

## Pattern of maxillofacial fractures in a Tertiary Referral Centre in Central Kerala - A comparison between the Pre-COVID and COVID periods

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### ABSTRACT

Our aim was to observe if there was any appreciable difference in the etiology and pattern of maxillofacial fractures during the pre-COVID-19 and COVID-19 periods in Central Kerala, South India. This retrospective study was conducted with data over a period of two years from the central database registry of our hospital. Age, sex, etiology, date of injury, and site of facial fractures were recorded and compared between both the time periods. Increase in facial fractures due to fall at home ( $p$  value < 0.01) and decrease in mass casualty cases ( $p$  value < 0.01) were observed during the COVID-19 period. Pedestrians involved were significantly more in the pre-COVID-19 period ( $p$  value < 0.01) and heavy vehicle accidents producing facial fractures were significantly more in the COVID-19 period ( $p$  value < 0.01). Frontal bone ( $p$  value = 0.008), nasal bone ( $p$  value < 0.001) and zygomatico-maxillary complex fractures ( $p$  value < 0.001) occurred significantly more in the COVID-19 time period whereas naso-orbito-ethmoidal ( $p$  value = 0.003), mandibular ( $p$  value = 0.011) and dentoalveolar fractures ( $p$  value < 0.001) were seen significantly more in the pre-COVID-19 period. There was decrease in the total number of maxillofacial cases during the COVID-19 period. However, this was not significant when only the number of facial fractures were compared between the two periods. This study provided an insight on the differences in etiology and pattern of maxillofacial fractures during the pre-COVID-19 and COVID-19 periods. Road traffic accidents involving two wheelers predominate during the COVID-19 period also, prompting further critical exploration of the reasons behind this finding.

### 1. Introduction

The COVID-19 pandemic has ineluctably affected the Health care system worldwide over the past couple of years. The first case of COVID-19 in Kerala, South India, was reported on the 30th of January 2020.<sup>1</sup> Henceforth, there were restrictions, period of complete lock down, followed by restrictions of varying degrees, which continue till date. This has considerably affected the lifestyle,<sup>2</sup> mobility and travel patterns of the population, which might have caused alterations in the pattern of trauma as well. Because of the fear of COVID-19 disease contraction and the strict rules imposed, movement of vehicles drastically reduced, effectuating decrease in the number of patients with maxillofacial injuries reporting to the Emergency Department (ED) of our Hospital. However, the cases almost returned to their previous numbers once the restrictions eased out subsequently towards the end of our study period. Study by Vishal et al. observed a massive drop in the number of maxillofacial trauma cases due to decrease in vehicular movements

during the lockdown days.<sup>3</sup>

These observations prompted us to evaluate if there was any appreciable difference in the pattern and etiology of maxillofacial fractures during the pre-COVID-19 and COVID-19 periods at our Tertiary Referral Centre in Central Kerala, which usually receives a high number of cases. An understanding of this will help us to identify the difference in etiological factors if any, and help us formulate preventive measures in a better way. The objective of our study was to interpret and compare the proportion of maxillofacial fractures among the overall cases reporting to ED during the study period. As COVID-19 and its effect on human life was never experienced before, there is no similar comparative study from our region to the best of our knowledge.

### 2. Materials and methods

Our present study was conducted at the Department of Oral and Maxillofacial Surgery, Government Medical College and Hospital,

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Kottayam, Kerala. Institutional Ethical clearance was obtained from our Institutional Review Board. This was a retrospective study with data of patients with maxillofacial fractures reporting to the Emergency Department between February 1, 2019 and January 31, 2021, retrieved from the central database registry of the Hospital.

The two groups that were analyzed for comparison were, Group 1: Cases with facial bone fractures reporting to ED during the pre-COVID-19 period, from February 1, 2019 to January 31, 2020 for a duration of one year and Group 2: Cases with facial bone fractures reporting to ED during the COVID-19 period, from February 1, 2020 to January 31, 2021 for a duration of one year.

Patients with clinico-radiographic diagnosis of maxillofacial bony injuries of both the sexes and all age groups were included in the study, whereas those with incomplete data in the registry were excluded. The following variables were recorded for each patient: age, sex, etiology, date of injury, and site of facial fractures. Age was divided into each decade, etiology grouped under Road Traffic Accident (RTA), mass casualty, assault, occupational hazard, fall from height, fall at home and sports injuries. Facial fractures were divided into sub units as, frontal, nasal, Naso-Orbito-Ethmoidal (NOE), Zygomatico-Maxillary-Complex (ZMC), isolated zygomatic arch, maxilla, mandible, condylar, dentoalveolar and primary tooth fractures. Patients with only maxillofacial soft tissue injuries were excluded from this study.

Data were entered in Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS version 21.0, IBM, Chicago, IL). Data were presented in percentages as the variables were categorical. Chi-square test was done to find out the association between categorical variables and a  $p$  value of  $\leq 0.05$  was considered statistically significant.

### 3. Results

A total of 2600 cases fulfilled our inclusion criteria with frequency of 1691 in the Pre-COVID-19 and 909 during the COVID period. A significant number of maxillofacial fracture cases were males ( $n = 2127$ ) accounting for 81.8% of the study population totally.

#### 3.1. Demography

The age of patients reporting with maxillofacial fractures varied from 10 months to 98 years. Most maxillofacial fractures occurred in the third decade in both the groups. There was no statistical difference on comparison between the two groups with respect to age ( $p$  value = 0.061). Though the number of males with facial fractures reporting to ED was much higher than the females in our study period, on comparing their proportions, there was no statistical difference between them in the pre-COVID-19 and COVID-19 periods ( $p$  value = 0.720).

#### 3.2. Etiology

RTA was the most common etiology in both the pre-COVID-19 and COVID-19 periods. In group 1, males (68.3%) had significantly higher occurrence of facial fractures due to RTA than females (48.6%) whereas females (9%) had significantly higher occurrence of facial fractures in a mass casualty than males (2.5%). In the same group, facial fractures due to fall at home was seen to be significantly higher among females (20.6%) than males (7%). Rest of the etiology of facial fractures were found to be non-significant between males and females in group 1. Comparison of etiology of facial fractures in the COVID-19 period between males and females showed significantly higher occurrence of facial bone fractures in males (70.1%) due to RTA than females (53.1%) whereas the facial fractures produced by fall at home were significantly higher for females (30.9%) than males (14.9%) in Group 2. Except for the increased incidence of mass casualty in the pre-COVID-19 ( $p$  value  $< 0.01$ ) and falls at home in the covid-19 period ( $p$  value  $< 0.01$ ), rest of them were statistically non-significant on comparison as shown in Table 1.

**Table 1**

Comparison between group 1 and group 2 with respect to etiology of facial bone fractures.

Etiology	Group 1		Group 2	
	Frequency	Percentage	Frequency	Percentage
RTA	1093	64.6	610	67.1
Mass casualty	62	3.7	3	0.3
Assault	198	11.7	72	7.9
Occupational hazard	40	2.4	18	2.0
Fall from height	64	3.8	22	2.4
Sports injury	73	4.3	23	2.5
Fall at home	161	9.5	161	17.8
Total	1691	100.0	909	100.0

Among the patients with facial fractures due to RTAs, two wheelers were the most common vehicles involved in both the group 1 and group 2. However, the occurrence of facial fractures in pedestrians were significantly higher ( $p$  value  $< 0.01$ ) in group 1 than in group 2 and facial fractures due to heavy vehicle RTA surprisingly higher ( $p$  value  $< 0.01$ ) in group 2 than group 1. As shown in Table 2, rest of the variables compared between the two groups were not statistically significant.

#### 3.3. Pattern of fractures

Dentoalveolar fractures were the most common fractures in both the groups. Frontal bone fractures were significantly higher in males (12.8%) than females (5.5%) whereas dentoalveolar and primary tooth fractures were significantly higher in females (50.8%) and (1.3%) than males (38.6%) and (0.2%) respectively in group 1. Frontal and nasal bone fractures were significantly higher in males (16.5%) and (14.3%) than females (8.6%) and (3.1%) respectively whereas primary tooth fractures were significantly higher in females (2.5%) than males (0.1%) in group 2. A significant difference was found between group 1 and 2 with respect to frontal bone ( $p$  value = 0.008), nasal bone ( $p$  value  $< 0.001$ ), and ZMC fractures ( $p$  value  $< 0.001$ ) occurring more during the COVID-19 period whereas NOE ( $p$  value = 0.003), mandibular ( $p$  value = 0.011), and dentoalveolar fractures ( $p$  value  $< 0.001$ ) occurred more during the pre-COVID-19 period as shown in Table 3.

As seen in Graph 1, the proportion of total maxillofacial cases including those with and without bony fractures ( $n = 8910$  in the pre-COVID-19 and  $n = 5121$  in the COVID-19 period) among the overall cases reporting to ED ( $n = 151402$  in the pre-COVID-19 and  $n = 96636$  in the COVID-19 period) was found to be significant ( $p$  value  $< 0.001$ ) between group 1 and group 2. However, the proportion of facial bone fracture cases ( $n = 1691$  in the pre-COVID-19 and  $n = 909$  in the COVID-19 period) among the total maxillofacial cases with both hard and soft tissue injuries, reporting to ED ( $n = 7219$  in the pre-COVID-19 and  $n = 4212$  in the COVID-19 period) was not statistically significant ( $p$  value = 0.071), as shown in Graph 2.

### 4. Discussion

The COVID-19 pandemic is a never-before-experienced disaster that produced a huge burden to the healthcare and economy of all the affected countries. As the mankind was not prepared to face such a

**Table 2**

Comparison between group 1 and group 2 with respect to type of RTA.

Type of RTA	Group 1		Group 2	
	Frequency	Percentage	Frequency	Percentage
Pedestrian	169	15.5	51	8.4
Bike	710	65.1	375	61.9
Car	193	17.7	123	20.3
Heavy vehicle	19	1.7	57	9.4
Total	1091	100.0	606	100.0

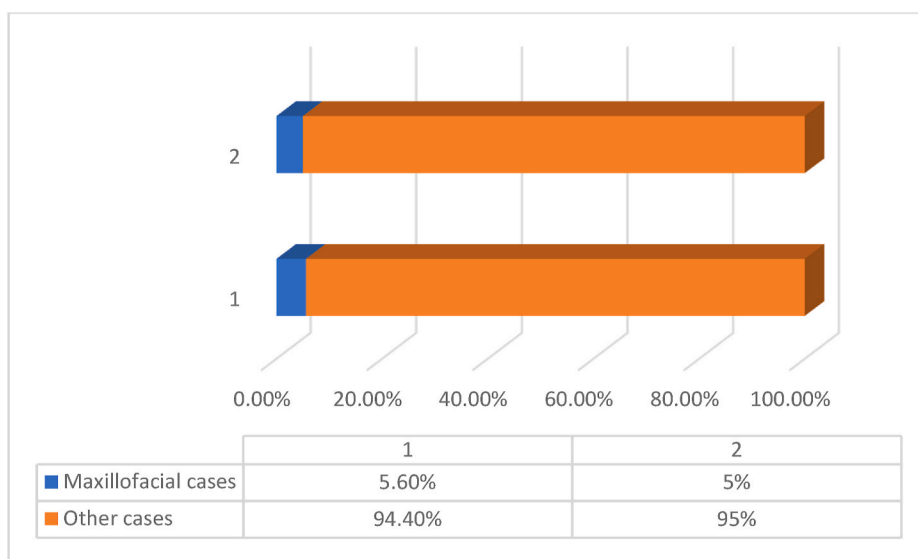
**Table 3**  
Comparison between group 1 and group 2 with respect to pattern of facial fractures.

Fractures	Group 1		Group 2	
	Frequency	Percentage	Frequency	Percentage
Frontal bone	193	11.4%	137	15.1%
Nasal bone	135	8.0%	112	12.3%
NOE	93	5.5%	78	8.6%
ZMC	422	25.0%	288	31.7%
Zygomatic arch	47	2.8%	28	3.1%
Maxilla	210	12.4%	109	12.0%
Mandible	229	13.5%	92	10.1%
Condyle	131	7.7%	64	7.0%
Dentoalveolar	691	40.9%	301	33.1%
Primary tooth	7	0.4%	5	0.6%

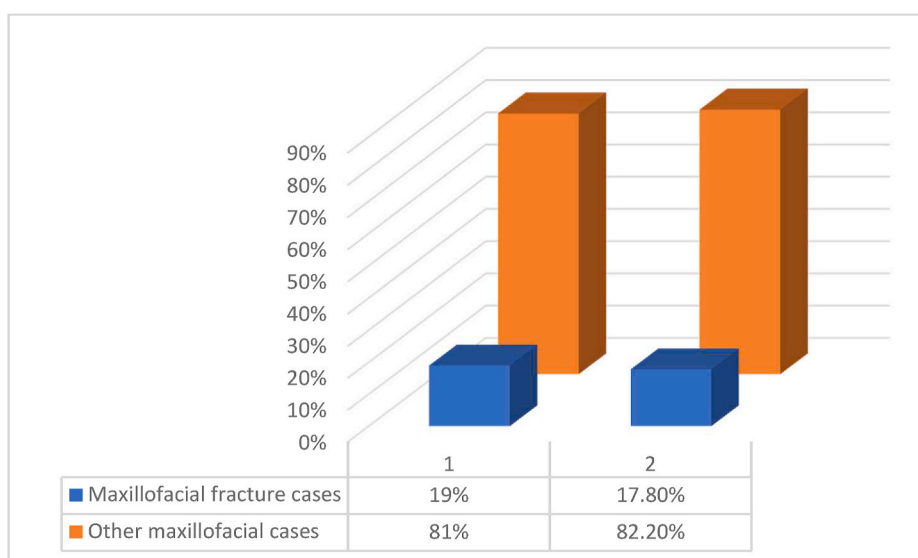
threat, the initial steps to defend the virus were aimed at the prevention of its transmission.<sup>4</sup> Owing to the whirlwind transmission of the deadly virus, the Indian Government based on the hint of other affected

countries, imposed a nation-wide lockdown.<sup>5</sup> Various guidelines for treating the disease and preventing its spread were put forward by several institutions and organizations in their genuine attempts to curb the spread of disease.<sup>4</sup> Although vaccines were developed by the end of our study period, the Indian Government proposed to vaccinate the Healthcare Workers (HCW) initially, followed by senior civilians.<sup>6</sup> The nation-wide lockdown, physical distancing and strict norms played a crucial role in cutting lines of viral transmission,<sup>7</sup> not forgetting its impact on the Indian economy.

Our Hospital which is a Tertiary Referral Centre in Central Kerala, South India, receives a huge number of cases at the ED as primary and referral from nearby hospitals and surrounding districts. Limitation of unnecessary travel, unavailability of public transport and curbing of interstate transport reduced the RTA drastically, reflected by the sharp decrease in the overall number of cases reporting to our ED. The total number of maxillofacial cases visiting the Oral and Maxillofacial Surgery (OMFS) casualty reduced drastically during the lockdown period. We also noticed a changing trend in the number, etiology and pattern of maxillofacial trauma cases, which motivated us to undertake this study.



**Graph 1.** Comparison between group 1 and group 2 with respect to maxillofacial injury cases among overall casualty cases in the ED.



**Graph 2.** Comparison between group 1 and group 2 with respect to maxillofacial bone fractures among overall maxillofacial injury cases in the ED.

On comparing the overall cases and maxillofacial cases reported during the pre-COVID-19 and COVID-19 periods, there was a significant decrease in maxillofacial cases with or without facial fractures. However, this was not significant when only the facial fractures among the total maxillofacial cases reporting to OMFS casualty were compared.

Facial fractures were barely reported during the initial strict lockdown stages. However, as the restrictions eased out by late 2020, the numbers gradually raised attaining their original intensity. The maximum and minimum number of maxillofacial fracture cases reporting per day in group 1 was 16 and 2 respectively with a mean of 5 cases per day whereas the maximum and minimum number of maxillofacial fracture cases reporting per day in group 2 was 11 and 0 respectively with a mean of 2 cases per day. The overall number of cases that reported in an inebriated state also decreased drastically due to the restricted alcohol availability during the lockdown period. This decrease in number of cases is comparable to the study on impact of the COVID-19 pandemic on emergency traumatology service by Nunez et al.<sup>8</sup>

From our study, although males were more commonly affected with facial fractures than females within each time period, there was no significant difference on comparing them between the two time periods. The young adult age group (third decade) were the most common ones affected by maxillofacial fractures. However, there was no statistical difference on comparison between the two groups with respect to age also. The statistically significant findings in our study on comparing etiology of facial fractures during the two time periods were, increase in facial fractures due to fall at home among women and children and decrease in mass casualty during the COVID-19 period. This could be explained by the increased amount of time spent at home and playing at home with children and parents during the lockdown period. Rest of the etiologies did not have any significant effect on comparing both the time periods. This result is in contrast to the observation by Vishal et al., affirming a significant increase in maxillofacial fractures produced by assault during the COVID-19 period attributed to the depression and anxiety affecting the mental health, increasing aggression and irritability of affected people.<sup>3</sup>

Similar to the study by Agarwal et al.,<sup>9</sup> RTAs still remain the major cause for facial fractures most commonly seen in young men driving two wheelers. Pedestrians were involved in RTAs significantly more often in pre-COVID-19 period and heavy vehicle accidents producing facial fractures were significantly more often seen in COVID-19 period. This can be assumed to be due to the increased speed of heavy vehicles in vehicle-less free roads during the COVID-19 period. Frontal bone, nasal bone and ZMC fractures occurred significantly more in the COVID-19 time period whereas NOE, mandibular and dentoalveolar fractures were seen significantly more in the pre-COVID-19 period. Strictly speaking, the true effects of COVID-19 on maxillofacial surgery can be studied only when the time period is limited to period of lockdown when the cases were scarce and facial fractures seldom reported. On the other hand, our study does not aim to compare the impact of COVID-19 on facial trauma but to analyse and compare the etiology and pattern of facial fractures in both the pre-COVID-19 and COVID-19 time periods. Therefore, the equal time frame of one year each for two groups were included in this study.

## 5. Conclusion

The unprecedented COVID-19 has resulted in unforeseen

disturbances in human life worldwide. Nature and etiology of trauma is expected to be altered due to the changes in the mobility of individuals in the society. There was a drastic decrease in the aggregate of facial trauma cases during the COVID-19 pandemic period. However, our study did not show any significant difference on comparing the two groups with respect to age and sex. Facial fractures due to fall at home were seen significantly more during the COVID-19 period and mass casualties were significant in the pre-COVID-19 period. Road traffic accidents involving two wheelers predominate during the COVID-19 period also, prompting further critical exploration of the reasons behind this finding.

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## Ethical approval

Institutional Ethical Clearance was obtained from the Institutional Review Board.

## Declaration of competing interest

All the authors associated with present manuscript declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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