Original Article

The Effect of Covid-19-Related Social Distancing Restrictions on Maxillofacial Fractures Epidemiology

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ABSTRACT

Background: The purpose of the present study was to evaluate the changes in maxillofacial fracture epidemiology and etiology regarding Covid-19-related social distancing restrictions in an Iranian population.

Methods: A retrospective cross-sectional study was undertaken in six major trauma center hospitals in Iran in a period of two years (March 2018 until March 2020). The primary outcome variable was the maxillofacial fractures incidence. Patients' demographic data, date of injury as well as fracture characteristics, fracture etiology, type, and site were all recorded, compared, and analyzed in the control and experimental groups.

Results: The patients consisted of 520 (83.6%) males and 102 (16.4%) females. Patients sustaining maxillofacial fractures over this two-year period displayed a mean age of 31.24±14.44, with an age range of 2 to 88 years. The incidence of maxillofacial fractures significantly decreased in all age groups ($p<0.001$). After social distancing restrictions were placed; there was a significant drop in the number of subjects attending due to motorcycle collisions and road traffic accidents, whereas the number of fractures caused by assaults and domestic violence significantly increased ($p<0.001$ for each).

Conclusion: The investigators realized that social distancing restrictions were able to change the trends and patterns in maxillofacial fracture incidence and etiology.

KEYWORDS
Maxillofacial Injuries; COVID-19; Physical Distancing; Epidemiology; Fractures, Bone

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INTRODUCTION

Maxillofacial fracture cases constitute a large number of trauma victims[1-3]. These types of injuries are reflected in significant morbidity, loss of function, and work disabilities for the afflicted individual and pose a major socioeconomic burden and expense for society[1-5]. Therefore, it is considered a critical health and economic issue for any healthcare system[1-3, 6-8]. Management of trauma to a particular body region with such complex anatomy has always been a challenge for the

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treating physician[1-3, 6, 7]. The treatment goals serve to preserve the integrity of vital structures, restore function and improve facial esthetics[9-11]. Any esthetic compromises can lead to the development of psychosocial disorders[10-12].

Rapid urbanization and industrial development have led to profound lifestyle changes in recent years[1-3, 7, 10-13]. These changes in activity patterns continue to inflict physical injury, increasing the incidence of all traumas including cases presenting with maxillofacial trauma[1-4, 7, 10-14]. In this commentary, obtaining a competent and detailed insight and knowledge of the epidemiology and etiology of maxillofacial traumas is mandatory[1-3, 7, 10-12, 14-17].

In late December 2019, the novel Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), caused an unprecedented outbreak of Covid-19 disease[4, 18-20]. This disease displays greatly varying degrees of severity and is capable of causing a flu-like infection to fatal pneumonia. This multi-symptomatic disease typically manifests as fever, cough, malaise, and dyspnea in the earlier stages. An average incubation period of 5 or 6 days is expected for symptom onset[4, 5, 21-23]. Thus, there is a high chance of cross-infection during the asymptomatic stage[4, 5, 21-23]. Due to the high transmission rate and pathogenicity of this virus, COVID-19 has made a global impact and affected every domain, especially medical sectors[4, 9].

At the beginning of the pandemic, health care systems faced serious disorientation regarding reallocating human and material resources[18, 21, 22]. Authorities engaged different responses to this newly emerged and devastating situation. One of the main countermeasures was mandating social distancing policies[4, 5, 8, 9, 20-24]. This entailed closure of schools and other social settings, canceling events as well as avoiding travel and crowded places as much as possible[4, 5, 9, 13, 20-24].

Iran was one of the most COVID-affected countries in the Middle East[13, 25, 26]. The first cases of COVID-19 were reported in March 2022; and ever since, this public health crisis has significantly impacted the health status of the Iranian population[13, 25, 26].Similar to other countries, the Iranian government also enacted preventive measures to counteract the rapidly spreading disease. The first total lockdown was introduced in April 2022. These changes posed fundamental social and economic disruptions for the entire society[13, 25, 26].

The socioeconomic status, cultural components, and behavioral patterns of a population are associated with disease epidemiology and can therefore highly influence the incidence and trends of physical injury, including maxillofacial fractures[6, 7, 10-12, 27]. Since the COVID-19 pandemic has changed the world and affected almost every aspect of our everyday lives, it is purported that this pandemic would also change the trends and patterns in maxillofacial trauma occurrence[4, 5, 8, 13, 20-22].

The literature regarding the changing trends in the epidemiology and etiology of maxillofacial fractures is still limited in the context of the pandemic[4, 5, 8, 9, 13, 20-22]. Despite its critical relevance in policy making and service planning, few studies have investigated the effect of the COVID-19 pandemic on the incidence of maxillofacial traumas[4, 5, 8, 9, 13, 14, 20-23]. Based on our literature review no study has heretofore scrutinized this matter in an Iranian population[10, 11, 25].

Hence, the purpose of the present study was to assess the impact of the government-imposed social distancing measures and total lockdowns; on the cases of maxillofacial fractures, in Iran. The specific aims were to compare the incidence and etiologic distribution of fractures of maxillofacial trauma when and when not COVID-19 restrictions were in place.

MATERIALS AND METHODS

Study design and participants

To address the research objective, the authors designed and implemented a descriptive cross-sectional census-based study.

This study was conducted following Good Clinical Practice guidelines and the principles of the Declaration of Helsinki. This research ethical code was IR.MUMS.DENTISTRY.REC.1400.096.

The study sample consisted of all patients referred to or visiting the Oral and Maxillofacial Department of four facilities in Iran and diagnosed with facial fractures from March 2018 until March 2020. The study took place in six medical trauma center institutions, namely: Kamyab Hospital, Taleghani Hospital, Shariati Hospital, Emam Reza Hospital, Ghaem Hospital, and Heshemi Nezhad Hospital.

The diagnosis of maxillofacial fracture was established based on clinical and radiographic evaluation (Panoramic and CT scan). The exclusion

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criteria were: 1) incomplete or unclear data documentation 2) isolated (solitary) soft tissue injury without hard tissue involvement 3) previous history of maxillofacial fracture and currently stabilized and immobilized (under rigid fixation) with mini-plates or arch-bars 4) patients who were treated nonoperatively. Patients were subdivided into two groups: those presenting when social distancing restrictions were in place, between March 1st, 2019 till March 1st, 2020 (experimental group), and those presenting outside the social distancing period, from March 1st, 2018 till March 1st, 2019 (control group).

Data collection and variables

Patients' existing electronic medical records were retrieved from the hospital databases and retrospectively reviewed. Data were abstracted from the patients' clinical records as well as using Photo Archiving and Communicating System (PACS). Privacy and confidentiality of all clinical information were maintained. The primary predictor variable was the timeframe in which subjects solicited for care (injury had occurred): within the social distancing period (2019-2020) or when measures of social distancing were not in effect (2018-2019). The primary outcome variable was the incidence of maxillofacial fractures. Other evaluated study variables include injury history as in the type and site of the fracture, mode of injury, as well as demographic characteristics of age and gender.

The mechanism of injury was defined as assault or interpersonal violence (IVP), motorcycle collision, domestic violence, road traffic accidents, unintentional falls, sport-related injuries, and workplace injuries. The incidence of maxillofacial fractures was compared between the experimental and control groups. The distribution of fracture etiology was also compared in different age groups, according to demographic characteristics.

Statistical analysis

This study was census-based and eligible patients were included and then subsequently omitted from the study if they had any of the above-mentioned exclusion criteria. Obtained data were recorded on Excel spreadsheets, coded and then sent for statistical analysis. Fischer exact tests and Chi-square test were used for descriptive analysis. Data were subjected to statistical analysis using SPSS version 20 (IBM Corp., Armonk, NY, USA) and the significance level was set at p-value = 0.05.

RESULTS

From March 1st, 2018 till March 1st, 2020, a total of 660 subjects were admitted to the mentioned centers in order to seek care for the maxillofacial injury. However, after an initial review of the retrieved electronic records, some subjects were subsequently excluded and only 622 documents were retrospectively analyzed. The majority of incoming patients were males (n=502, 83.6%). A less number of female patients (n=102, 16.4%) attended for maxillofacial fracture management. Patients sustaining maxillofacial fractures over this two-year period displayed a mean age of 31.24±14.44 years and an age range of 2 to 88 years.

Table 1 presents the subjects' injury characteristics. A total of 235 patients (37.8%) comprised the experimental group i.e. were injured after social distancing restrictions (2019-2020) and 387 patients (62.2%) composed the control group who experienced trauma prior to social distancing legislations (2018-2019). The leading cause of maxillofacial injury was motorbike collision, responsible for 46.3% of fractures (n= 288); followed by interpersonal violence, unintentional falls, domestic violence, road traffic accidents, sport-related injuries, and workplace injuries, in descending order of frequency. A higher proportion of patients sustained multiple fractures and isolated fractures were less common (n= 426 and n= 196, respectively). The mandible was the most highly affected fracture site, accounting for almost half of all presenting cases. Mandibular fractures were subcategorized as per region; subcondylar fractures (n= 142) and coronoid process fractures (n=4) acquired the highest and lowest frequency rates among all mandibular fractures. (The mandible and nasal bones were the most highly affected fracture sites, accounting for 49.2% and 27% of all fracture cases, respectively).

An age paradigm shift took place over the social distancing period. The mean age of the patients presenting for evaluation of maxillofacial fractures during 2018-2019 was 32.32±15.21 years and significantly decreased to 29.47±12.90 years, the

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year after (p=0.04). As displayed in Table 2, the largest age group who presented with fractures was 20 to 30-year-old patients, representing 34.1% of subjects.

As illustrated in Fig. 1, all age groups exhibited a statistically significant decline in maxillofacial trauma incidence after social distancing policies were placed (P<0.001). The most drastic decrease was noted in the 50-59-year-old age group.

Following social distancing measures, fracture frequency decreased from 10.6 % to 5.8% in female patients and from 51.6% to 32% in male patients

Table 1: Patients' injury characteristics

Variable		N (%)
Gender	Female	102(16.4)
	Male	520(83.6)
Cause	Motorcycle collision	288(46.3)
	Assault	120(19.3)
	Falls	66(10.6)
	Domestic violence	44(7.1)
	Road traffic accidents	24(3.9)
	Sport-related injuries	50(8.0)
	Workplace injuries	30(4.8)
Fracture type	Isolated	426(68.5)
	Multiple	196(31.5)
Fracture site	Angle mandible	62(10.0)
	Parasymphisis mandible	52(8.4)
	Subcondylar mandible	142(22.8)
	Body mandible	46(7.4)
	Coronoid mandible	4(0.6)
	Lefort 1 maxilla	14(2.3)
	Lefort 2 maxilla	14(2.3)
	Lefort 3 maxilla	6(1.0)
	Nasal	168(27.0)
	NOE	16(2.6)
	Orbit	26(4.2)
	Zygomaticomaxillary complex	44(7.1)
	Zygomatic arch	22(3.5)
	Frontal bone	6(1.0)
Social distancing in effect	No	387(62.2)
	Yes	235(37.8)

Table 2: Patients' age distribution

Age (yr)	Frequency (N)	Percent (%)
<10	22	3.5
10-19	92	14.8
20-29	212	34.1
30-39	141	22.7
40-49	87	14.0
50-59	38	6.1
≥60	30	4.8
Total	**622**	**100.0**

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(Fig. 2). The magnitude of the decline in fracture frequency was not proven to be significantly different between male and female subjects (P=0.571). The number of cases sustaining multiple fractures and those presenting with isolated maxillofacial fractures decreased over the social distancing period; the former from 36.7% to 31.8% and the latter from 25.6% to 5.9%. According to the Chi-square test, this reduction was significantly greater regarding multiple fractures (P<0.001).

Fig. 3 displays the variations in the etiologic distribution of maxillofacial fractures after and prior to social distancing. There was a significant rise in the frequency rate of fracture due to assaults (n=32, 5.1% versus n=88, 14.1%) and domestic violence (n=4, 0.4% versus n=40, 6.4%) (P<0.001). However, after social distancing policies were enacted, a statistically significant reduction in the frequency of other etiologic causes was noted (P<0.001). The number of subjects attending due to motorbike collisions decreased from 219 (35.2%) to 69 (11.1%) and from 20 (3.2%) to 4 (0.6%) cases who were injured in road traffic accidents. The incidence of accidental falls, sport-related injuries, and workplace injuries reduced from 8.4 to 2.3%, 6.4% to 1.6%, and from 3.2% to 1.6%, respectively.

The cumulative incidence of mid-facial, upper face, and lower face fractures all significantly decreased after social distancing policies were imposed (P<0.05). Nonetheless, mid-face and nasal fractures showed the greatest decline (Table 3). The incidence of fractures to most of the maxillofacial sites progressively decreased from 2019 to 2020 (social distancing restrictions era). The most

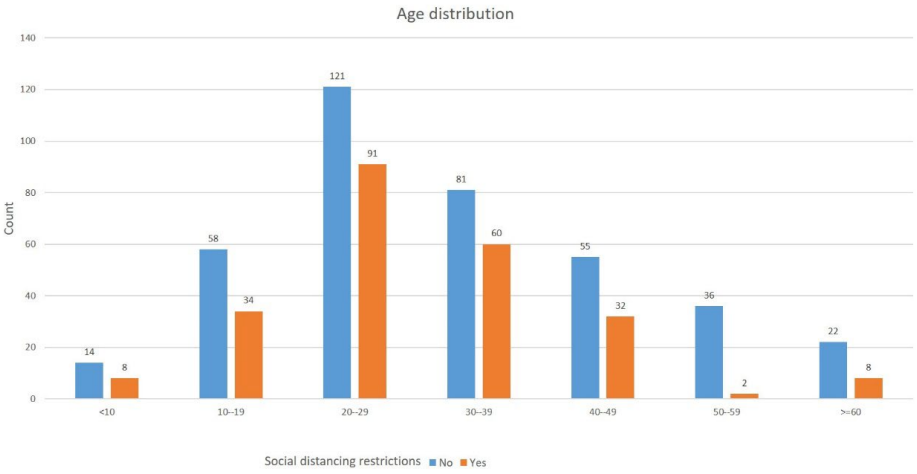

Figure 1: Age distribution when social distancing policies were and were not in effect.

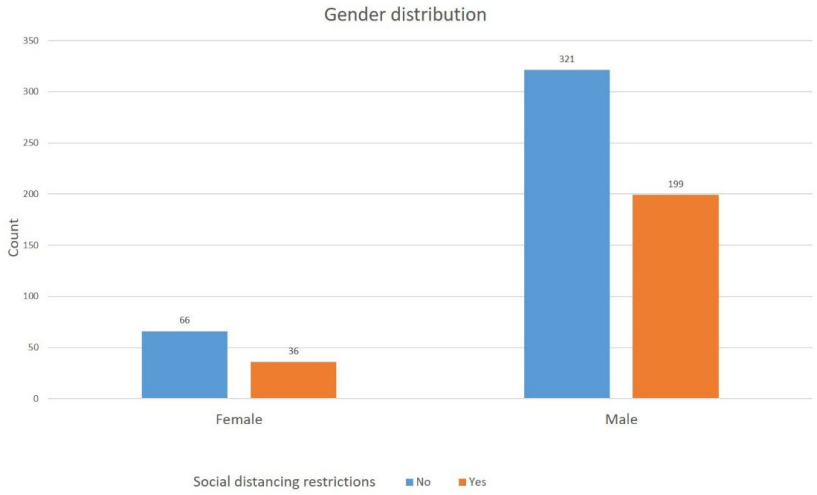

Figure 2: Gender distribution when social distancing policies were and were not in effect.

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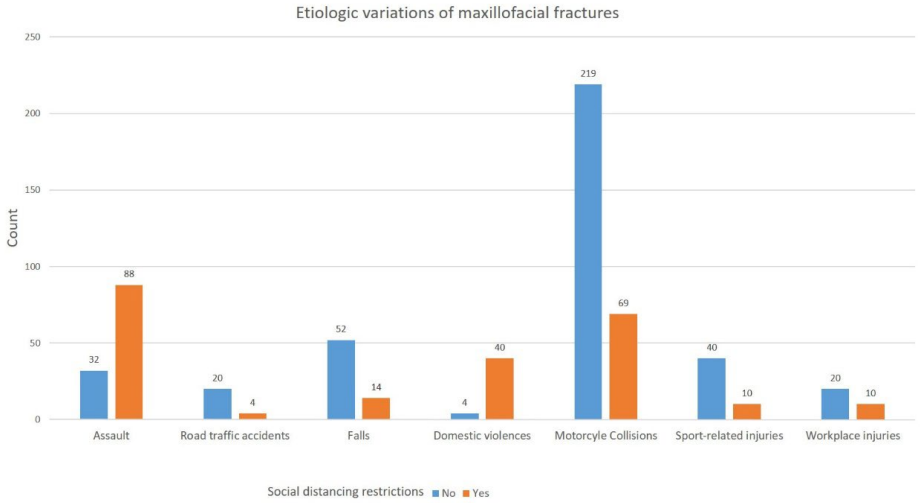

Figure 3: Etiologic variations of maxillofacial fractures when social distancing policies were and were not in effect.

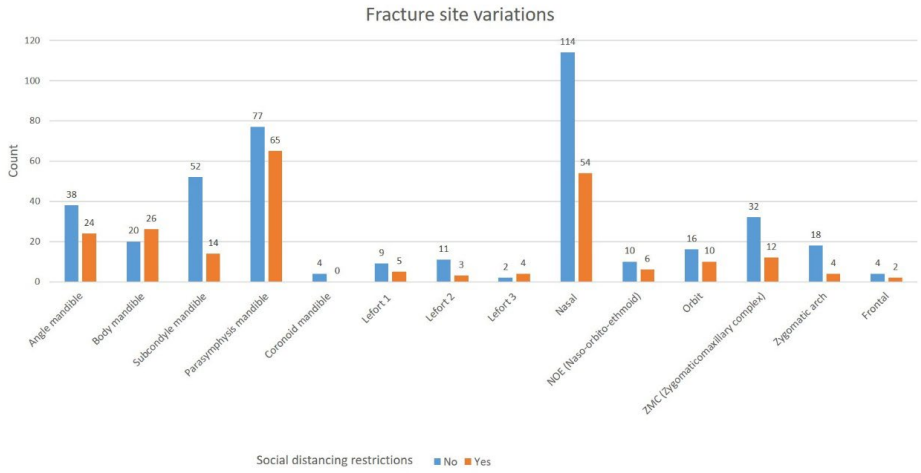

Figure 4: Fracture site variations when social distancing policies were and were not in effect.

Table 3: Variations in fracture site between the experimental and control group.

Fracture site		Social distancing in effect		P value
		No	Yes	
Lower face	Count	171	135	<0.05
	Percentage	27.5%	21.7%	
Midface & Nasal	Count	212	98	
	Percentage	34.1%	15.8%	
Upper face	Count	4	2	
	Percentage	0.6%	0.3%	

Note: Percentages were calculated as a fracture of the total 662 subjects.

prominent decline was noted in nasal fractures (n=114 versus n=54) followed by fractures to the ZMC (zygomaticomaxillary complex) (n= 32 versus n=12). These reductions in fracture incidence were considered statistically significant (*P*=0.024). Fig. 4 presents these findings in detail.

DISCUSSION

The results of this study showed that the incidence of maxillofacial fractures significantly decreased in all age groups after social distancing restrictions were placed. Furthermore, there was a significant drop in

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the number of subjects attending due to motorcycle collisions and road traffic accidents, whereas the number of fractures caused by assaults and domestic violence significantly increased.

Besides the fact that maxillofacial trauma can be potentially life-threatening and fatal, these types of injuries are associated with a high risk of unsalvageable aesthetic problems and functional disability[1, 6, 10-12]. This precipitates substantial psychological, social, and financial challenges for the affected individuals and the entire society[1, 3, 6, 7, 10-12]. On that account, obtaining a competent insight into the epidemiology and etiology of maxillofacial fractures is integral to appropriate planning both on a clinical and management level[1, 3, 6, 7, 10-12].

Iran is located in Western Asia and has a population of 85 million making it the 17th most populous country in Asia. Iran is the fourth largest country in Asia and covers an area of 1,648,195 km^2 [10, 11, 25]. Iran was one of the countries most affected by COVID-19 in the Middle-east[25, 26]. A variety of ethnic groups, immigrants, and refugees reside in Iran and comprise a multicultural population[28]. It is also considered the region's religious hub and has a high tourist flow from neighboring countries[10-12, 29]. National reports indicate a high rate of road traffic accidents, interpersonal violence, and sport-related injuries in this country[10-12]. Every year Iranian hospital facilities manage a large caseload of physical injuries[10-12]. The six aforementioned medical institutions, which were selected for carrying out the present study, are among the well-equipped hospitals in Iran. A retrospective study provided accurate data on the epidemiology of Maxillofacial fractures in Iran in recent years[10]. This study also recognizeded motorbike incidences to be the leading cause of maxillofacial injury. The body of the mandible was reported to be the most common fracture site. The employed treatment modality significantly correlated to the patients' age. They also noted a significant correlation between the type of sustained fracture and the patients' gender. They concluded that the patient's age at injury and gender can significantly affect the incidence and type of sustained fracture as well as the treatment of choice[10].

The purpose of this multicenter observational study was to assess the changes in the incidence and trends of maxillofacial trauma activity when COVID-19-related social distancing was enforced (2019-2020). This was accomplished by comparing the obtained figures with those of patients attending during the equivalent period, the preceding year. The literature on the impact of the COVID-19 pandemic on maxillofacial trauma activity is still relatively scarce[4, 5, 8, 9, 20-23].

A retrospective cohort study by Ludwig et al. investigated the changing trends and patterns in maxillofacial trauma within the social distancing period in the United States of America[4]. The type of facial fracture, abbreviated injury scale (AIS), injury severity score (ISA), and mechanism of injury was abstracted from 883 medical records. These parameters were analyzed and compared when social distancing policies were (2019-2020) and were not (2018-2019) in effect. They concluded that although the overall incidence of facial fractures decreased after the enforcement of social distancing measures, the severity of oral and maxillofacial fractures was greater during this period, which was in line with our study findings[4].

De Boutray et al. investigated how COVID-19 restrictions affected the epidemiology of maxillofacial fractures in France[22]. The setting of this multicenter study was 13 governmental facilities. The incidence of maxillofacial fractures requiring surgical intervention was evaluated during the first month of lockdown and throughout the years 2018 to 2019. The frequency of maxillofacial trauma significantly decreased after the lockdown period, which was consistent with our study results[22]. They also observed that the rate of sport-related injuries had significantly decreased during this time. Considering the reduction in maxillofacial trauma activity during the lockdown period, it would be beneficial if human and material resources were allocated to other specialties and departments with more urgent needs and higher caseloads[22].

A recent study by Donohe et al. assessed the impact of the COVID-19 pandemic on maxillofacial surgery patient presentation in western Ireland[21]. Patients attending the emergency department within the first three months of lockdown were retrospectively analyzed and compared with those attending during the equivalent period in 2019. The average decline in maxillofacial trauma over three months amounted to 46%. Furthermore, they also noted a significant decrease in the number of young patients presenting for maxillofacial injuries, which was similar to the present study[21]. There was a two-fold increase in the number of cases with a chief complaint of dental

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pain and a rise in the number of those attending the emergency department due to infection requiring maxillofacial surgery input[21].

The COVID-19 outbreak and its subsequent imposed restrictions significantly affected the incidence and patterns of maxillofacial trauma in Italy[8]. This multicenter study was conducted in 6 hospitals in Italy and a 69.1% decrease in the frequency of maxillofacial fractures was observed. The number of foreign patients presenting during this period decreased, while there was an elevation in the mean age of attending patients. Similar to our study, the number of fractures caused due to motor vehicle accidents or falls significantly reduced during the lockdown period[8].

A comparative study by Prakash et al. evaluated the effect of COVID-19-related restrictions on cases presenting for maxillofacial trauma, in an Indian population[20]. Patients were subcategorized based on fracture etiology. Similar to our study, they also noted a significant decrease in the mean age of attending patients after the restrictions were placed and a lower incidence rate of maxillofacial fractures during this period. The frequency rate of maxillofacial fractures due to road traffic accidents and self-falls decreased; whereas there was a significant increase in the number of patients with fractures caused by interpersonal violence. This was attributed to how COVID-19 restrictions impinged on citizens' mental health and induced psychological stress and violence[20, 24].

In Iran, after lockdowns were introduced to contain the spread of the COVID-19 virus, a significant decline in maxillofacial surgery activity was observed on a national scale. The number of patients, who underwent surgery for maxillofacial fracture, was significantly less during the lockdown era compared to the same time during the two previous years. This also indicates a nationwide decline in maxillofacial surgery activity. The authors also hypothesize that this decline may be due to patients' fear of being infected in a hospital setting, which caused them to be reluctant in seeking care even if in desperate need, which was in line with De Boutray et al. study[22]. However, this decrease in trauma frequency was also explained by physical distancing measures and changes in social contact patterns[13, 19, 25, 26].

Iran faced major economic fallouts after the coronavirus outbreak and this caused significant hardships, such as financial constraints and unemployment for citizens[13, 25, 29]. Rates of mental health issues and domestic violence are higher in times of financial vulnerability[19]. The imposed sanctions against Iran also contributed to these economic downturns[13, 25, 29]. This might explain the rise in the number of fractures due to assaults and domestic violence.

The most drastic decrease in patient presentation was seen in 50-59-year old individuals. This may be rationalized by the high infection to fatality ratio in this age group[10, 11]. These patients were also more likely to experience greater morbidity and develop severe symptoms[7, 10, 11]. We supposed that these patients would be extremely afraid of even leaving their homes and thus less susceptible to physical injury, including maxillofacial trauma. Due to the mentioned reasons, these elderly individuals were also among the priority groups for COVID-19 vaccination in Iran[13]. Social distancing policies were implemented as a non-pharmaceutical intervention in aims of reducing frequency and transmission of respiratory diseases such as SARS-Cov2 infection[4, 8, 22]. The coronavirus outbreak prompted various government responses around the world, which very much interfered with peoples' livelihood[4, 8, 22, 23]. Recent studies report that the costs associated with the COVID-19 pandemic have severely aggravated global economic growth[25, 30, 31]. Perceiving how these alterations and countermeasures impact maxillofacial trauma epidemiology can aid in decision making for human and material resource reallocation[25, 30, 31].

Maxillofacial fractures were principally caused by domestic violence, assault, road traffic accidents, and falls[1-3, 6, 7]. Previous studies also present road traffic accidents to be the most common cause of maxillofacial trauma in Iran[10, 11]. The present study recognized motorbike collision to be the number-one cause of maxillofacial fractures, followed by road traffic accidents. Negligent driving, exceeding speed limits and failure to wear a safety belt or helmet are all contributing factors to the high incidence of motor-vehicle-accidents (MVA) in Iran[2, 10, 11]. Most national and some international studies corroborate this finding[2, 10, 11]. The literature also attests that MVA is considered the main etiology of facial fractures in developing countries such as Iran[2, 3, 7, 10, 11]. On the other hand, in developed countries predominance of interpersonal violence is evident[2, 3, 7, 10, 11]. This etiologic variation is probably due to the difference

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in traffic safety and driving laws in developed and developing countries[10, 11]. After social distancing and traveling restrictions were implemented, the frequency of MVA-related injuries consequently decreased in Iran, which was consistent to other articles[4, 8, 20, 22].

The present study revealed a higher proportion of injuries caused by interpersonal violence after social distancing policies were in effect. The increase in domestic and gender-based violence incidents after the imposition of lockdown orders may be related to the family stress and psychological impact of long-time quarantine[13, 19]. The national statistics regarding suicide attempts, domestic and intimate partner violence during lockdowns, are alarming and constitute a significant concern for the whole society; especially those engaged in the psychological field of practice[13, 19].

CONCLUSION

Amid the COVID-19 pandemic, social distancing restrictions had a significant impact on the etiology and epidemiology of maxillofacial fractures in Iran. We believe that the findings of this study can contribute to policies for judicious allocation of scarce medical resources in the time of a global crisis such as COVID-19 and can help develop preventive strategies for such injuries.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interests.

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