within CovidSurg Collaborative data included the category of 'head and neck' patients (n=40). 30-day mortality of this group was 20% (n=8) with 74.4% (n=29)

going on to develop pulmonary complications. This research demonstrates the importance of establishing COVID-19 status preoperatively with a view to mitigate this risk.

Proportionally more patients required extra-oral approach ( $p=0.056$ ) to drainage within the COVID-19 lockdown cohort than pre COVID-19. Whilst not statistically significant, this suggests that the severity of disease on admission is worse in the COVID-19 cohort. A potential limitation in our study demonstrating that patients persisted with their symptoms for longer and sought treatment later in their disease during lockdowns is recall and/or recording bias given this relies on both the patient and clinicians interpretation and documentation of admission. The cause is difficult to ascertain, however is likely to either be due to restricted access to primary dental services and/or COVID-19 lockdown related anxiety leading to reluctance in seeking early healthcare assessment/intervention.<sup>19</sup>

## Conclusion

Lockdowns without adequate primary care provision have led to delays in patients seeking treatment for odontogenic infection, patients presenting with more severe CFI which required longer episodes of care in hospitals. As local lockdowns form part of the government strategy in the regional management of potential future COVID-19 surges it is vital that access to primary care treatment is provided to allow early intervention in patients with CFI. It is important that commissioners and clinicians in both primary and secondary care understand the morbidity associated with local lockdowns in order to adequately resource health care services.

## Conflict of interest

We have no conflicts of interest.

## Ethics statement/confirmation of patients' permission

Not applicable.

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