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# Impact of COVID-19 lockdown on incidence of maxillofacial fractures: A retrospective analysis

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## ABSTRACT

COVID-19 lockdown restrictions greatly influenced people's behaviour and movements, and therefore patient presentation may differ in maxillofacial trauma surgery during lockdown. The aim of this study is to evaluate the impact of a lockdown on the incidence, types and mechanisms of injury of maxillofacial fractures. In this single-centre retrospective cohort study patients who visited the maxillofacial surgeon after traumatic injury between 15 March and 1 June in the years 2018, 2019, 2020 and 2021 were included. The primary outcome is the incidence of maxillofacial fractures during the lockdown in 2020 compared to the pre-lockdown and post-lockdown periods. Secondary outcomes are type of fracture and mechanism of injury. A total of 130 patients with maxillofacial fractures were identified. During the lockdown 0.51 (95% CI 0.32–0.84) times less maxillofacial fractures were reported. A significant association was found between mechanism of injury and lockdown compared to the post-lockdown period. No further associations were found between a lockdown and type of fracture or mechanism of injury. In conclusion, the incidence of maxillofacial fractures was significantly lower compared to equivalent time periods in other years, but recovered after lockdown.

## 1. Introduction

After the first human cases of coronavirus disease (COVID-19) emerged in early December 2019, the virus was genetically identified as SARS-CoV-2 and globally shared on 11 January 2020. The virus has greatly stirred the world since, achieving the status of pandemic on 11 March 2020 [1]. Governments were forced to implement severe measures to prevent exponential transmission of the virus. In many countries the rapid spreading inevitably led to nationwide lockdowns, the Netherlands included [2].

The COVID-19 lockdown in the Netherlands was implemented on 15 March 2020. Additional measures were taken on 24 March 2020 and an 'intelligent' lockdown was introduced [3]. The complete package of measures included social distancing, bans on festivals and gatherings, closure of schools, restaurants and sports facilities and the strong advice for non-essential occupations to work from home if possible. These restrictions instantly limited people's movements. Eventually most restrictions were lifted on 1 June 2020 as the end of the intelligent lockdown was announced [4].

The strict social and public health measures greatly influenced people's behaviour. In traumatology it is known that fracture

epidemiology primarily depends on human behaviour and lifestyle [5–8]. In the past, nationwide health emergencies such as natural disasters have influenced epidemiology of pathologies that normally occur in the population [9–11]. The COVID-19 pandemic may be considered as such a rare event. It is therefore a reasonable assumption that the pandemic and related lockdowns may impact patient presentation.

Severe facial injuries involving mobility and bleeding of facial bones may promote life-threatening airway obstruction and hypovolemia [12]. Therefore traumatology is an important subspeciality in maxillofacial surgery that needs continuation of patient care, especially in a state of national health emergency.

Differences in patient presentation may alter the demand for specific healthcare resources and therapies. Due to the pandemic, the presentation of patients, medical staffing levels and provision of resources are subject to change across almost all medical fields, with no exception for maxillofacial surgery [13]. Efficient reallocation is therefore necessary to ensure qualitative and sufficient patient care, especially for immediate and unscheduled maxillofacial trauma surgery. Epidemiological analysis of maxillofacial fractures during an unprecedented pandemic provides crucial insights to ensure adequate patient care. Eventually these new insights allow healthcare workers and policymakers to

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develop an efficient planning system for resource allocation to sustain future health crises.

Furthermore the effects of a lockdown on behaviour can be monitored through fluctuations in incidence, type and aetiology of fractures. To evaluate if influences of a lockdown are either temporary or permanent, comparison to a post-lockdown time period is necessary. Therefore the aim of this study is to evaluate the impact of a COVID-19 lockdown on the incidence, types and mechanisms of injury of maxillofacial fractures compared to pre-lockdown and post-lockdown periods.

## 2. Methods

### 2.1. Design

This study is a retrospective cohort study conducted at the Department of Oral & Maxillofacial Surgery of the Erasmus University Medical Centre in Rotterdam, the Netherlands.

### 2.2. Patient population

The electronic patient record was searched for consultations concerning maxillofacial fractures between 15 March and 1 June in 2018, 2019, 2020 and 2021. Patients were included if they had either visited a maxillofacial surgeon or had undergone surgery for a maxillofacial fracture in predefined time periods. Maxillofacial fractures included zygomatic, nasal, orbital, sinus frontalis, maxillary and mandibular fractures. When patients had multiple fractures in different facial bones, each fracture was registered separately. Patients with maxillofacial fractures caused by other aetiology than trauma for example pathological fractures, were excluded. Patients with isolated dental trauma were also excluded. Patients were divided in three different groups: a pre-lockdown group (2018 and 2019), a lockdown group (2020) and a post-lockdown group (2021).

### 2.3. Study outcomes

The primary outcome of the study is the incidence of maxillofacial fractures. Secondary outcomes are mechanism of injury and type of maxillofacial fractures. Mechanism of injury was categorized as work-related, violence, domestic, fall, traffic, sports trauma and alcohol or drugs abuse. Traumas with bicycles with no other traffic involvement were considered as falls.

### 2.4. Variables

Patient characteristics, as retrieved from the electronic patient record, were age at the time of injury and sex. In addition, time to presentation was calculated based on the date of injury and the date of presentation to a clinician. Secondly time to surgery and duration of hospitalization, if both applicable, were calculated based on the dates of surgery, hospitalization and hospital discharge. Lastly, the day of the week was calculated from the injury date and dichotomized to week or weekend.

### 2.5. Statistical analysis

Descriptive statistics were used to generate baseline characteristics. Categorical data were described using absolute numbers and percentages. For comparison of categorical data between groups a Fisher's exact test or a Pearson's chi square test were used as appropriate. Poisson regression was performed to estimate the effect of a lockdown on the number of maxillofacial fractures. Independent Student's t-test was used for comparison of averages between groups. Data were analysed in IBM Statistical Package for Social Sciences version 25. A two-tailed p-value < 0.05 was considered statistically significant.

## 3. Results

A total of 130 traumatic maxillofacial fractures were identified during the 2020 lockdown and equivalent periods in 2018, 2019 and 2021. General patient characteristics are summarized in Table 1. The mean age of patients was  $43.5 \pm 21.5$  years. The male to female ratio equals 1:2.6. The most reported mechanism of injury overall were traffic accidents.

Data separated by year are presented in Table 2. Poisson regression showed that during a period of lockdown 0.51 (95% CI 0.32–0.84) times less maxillofacial fractures were reported, a statistically significant result ( $p = 0.007$ ).

Since patients may have had multiple maxillofacial fractures, no statistical analysis was performed on differences in type of fractures between the different time periods. Larger facial bones such as orbita, zygoma, maxilla and mandibula were mostly reported across all years. During the lockdown however only one mandibular fracture was reported.

Furthermore, no significant association was found between the presence of a lockdown and mechanism of injury compared to the pre-lockdown period ( $p = 0.959$ ). In comparison with the post-lockdown period, mechanism of injury was significantly associated with a lockdown ( $p = 0.024$ ). In 2021 relatively more falls and less traffic accidents were reported compared to 2020. Overall traffic-related injuries were most reported across all years except for 2021.

Alcohol-related maxillofacial injuries did not show a significant relation with the lockdown compared to both other periods ( $p = 0.290$  and  $p = 0.400$ ). No association was found for mean age and the presence of a lockdown ( $p = 0.709$  and  $p = 0.732$ ). In addition, no association was found for sex in relation to a lockdown ( $p = 0.579$  and  $p = 0.749$ ).

Due to a low number of patients experiencing delays in time to presentation, time to surgery and duration of hospitalization, these time variables were unfit for Kaplan-Meier analysis. Significant differences were not found for time variables during lockdown with Student's t-test. Patients with maxillofacial fractures went to see a clinician within one day on average across all years. In the lockdown period relatively less injuries occurred during the weekend compared to the pre-lockdown period, an almost significant association ( $p = 0.073$ ). No significant difference was found compared to the post-lockdown period ( $p = 0.555$ ).

## 4. Discussion

Following lockdown regulations we observed a significant decline in

**Table 1**  
Patient characteristics of all years combined.

Patient characteristics	No.	% or mean $\pm$ SD
<b>Gender</b>		
Male	94	72.3
Female	36	27.7
<b>Age</b>	130	$43.5 \pm 21.5$
<b>Type of fracture</b>		
Frontal sinus	14	10.8
Nasal	26	12.0
Orbital	68	52.3
ZMC	49	37.7
Maxillary	37	28.5
Mandibular	43	33.1
<b>Mechanism of injury</b>		
Work-related	1	0.8
Violence	27	20.8
Fall	35	26.9
Traffic	60	46.2
Sports trauma	6	4.6
Unknown	1	0.8
<b>Total</b>	130	100.0

ZMC = zygomatic maxillary complex.

**Table 2**  
Patient characteristics separated per year.

	2018	2019	2020	2021	p-values
	Pre	Pre	Lock	Post	
<b>Number of fractures</b>	29	48	19	34	0.007*
<b>Type of fractures</b>					
Sinus frontalis	5	3	4	2	
Nasal	2	11	6	7	
Orbital	17	22	13	16	
ZMC	10	24	7	8	
Maxillary	7	13	9	8	
Mandibular	10	15	1	17	
<b>Mechanism of injury</b>					0.959, 0.024*
Work-related	0	1	0	0	
Violence	6	10	4	7	
Fall	8	7	4	16	
Traffic	14	28	11	7	
Sports trauma	1	1	0	4	
Unknown	0	1	0	0	
<b>Intoxications</b>					
Alcohol	9	5	1	6	0.290, 0.400†
Drugs	2	2	1	1	
<b>Age</b>					
Mean ± SD	39.6 ± 18.7	43.6 ± 22.9	44.2 ± 21.6	46.3 ± 22.1	0.709, 0.732‡
Median	35.0	35.5	56.0	42.0	
Q1-Q3	23.0-53.0	23.0-68.5	23.0-61.0	28.8-66.3	
<b>Sex</b>					0.579, 0.749†
Male (%)	20 (69.0)	35 (72.9)	15 (78.9)	24 (70.6)	
Female (%)	9 (31.0)	13 (27.1)	4 (21.1)	10 (29.4)	
<b>Time variables</b>					
Time to presentation	0	0.7 ± 1.8	0.2 ± 0.7	0.3 ± 1.1	0.478, 0.638‡
Time to surgery	3.4 ± 3.7	1.2 ± 1.8	4.6 ± 5.8	2.3 ± 5.2	0.325, 0.411‡
Duration of hospitalization	2.5 ± 3.2	4.7 ± 8.5	2.0 ± 0.8	1.4 ± 0.5	0.610, 0.227‡
<b>Day of the week</b>					0.073, 0.555‡
Weekend	17	22	5	12	
Weekday	12	26	14	22	

Pre, lock and post stand for pre-lockdown, lockdown and post-lockdown group respectively. The first P-value represents the comparison between pre-lockdown and lockdown group. The second P-value represents the comparison between lockdown and post-lockdown group. For Poisson regression data were put in by year, producing only one p-value. ZMC = zygomatic maxillary complex. \* Poisson regression ^ Pearson's chi square † Fisher's exact test ‡ Student's T test.

maxillofacial fractures up to 49% compared to the same period in 2018, 2019 and 2021. Other studies found a decline in maxillofacial fractures as well [14–16]. The overall reduction of maxillofacial fractures could be attributed to the decrease in traffic-related injuries, as numbers of other mechanisms of trauma remained approximately the same. Lockdown measures encouraged people to work from home and massively limited movements, thus decreasing overall traffic. Moreover the decrease in traffic-related injuries remained in 2021, leading to a significant association between mechanism of injury and a lockdown when compared to the post-lockdown period. One explanation could be that the Dutch government strongly advised to work from home and limit travel movements even after lockdown.

Isolation and financial stressors during the COVID-19 pandemic may alter home-situations and raise tensions within families, possibly leading to greater numbers of violence [17]. Ludwig et al. reported a significant increase in assault-related facial trauma [18]. Though Marchant et al. did not find an increase in interpersonal or domestic violence during lockdown [19]. Our study found no increase in cases of violence during lockdown as well. On one hand, our study was conducted at one of the eleven national trauma centres in the Netherlands, which treats more severe and complex trauma. Victims of violence may present themselves at lower-level trauma centres or other healthcare providers [20]. On the other hand, domestic violence is often underdiagnosed by clinicians at initial visits [21]. Therefore, the number of violence related injuries in this study may not be indicative for the prevalence of domestic violence in the Netherlands.

No significant increase was found in time to presentation to a clinician. The short duration of hospitalization in 2020 persisted in 2021. A possible explanation may be the prevention of shortage of hospital beds. During the lockdown management of available beds was paramount.

This may have carried on after the lockdown as healthcare workers remained cautious for a new surge in COVID-19 infections. This is important since maxillofacial fractures have the potential to be life-threatening and healthcare must remain easily accessible to patients especially in times of lockdown.

Although not significant, a trend could be observed in the timing of injuries during the week. In the lockdown relatively less fractures were reported in the weekends. Restaurants, bars and nightlife were closed leading to less travel movements and less violence from person-to-person interactions. Thus, less maxillofacial fractures occurred. On 28 April 2021 bars and restaurants were gradually allowed to reopen, which might explain the light resurgence of trauma during weekends in 2021. Alcohol consumption might play a part in this. On one hand alcohol consumption might decrease when bars and restaurants were closed. But isolation and stress after abrupt alteration of everyday life may promote alcohol consumption on the other hand. Alcohol-related injuries however were not significantly associated with a lockdown in this study. Because average alcohol consumption remained the same during lockdowns worldwide [22], a lockdown might not provoke an increase in maxillofacial fractures involving alcohol.

Several limitations in this study were observed. As with all single-centre studies the data do not capture all trauma in our region. As earlier mentioned, this study was performed at a national trauma centre, where severe and complex injuries are more common. Only patients who are directly admitted or transferred by peripheral hospitals are captured in this study. Patients that met our inclusion criteria, but with less severe trauma, are therefore out of scope. Secondly a single-centre study produces a lower sample size of injuries during lockdown, which sometimes makes it difficult to produce significant associations. When multiple centres are involved, higher numbers of injuries might be reported and

several results may become significant.

A strength of our study is the inclusion of an equivalent time period in 2021. Currently no studies reported on incidence of maxillofacial fractures after a lockdown. Observing the same time period after lockdown allows for evaluation of temporary and permanent changes made in the heat of the COVID-19 pandemic. Valuable lessons can be learned from observing these data. Future studies should therefore focus on mapping changes in the field of maxillofacial surgery during the COVID-19 pandemic.

In summary, the incidence of maxillofacial fractures was significantly lower compared to equivalent time periods in other years, but recovered after lockdown. Lockdown measures seem to decrease the number of maxillofacial fractures, mainly attributed to the decrease in traffic-related injuries. Further associations between the lockdown period and changes in the presentation of maxillofacial fractures were not found.

### Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

### Ethics statement/confirmation of patient permission

This retrospective study was approved by the Ethics Committee of the Erasmus University Medical Centre. No personal details or identifying information of patients are included in this article.

### Declaration of interests

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

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