**How to Cite:**
Fabi, B. A. J., Kumar, A. P., Vennila, M., Solomon, V., Abijah, R., & Jhansirani, C. (2021). Prevalence, pattern and etiology of maxillofacial injury in chengalpattu India: A retrospective study. *International Journal of Health Sciences*, *6*(7), 114–126. https://doi.org/10.53730/ijhs.v6n7.10747

# Prevalence, pattern and etiology of maxillofacial injury in chengalpattu India: A retrospective study

**Dr. B.Anselm Justhius Fabi**
Senior Assistant Professor, Department of Dental Surgery, Chengalpattu Medical college and hospital, Chengalpattu

**Dr. A.Pravin Kumar***
Senior Assistant Professor, Department of Dental Surgery, Chengalpattu Medical college and hospital, Chengalpattu
*Corresponding Author

**Dr. M.Vennila**
Postgraduate, Department of Forensic medicine Adhiparasakthi institute of medical sciences & research, Melmaruvathur

**Dr. Vashni Solomon**
Senior trainee, Department of Dental Surgery, Chengalpattu Medical college and hospital, Chengalpattu

**Dr. R.Abijah**
Senior trainee, Department of Dental Surgery, Chengalpattu Medical college and hospital, Chengalpattu

**Dr. C.Jhansirani**
Senior trainee, Department of Dental Surgery, Chengalpattu Medical college and hospital, Chengalpattu

***Abstract*---**Introduction: Maxillofacial injures are affected by population, social and financial conditions. Increased and up-to-date knowledge about maxillofacial trauma may aid in the implementation of preventive strategies to reduce maxillofacial trauma. Aim: The objective of this research was to evaluate the prevalence, pattern, and etiology of maxillofacial trauma in patients treated at Chengalpattu Medical College and Hospital. Materials and methods: This retrospective study was conducted in the Department of Dental Surgery. Information on age and gender, etiology and mechanisms of trauma and facial bone fractures have been collected and analysed retrospectively to determine the prevalence, pattern and etiology of

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
*Manuscript submitted: 9 September 2020, Manuscript revised: 18 December 2020, Accepted for publication: 27 January 2021*

maxillofacial trauma. Results: This study included a total of 854 maxillofacial trauma patients. 90.3 percent of the overall trauma was attributed to maxillofacial fractures. There is a statistically significant association between gender and the etiology of study subjects with maxillofacial trauma. Fractures of the mandible (42.6 %) were significantly more frequent than malar and maxillary bone fractures (35.7%). Conclusions: It can be concluded that maxillofacial injuries occur mainly as a result of road traffic accidents with male predominance and that there is a significant association between gender and mechanisms of trauma in the prevalence of maxillofacial trauma.

***Keywords*---**Fractures, Injuries, Mandible, Maxillofacial, Road traffic accident, Zygomatic.

## Introduction

Maxillofacial injuries are one of the most serious health complications and account for up to 8.4% of all medical emergencies in the world. 93% of the world's road fatalities occur in low and middle-income countries, according to the World Health Organization (WHO)(Peden, Margie; Scurfield, Richard; Sleet, 2004) . Industrial development and rapid population growth have altered people's lifestyles and activities, leading to an increase in trauma rates, particularly maxillofacial fractures, due to the specific anatomical characteristics of the maxillofacial region. (Dongas & Hall, 2002; Zix et al., 2011) The occurrence and nature of maxillofacial injuries vary around the world based on existing geographic, social, cultural, and environmental factors, and therefore differ by population.(Kieser et al., 2002; Motamedi et al., 2014; Torgersen & Tornes, 1992) In recent decades, maxillofacial injuries have increased significantly. Although males are more prone to maxillofacial injuries, there is a widespread misconception among females that full-face helmets are only for men. A woman who presents with maxillofacial fractures is 4.5 times more likely to be a victim of domestic violence than a woman with trauma limited to other locations.(Devakumari et al., 2021) Subhasraj et al. (Subhashraj et al., 2007) reported in 2007 that people believe myths such as wearing helmets causes hair loss, not realising that it could cost them their lives. Since maxillofacial trauma is rarely life-threatening on its own, surgeons tend to focus on other regions of the body. However, it is frequently related to vital organs like the brain, cervical vertebral fractures, and airway obstruction, all of which can result in loss of function or even death. The face, as the basic foundation of an individual's identification, plays a critical role in social approach-reception and appreciation, and thus victims of maxillofacial trauma are affected physically, psychosocially, and cosmetically, having a significant impact on personal relationships, employment opportunities, and also in integrating back into society(Gurung et al., 2020), indicating the importance of periodic verification of the demography, etiology, and prevalence of maxillofacial injuries. The findings can be used to address and prevent morbidity and mortality, as well as aid in the implementation of preventive strategies to reduce maxillofacial trauma. A variety of studies have been performed in different communities in various parts of India on the epidemiology of maxillofacial trauma.(Bajwa et al., 2012; Chandra Shekar &

Reddy, 2008; Kamath et al., 2012; Kapoor & Kalra, 2012; Lone et al., 2014; Sawhney & Ahuja, 1988; Singaram et al., 2016) There is limited evidence, however, on the epidemiology of maxillofacial injuries in the district of Chengalpattu, Tamilnadu. Therefore, the purpose of this research was to assess the prevalence, pattern, and etiology of maxillofacial trauma, in patients who visited Chengalpattu Medical College (CMC), Chengalpattu District, Tamilnadu.

**Method**

This retrospective study was conducted in the Department of Dental Surgery. The period for which the data was collected was from February 2017 to September 2019 and the duration of this study was six months from October 2019. Ethical clearance was obtained from the institutional review board.

Inclusion criteria:
All patients with maxillofacial trauma.
A computed tomography report is attached to the patient's record.
Patients residing in Chengalpattu.

Exclusion criteria:
Patients records with incomplete information
Records without final diagnosis and radiographic confirmation were excluded.

The sample size was calculated using the formula
Sample size $n$=[DEFF*Np(1-p)]/[$(d^2/Z^2_{1-\alpha/2}$*(N-1)+p*(1-p)]
and a sample size of 854 has arrived at the confidence level of 99.9% with a hypothesized % frequency at 18.5+/- 5.

Information on age and gender, etiology, mechanisms of trauma and facial bone fractures was collected and analysed retrospectively. Data were collected by qualified personnel, and investigators ensured the confidentiality of patient data. The etiology has been categorized as a road accident, assault, self-fall, and industrial accident. Fractures were graded and evaluated following the International Classification of Diseases(Singaram et al., 2016) ICD-10 version 2019 S02.3, orbital floor fracture S02.4, malar, and maxillary bone fracture (zygomatic complex fracture) S02.6, mandibular fracture; and S02.2, fracture of the nasal bone.

Statistical analysis
Descriptive analysis and Pearson's chi-square test were done to study the prevalence and pattern of maxillofacial trauma. All data entries and statistical studies were completed through SPSS v.25 (SPSS Inc., USA).

**Results and Discussion**

This study included a total of 854 maxillofacial trauma patients. The gender distribution of the study population of 854 patients: 704 (82.4%) patients were males and 150 (17.6%) patients were females, with a ratio of 4.7 to 1. (Fig-1) and (Table 1). The mean age of the group studied was 35.17 ± 12.94 years, the minimum age is 7 years and the maximum age is 85 years. 90.3% (771) of the

overall trauma was attributed to maxillofacial fractures. The prevalence of fractures was significantly higher among males than females, with a ratio of 8.3:1 (Fig-1) and a maximum of maxillofacial trauma among males aged 20 to 39 years and females aged 30 to 49 years (Table 1). In terms of etiology, 75.2% (642) of the maxillofacial trauma were due to the road traffic accident followed by self-fall and assault (Table 1). There is a statistically significant correlation between gender and etiology of study subjects with maxillofacial trauma ($P<0.05$) (Table 2). Fractures of the mandible 42.6% (364) were significantly higher ($P<0.05$) than fractures of the malar and maxillary bones, which were 35.7% (305) (Table 3). Parasymphysis fractures 16.3% (139), followed by condylar fractures 10.8% (92), were more prevalent among mandible fractures (Table 3).

Maxillofacial injuries are affected by population, social, and financial conditions. Chengalpattu Medical College Hospital is very close to the National Highway and there are many nearby villages where labour and agriculture are the main sources of income and they rely primarily on government buses and two-wheelers for transportation. In this study, males (82.4%) were primarily affected compared to females (17.6%) which is consistent with other reports. From the table 4, it is evident that males are predominantly affected in all the 25 studies. Similarly, a study was done by Patiguli Wusiman et al(Wusiman et al., 2020) in China in the year 2020 gave an insight into why young adult males are more prone to maxillofacial injury. The reasons stated were (i) men indulge more in physical activities than women. (ii) males participate in a greater number of social activities. (iii) males are considered as the main labour force. These scenarios are similar to India. The ratio between males and females was 4.7:1, corresponding to most studies ranging from 2.3:1(Bamjee et al., 1996) to 11.8:1.(Iida et al., 2001) Males are at higher risk due to their participation in high-risk activities and substance abuse. Adults between the ages of 20 and 39 years were most affected (59.4%), which was similar to the results of various studies. (Chrcanovic et al., 2012; Subhashraj et al., 2007)Assaults, motor vehicle crashes, self-fall, and sports injuries are the main causes of maxillofacial fractures worldwide.(Qudah & Bataineh, 2002) Our research indicated that the major reasons for maxillofacial trauma are road traffic accidents (75.18 %), similar to what was found in other studies that claimed that in developing regions, road traffic accidents were the key cause of maxillofacial fractures.(Chrcanovic et al., 2012; Iida et al., 2001) Out of the 25 studies in the table 4 twenty four studies reports, RTA is the common cause of injury. In addition, it was found that all the age groups mentioned in the table are more prone to RTA. This result is similar to the findings of this current study. The most common fracture site in this current study (42.6%) was the mandible, followed by the midface since the mandible is more vulnerable than the zygomaticomaxillary complex because the mandible is a movable part and has less bone protection than the maxilla.(DMD et al., 2004) 5 studies (Bali et al., 2013; Gali et al., 2015; Kaura et al., 2018; Kumar et al., 2015; Singh et al., 2012) from table 4 shows that people in the age group between 18 to 40 years are more prone to mandibular fracture alone. The parasymphysis fracture (16.3 %) was the most prevalent site in the mandibular fractures, followed by the condyle region (10.8 %), which is similar to other studies.(Cossio et al., 1994; Kotecha et al., 2008) On the other hand, Zhou HH et al (Zhou et al., 2019) reported that condylar fracture was the highest. Lekven N et al (Lekven et al., 2011) found that change in fracture pattern is because of different behavioural patterns and also depends on

the anatomical development of the condyle. From the table 4 it is evident that 18 studies (Abhinav et al., 2019; Agarwal et al., 2017; Gadre et al., 2013; Guruprasad et al., 2014; Kalathil et al., 2021; Kamath et al., 2012; Kanala et al., 2021; Kapoor & Kalra, 2012; Kar & Mahavoi, 2012; Kaul et al., 2014; Lone et al., 2014; Niazi et al., 2020; Rajendra et al., 2009; Rajput & Bariar, 2013; Sawhney & Ahuja, 1988; Singaram et al., 2016)reports incidence of mandibular fractures along with other fractures like zygomaticomaxillary complex fractures, nasal bone fractures etc. In this study, in the mid-facial area, fractures of the maxillary zygomatic complex (35.7%) were the most common site of the fracture and this correlates to that reported by Hussain et al. at 20%. (Hussain et al., 1994)

The second most common cause of fracture in this study was due to fall. Liu FC et al(Liu et al., 2019) reported that fracture increases significantly with an increase in age. The third most common cause of injury in this study was assault, which contributed to 12.2% and was highest in the age group between 30 to 39 years. Lee KH (Lee, 2009) reported that interpersonal violence is mostly reported in metropolitan areas. As the Chengalpattu district has both urban and rural areas, it could be a possible reason that this study has assault as the third most common cause of injury when compared to table 4 where only one study [13] reported interpersonal assault.

From this study, we infer that maxillofacial injuries occur mainly as a result of road traffic accidents with a male predominance and that there is a significant correlation between age, gender, and mechanisms of trauma in the prevalence of maxillofacial trauma. The findings of this study emphasize the significance of road accidents in this part of India. Certain criteria must be fulfilled to reduce the rate of maxillary facial injuries, such as public knowledge of road traffic accidents, awareness of road traffic laws and regulations, the constitutional banning of driving while intoxicated, the banning of the use of smartphones when driving, and the enforcement of the use of protective gear while driving

Limitations

This is a retrospective study based on the department's trauma register, and errors can occur due to insufficient information and incomplete data. Furthermore, because all collected data is dependent on the accuracy of the initial examination and documentation, the study is compromised and limited when items are excluded from the initial examination or are not documented.

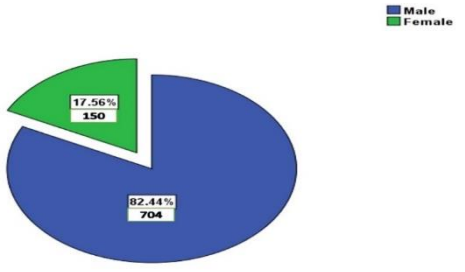

Figure 1. Pie chart showing study subjects according to gender.

Table 1
Prevalence of maxillofacial trauma

| Age (yr.) | Number of Patients | Gender distribution | | Etiology | | | |
|---|---|---|---|---|---|---|---|
| | | Male | Female | RTA | Fall | Assault | Industrial |
| </=12 | 14(1.6%) | 12 | 2 | 11 | 2 | 1 | 0 |
| 13-19 | 55(6.4%) | 45 | 10 | 46 | 8 | 1 | 0 |
| 20-29 | 251(29.4%) | 225 | 26 | 196 | 26 | 29 | 0 |
| 30-39 | 256(30%) | 218 | 38 | 188 | 35 | 33 | 0 |
| 40-49 | 159(18.6%) | 120 | 39 | 120 | 22 | 17 | 0 |
| 50-59 | 79(9.3%) | 57 | 22 | 53 | 8 | 17 | 1 |
| >/=60 | 40(4.7%) | 27 | 13 | 28 | 6 | 6 | 0 |
| Total | 854(100%) | 704 | 150 | 642 | 107 | 104 | 1 |
| Percentage | | 82.4 | 17.6 | 75.2 | 12.5 | 12.2 | 0.1 |

Table 2.
Cross tabulation showing the gender-wise etiology of maxillofacial trauma in the study subjects.

| Gender | Etiology | | | | Total |
|---|---|---|---|---|---|
| | RTA | Fall | Assault | Industrial | |
| Male | 544 | 87 | 72 | 1 | 704 |
| Female | 98 | 20 | 32 | 0 | 150 |
| Total | 642 | 107 | 104 | 1 | 854 |

Table 3
Pattern of maxillofacial trauma

| Age (yr.) | Pattern of fracture | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | S02.2 nasal | S02.3 orbital | S02.4 zygomatic complex | S02.6 Mandible | | | | | | | |
| | | | | Symphysis | Para symphysis | Body | Angle | Ramus | Coronoid | condyle | total |
| </=12 | 1 | 0 | 1 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 5 |
| 13-19 | 4 | 1 | 14 | 4 | 6 | 3 | 1 | 2 | 0 | 8 | 24 |
| 20-29 | 17 | 21 | 93 | 15 | 44 | 14 | 5 | 13 | 4 | 27 | 122 |
| 30-39 | 11 | 13 | 96 | 9 | 48 | 9 | 7 | 6 | 2 | 29 | 110 |
| 40-49 | 15 | 12 | 68 | 6 | 25 | 6 | 3 | 6 | 1 | 17 | 64 |
| 50-59 | 4 | 1 | 18 | 6 | 5 | 3 | 0 | 2 | 0 | 6 | 22 |
| >/=60 | 0 | 2 | 15 | 1 | 7 | 0 | 2 | 2 | 0 | 5 | 17 |
| Total | 52 | 50 | 305 | 42 | 139 | 35 | 18 | 31 | 7 | 92 | 364 |
| Percentage | 6.1 | 5.9 | 35.7 | 4.9 | 16.3 | 4.1 | 2.1 | 3.6 | 0.8 | 10.8 | 42.6 |

International Classification of Diseases (ICD)-10: S02.3, orbital floor fracture S02.4, malar, and maxillary bone fracture (zygomatic complex fracture) S02.6, mandibular fracture; and S02.2, fracture of the nasal bone.

Table 4
Table showing the prevalence and demographic data of various maxillofacial injuries in India.

| | Author & year | Place | Sample size | More common Age | Gender | Common cause | Fracture site | Type of study & Data collection period |
|---|---|---|---|---|---|---|---|---|
| | Present study | Chengalpattu | 854 | 20-39 | Male | RTA 75.2% | Mandible 42.6%<br>Zygomatic maxillary complex 35.7% | Retrospective study<br>Feb 2017 to Sep 2019 |
| 1 | Sawhney C. P et al. 1988 | Chandigarh | 262 | 16-45 (75%) | Male 79.3% | RTA 50% | Mandible 35.5%<br>Nasal bone 28% | Retrospective study<br>Jan 1982 - Dec 1983 |
| 2 | Chandra Shekar BR et al. 2008 | Mysore | 546 | 11-40 years (78.3%) | Male 83% | RTA 61.3% | Mandible 60.4%<br>Middle third fracture 39.6% | Retrospective study<br>Jan 1998 - Dec 2002 |
| 3 | Rajendra PB et al. 2009 | Mangalore | 100 | 21-40 (79%) | Male 80% | RTA 54% | Zygoma 48%<br>Mandible 42% | Retrospective study<br>Jan 2004 - Dec 2004 |
| 4 | Gupta AK et al. 2009 | Ludhiana, Punjab | 189 | 21-40 (58.7%) | Male 72.5% | RTA 79.9% | Zygoma 57.4% | Retro<br>Feb 2007 to Jan 2008 |
| 5 | Kapoor P et al. 2012 | East Delhi | 1000 | 21-30 (60.0%) | Male 85.0% | Interpersonal assault 54%<br>RTA 40% | Mandible 63.0%<br>Midface 22.0% | Retrospective study<br>Mar 2008 -Feb 2009 |
| 6 | Bajwa SJS et al. 2012 | Patiala, Punjab | 129 | 15-40 (62.8%) | Male 83.72% | RTA 90% | Maxilla and nasal bones 51.9%<br>Mandible 39.5% | Retrospective study<br>Jul 2008 to Aug 2011 |
| 7 | Kamath RA et al. 2012 | Davangere, Karnataka | 95 | 21-30 (41.8%) | Male 74.7% | RTA 74.7% | Mandible 55.78%<br>zygomaticomaxillary complex fractures 44.2% | Retrospective study<br>Jan 2004 to Dec 2009 |
| 8 | Singh V et al. 2012 | Lucknow | 1,038 | 21-30 (37.66%) | Males 89.69% | RTA 97.10% | Mandible 47.87% | Retrospective study<br>Jun 2006 to Jun 2011 |
| 9 | Kar IB et al. 2012 | Cuttack, Odisha | 503 | 21-30 (37.4%) | Male 87.87% | RTA 80.31% | Mandible 82.1%<br>midface fractures 17.8% | Retrospective study<br>Dec 2004 to Nov 2009 |
| 10 | Bali R et al. 2013 | Yamunanagar | 740 | 21-30 (38.3%) | Male 81.08% | RTA 71.89% | Mandible 70.2% | Retrospective study<br>2003-2010 |
| 11 | Gadre KS et al. 2013 | Pune | 6,872 | 21-30 35.2% | Male 71.4% | RTA 86.4% | Mandible 51.63%<br>Middle-third fracture 40.18% | Retrospective study<br>Jul 1989 to Jun 2010 |
| 12 | Pandey S et al. 2013 | New Delhi | 1,108 | 21-30 (39.98 %) | Male 89.62 % | RTA 49.01 % | Mandible 33.57 %<br>Maxilla 31.13 % | cross-sectional study<br>Apr 2010 to Mar 2011 |
| 13 | Rajput D et al. 2013 | Aligarh | 1202 | 21-30 (32.36%) | Male 88% | RTA 56.73% | Mandible 64.6%<br>Zygoma 28.6% | Retrospective study<br>Oct 2008 - Jan 2011 |
| 14 | Kaul RP et al. 2014 | New Delhi | 542 | 31–40 (36.3%) | Male 78.9% | RTA 56.8% | Mandibular 77%<br>Middle third 23% | Retrospective study<br>Jan 2007- Jun 2010. |
| | Lone P et al. 2014 | Jammu | 787 | 21-30 (76.49%) | Male 76% | RTA 73.95% | Mandible 44.34 %<br>Mid face fracture 8.42 % | Retrospective study<br>Jan 2011 - Dec 2012 |
| 16 | Guruprasad Y et al. 2014 | Bangalore | 689 | 21-30 (42.5%) | Male 75.9% | RTA 74.3% | Mandible 50.3%<br>Maxillary 28.7% | Retrospective study<br>2006-2009 |
| 17 | Gali R et al. 2015 | Nellore, Andhra Pradesh | 638 | 18-40 (53.9%) | Male 79.4% | RTA 73.6% | Mandible 41.4% | Retrospective study<br>Jan 2008 to Dec 2014 |
| 18 | Kumar GB et al.2015 | Goa | 2,731 | 19 - 35 (56 %) | Male 86.78% | RTA 76% | Mandible 34 % | Retrospective study<br>2005 to 2010 |
| 19 | Singaram M et al. 2016 | Chennai, Tamil nadu | 267 | 20 to 40 (85.3%) | Male 74.5% | RTA 73.8% | Malar and Maxillary bone 41.9%<br>Mandibular 33.0% | Retrospective study<br>May 2014 and Nov 2015 |
| 20 | Agarwal P et al. 2017 (33) | Lucknow, Uttar Pradesh | 1,000 | 21–30 (35.5%) | Male 88.9% | RTA 64.4% | Zygomatic 45.1%<br>Mandible fractures 44.4% | Retrospective study<br>Mar 2015 to Mar 2016. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 21 | Kaura S et al. 2018 (27) | Ludhiana, Punjab | 353 | 21-30 (47%) | Male 80% | RTA 61% | Mandible 94.3% | Retrospective study 2010 to 2016 |
| 22 | Abhinav RP et al. 2019 (34) | Chennai, Tamil nadu | 944 | 20–29 (44.5%) | Male 87.5% | RTA 71% | Mandible 64% Midface 19% | Retrospective study Jan 2009 - Dec 2017. |
| 23 | Niazi TM et al. 2020 (35) | Madurai, Tamil Nadu | 136 | 11-30 (40.44%) | Male 86% | RTA 77.21% | Mandible 44.85% Maxilla 19.12%, | Retrospective study Jan 2007 to Dec 2017 |
| 24 | Kanala S et al. 2021 (36) | Vijayawada, Andhra Pradesh. | 1112 | 21–30 (41%) | Male 89% | RTA 70% | Mandible 47.2% Zygomatic complex 17.4% | Retrospective study Feb 2008 - Oct 2017 |
| 25 | Kalathil LSM et al. 2021 (37) | Malappuram, Kerala | 176 | 21–30 years (32.19%) | Males 80.14% | RTA 71.23% | Middle third fractures 47.9% Mandible 39.73 % | Observational Study Jan 2019 to Sep 2020 |

## Conclusion

- Maxillofacial injuries occur mainly as a result of road traffic accidents.
- Young males in their productive years, predominantly sustain maxillofacial injuries.
- There is a significant association between gender and mechanisms of trauma in the prevalence of maxillofacial trauma.

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