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RESEARCH ARTICLE

VARIATION OF INCIDENCE OF MAXILLOFACIAL TRAUMA DUE TO ROAD TRAFFIC ACCIDENTS DURING MONSOON AND NON-MONSOON PERIOD IN MALABAR REGION, KERALA, INDIA

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ABSTRACT

Background & Objectives: With the advent of high-speed transportation systems, the occurrence of Injury and death due to trauma is on the rise. Road traffic injuries are the eighth leading cause of death globally. The weather has been cited as a risk factor for road traffic accidents. The objective of the study is to find out the variation of incidence and severity of maxillofacial trauma caused due to road traffic accidents during the various seasons in the Northern Districts of Kerala. **Method:** Hospital records of 3233 patients who sought treatment in the Department of Oral and Maxillofacial Surgery for traumatic maxillofacial injury irrespective of the aetiology over a period of one year extending from 1st Jan 2017 to 31st Dec 2017 were assessed. The patients were identified according to the type of aetiology, season in which trauma has occurred and the severity of the trauma. **Result & Discussion:** The proportion of distribution of maxillofacial trauma seems to be similar, and in the case of RTA the daily average of number of cases were 4.51 and 5.51 cases per day ($p=0.13$) during monsoon and non-monsoon season. There severity of maxillofacial trauma cases during monsoon was greater ($p < 0.01$). Most of the victims being two-wheeler users and among the 21-30 yrs. age group. **Conclusion:** There is a definite decrease in average number of maxillofacial trauma during monsoon compared to non monsoon season, the decrease may be due to increased caution taken by the road users. Trauma during monsoon season are more severe.

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INTRODUCTION

Injuries to the face were common since time immemorial. Surveys of facial injuries have shown that the aetiology varies from one country to another and even within the same country depending on the prevailing socioeconomic, cultural and environmental factors¹. Epidemiological studies of maxillofacial trauma are very less from the Malabar region of Kerala.

Facial trauma is an important health issue because its incidence has repeatedly been shown to be associated with motor vehicle accident and assaults², both of which can be prevented. Road traffic injuries are the eighth leading cause of death globally. About 1.35 million people die in road traffic accidents and between 20 and 50 million people are injured (WHO, 2018)³. Road traffic accidents and their related injuries have become a major health problem and concerns worldwide. Road traffic crashes cost most countries 3% of their gross domestic product.³ The road traffic accidents may be caused by a variety of reasons, the effect of change of environment due to change in seasons can be a factor.

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It is logical to presume a relationship between the environmental changes during seasonal variation and the incidence of maxillofacial trauma caused by various road traffic accidents (RTA). The variation in the rate of incidence and severity of the maxillofacial trauma is of significant concern.

The objective study was to find out the variation of the number of incidents of maxillofacial trauma from RTA during monsoon and non-monsoon season and also to find out whether there is any relation between the season and the severity of the injury. *Null Hypothesis (Ho)* was set which stated that there would be no significant association between the type of seasonal variation and maxillofacial injuries in a trauma patient due to RTA.

MATERIALS AND METHODS

A retrospective study was done by taking data from the hospital records. The study population was all the patients who reported to department of Oral and Maxillofacial Surgery in Kozhikode Govt. Medical College casualty over a period of one year from 1st Jan 2017 to 31st Dec 2017. The patients are identified according to the cause of maxillofacial trauma which is RTA and is related to the season. Season timings were allotted according to the data provided by the Indian Meteorological Department. The hospital records were assessed and classified according to age, sex, a season during which injury occurred and the cause and severity of maxillofacial trauma.

The severity of the maxillofacial injury is divided into severe and not severe. An injury was said to be severe if any one of the following is present:

-) Total lacerated wound greater than 10 cm length
-) Presence of any fractures of facial bone
-) Avulsion or fracture of the tooth
-) Deranged occlusion
-) GCS < 15
-) Presence of head injury

These criteria were validated using a pilot study comprising of 100 subjects with maxillofacial injury, the data was then collected and analysed. The pilot study population was not included in the study. All the data were recorded in a pre-designed and structured proforma in the causality registers used to maintain the hospital records, from which relevant data were extracted and processed in the excel format, avoiding the personal data of the individuals.

Statistical Analysis: The variation of incidence of maxillofacial trauma due to RTA was calculated in relation to the total maxillofacial trauma cases and expressed as proportions, and the data was analysed. Data about the severity of the trauma was analysed using the chi-square test. Mann-Whitney U test was done to compare between average incidence of trauma during monsoon and non-monsoon.

Univariate analysis of factors like season, gender, age group etc with RTA was calculated with chi-square test. Binary logistic regression analysis was done to find out the adjusted odds ratio of relation between variables like season, gender, age group, etc with RTA. Statistical package SPSS version 17 for windows was used. α value will be set at 5% & β value will be set at 80%.

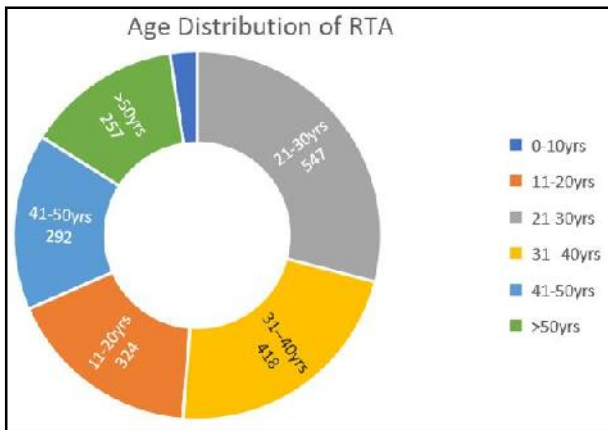
RESULTS

A total of 3233 patients were referred to the emergency department of Oral & Maxillofacial Surgery, Government Medical College, Kozhikode with maxillofacial injuries during the study period which spanned from 1st Jan 2017 to 31st Dec 2017. Out of which 1880 (58.15%) cases were due to road traffic accidents; the assault had led to 337 (10.42%) subjects with maxillofacial trauma, fall caused 805 (24.90%) maxillofacial trauma cases, and all the other cases combined that caused maxillofacial trauma accounted for 211 (6.53%) cases. The period from 1st Jan 2017 to 31st Dec 2017 was divided into seasons based on the data provided by the Indian Meteorological Department. Monsoon season commenced in the Malabar region of Kerala by 31st May 2017. The withdrawal of South-West monsoon season and commencement of North East monsoon season was around the same time, providing a continuous monsoon season till the withdrawal of the North East monsoon on 10th Oct 2017. Based on the details provided by Indian Meteorological Department, the monsoon season consisted of 132 days (36.16%) of the year, while the non-monsoon season was the rest 233 days (63.84%) (Fig 1).

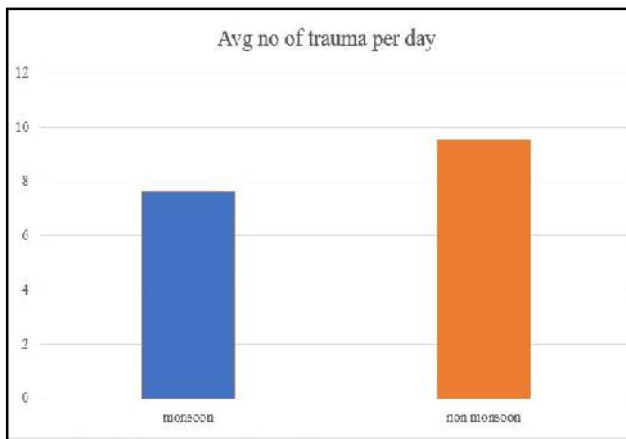
Out of the total 3233 cases that reported in the emergency department of Oral & Maxillofacial Surgery, Government Medical College, Kozhikode; 1007 cases (31.15% of the total cases) were reported during the monsoon season and the rest 2226 cases (68.85% of the total cases) reported during the non-monsoon. The average occurrence of maxillofacial trauma per day during monsoon and non-monsoon seasons were 7.62 and 9.56 respectively ($p < .01$) (Fig 2), while the annual average was 8.85 cases of maxillofacial trauma per day. The average occurrence of maxillofacial trauma due to RTA per day during monsoon and non-monsoon seasons were 4.51 and 5.51 respectively, while the annual average was 5.15 cases of maxillofacial trauma due to RTA per day. Of the 1284 RTA reported during non-monsoon period 758 (59.03%) of the cases sustained only mild injury while 526 (40.97%) sustained severe injuries. Of the 596 RTA reported during the monsoon period 300 (50.34%) of the cases sustained only mild injury while 296 (49.66%) sustained severe injuries ($p .01$). During the monsoon season, the maxillofacial trauma due to RTA was 596 of which 56 (9.40%) were pedestrians, of which 41 (73.21%) were men and 15 (26.79%) were women. Four hundred and twenty-three (70.97%) were people using 2-wheelers; of which 373 (88.18%) were men and 50 (11.82%) were women. Thirty-nine (6.54%) cases were due to RTA involving auto rickshaw of which men and women affected were 30 (76.92%) and 9 (23.08%) each respectively. Forty-seven (7.88%) and 34 (5.70%) were the numbers of cases due to RTA involving light motor vehicle (LMV) and heavy motor vehicle (HMV) respectively. During the non-monsoon season, the maxillofacial trauma due to RTA was 1284 of which 126 (9.81%) of the victims were pedestrians of which 95 (75.40%) were men and 31 (24.60%) were women. 915 (71.26%) of RTA involved people using 2-wheelers; of which 764 (83.50%) were men and 151 (16.50%) were women. Eighty-seven (6.78%) cases were due to RTA involving auto rickshaw of which men and women affected were 52 (59.77%) and 35 (40.23%) each respectively. Ninety (7.01%) and 66 (5.14%) were the numbers of cases of maxillofacial trauma reported due to RTA involving LMV and HMV respectively (Table 1)

Table 1. Relationship between season, mode of transport involved in RTA and gender

Vehicle			Gender		Total
			Male	Female	
Pedestrians	Season	Non-Monsoon	95	31	126
		Monsoon	41	15	56
	Total		136	46	182
2-Wheelers	Season	Non-Monsoon	764	151	915
		Monsoon	373	50	423
	Total		1337	201	1338
Autorickshaw	Season	Non-Monsoon	52	35	87
		Monsoon	30	9	39
	Total		82	44	126
LMV	Season	Non-Monsoon	69	21	90
		Monsoon	33	14	47
	Total		102	35	137
HMV	Season	Non-Monsoon	36	30	66
		Monsoon	24	10	34
	Total		60	40	100



Graph. Age distribution of RTA



Graph. Average number of trauma per day

Of the total 1880 cases due to RTA 1513(80.48%) of the victims were men and the rest 367 (19.52%) are women. The bulk of the cases reported with maxillofacial trauma were of age group 21 – 30 years and 31 – 40 years, they were 547 (29.04%) and 418 (22.19%) respectively. Minimum number of RTA was reported in 0 – 10 years age group which is 45 (2.3%) cases. While age group 11 – 20 years reported 324 (17.17%) cases, 41 – 50 years age group reported 292 (15.48%) cases, and age group containing subjects >50 years of age reported 257 (13.63%) cases. The age distribution was similar in both monsoon and non-monsoon season with no significant statistical difference. The maxillofacial trauma case distribution during the seasons when divided into age group below 20 years and above 20 years was statistically significant (p=.02).

The age distribution of RTA follows a similar pattern in both monsoon and non-monsoon periods, with an exception of slightly increased incidence of RTA in >50 years age group compared to 41 – 50 years age group during the non-monsoon season (Fig 3).

DISCUSSION

The occurrence of road traffic accidents and other traumas in India is rapidly increasing due to industrialization, increase in personalized modes of transport, a mixture of slow and fast-moving vehicles, lack of proper infrastructure to handle the ever-increasing number of vehicles on the road and lack of road discipline, drunken driving and use of mobile phones while driving and sudden change in the weather conditions.

The incidence of maxillofacial trauma in the present study was 3233. In comparison with a similar study conducted in Calicut by Ravindran *et al.* (2011) the number of cases of maxillofacial trauma has increased one and a half times. Similar studies also show an increase in the maxillofacial trauma Kontio *et al.* (2005) reported 27% of increase in the maxillofacial trauma by 16 years from 1981 to 1997. Fasola *et al*⁷ (2003) reported an increase in maxillofacial trauma. Buchanan *et al.* (2005) reported that maxillofacial trauma almost doubled in a period of 12 years. The rainfall over the whole of the country during the monsoon season was 95% of long-term average. Seasonal rainfall in the southern peninsula was 100% of long-term average. The forecast for the onset of monsoon for Kerala was very accurate this year, with forecast and realization of onset on 30th May. The reduction in maxillofacial trauma during the monsoon season may be attributed to the increased caution taken by the people to avoid trauma, also can be attributed to increased tendency to stay indoors. These findings come in line with many studies conducted earlier by various authors such as Bhattacharya *et al.* (2001), Friede *et al.* (2009) who also found that strong positive correlation between maximum daily temperature and trauma admissions, precipitation associated with fewer admissions, snow weakly associated with fewer admissions.

A study by Keay *et al.* (2005) found that for the all-day case on wet days, the volume is decreased by 1.04% compared with dry days. Using daytime rainfall, we see that the volume decreases by 0.149% per mm of rainfall. Karlaftis & Yannis¹² (2010) found that, contrary to much previous research, increases in rainfall reduce the total number of accidents and fatalities as well as the pedestrian accidents and fatalities, a finding that may be attributed to the safety offset hypothesis resulting from more cautious and less speedy driver behaviour. Similarly, temperature increase was found to lead to increased accidents. The time-varying effects of rainfall have also been investigated. Eisenberg (2004) found that a surprising negative and significant relationship between monthly precipitation and monthly fatal crashes is found. The incidence of RTA among the two-wheeler users in our study may be attributed to the high number of two-wheelers that are used due to affordability and providing greater mobility, which makes it a choice of transportation for the common man. Similar findings were noted in the study by Pathak *et al.* (2014) in Pune. Yannis *et al.* (2012) found two-wheelers drivers are among the most vulnerable road users encompassing an increased level of risk during critical driving situations, as a result of the nature of their traffic and their interaction with the other road users.

The increased incidence of maxillofacial trauma in this group may be due to the flaunting of the road safety instructions by the operators and riders of this means of transport such as not using the helmet or drunken driving, and the lack of infrastructure development in accordance with the increase of number of vehicles. In this study, the incidence of maxillofacial trauma due to RTA in men is 4.123 times than women. Similar results were also observed in India by a study in the same institution by Ravindran *et al.* (2011), in South India by Jha *et al.* (2004), Mehta (1968) in Delhi, Pathak *et al.* (2014) in Pune. And also internationally by Van Hout *et al.* (2013) in Netherlands, Mahmoud Al-Dajani *et al.* (2015) in Canada.

It has been reported that 80% of the victims involved in RTAs were males^{20,21}, which is consistent with the present study which found that 80.5% of victims are males. The higher incidence of men having maxillofacial trauma can be attributed to more number of men using vehicles and/ or use them more carefree than their female counterpart. However, in another study by Gosh *et al.* (1992) in Delhi, the male to female ratio was very high (9:1)²². In the present study the age group 21-30 yrs. have the greatest incidence of RTA 29.04% followed by 31-40 yrs. with 22.19% of all RTA. The similar findings were also reported from Calicut, South India, Delhi and Nepal also^{5,16,17,18}.

Gregersen and Bjurulf²³ (2006) postulated that inexperience is a more important factor than youth and is associated with increased accidents. A higher accident risk of young novice drivers compared to older experienced drivers driving with passengers was found by Vollrath *et al.* (2001) in Germany²⁴. This shows that the people of the most active and productive age group are involved in RTAs, which adds a serious economic loss to the community. Similar observations were also made by others^{25,26}. The present study showed that below and above the age of 20 and 49 years, there were fewer accidents. The reasons may be that children are taken care of by elders and restricted use of vehicles in the adolescent age group. A lower proportion of RTAs in those aged 60 and above generally could be due to their cautious nature and less use of vehicles.

Conclusion

There is variation in the incidence of maxillofacial trauma due to RTA in various seasons. The number of maxillofacial trauma due to RTA is lesser in monsoon season, but severity is more. The population most affected are the ones using two-wheelers in the 21-30 yrs. age group, with men more affected than women. By increasing the awareness of the general public about precautions, improving road infrastructure, passing legislations to improve the roadsafety and the strict implementation of these legislations can reduce the load of maxillofacial trauma, thereby reducing a lot of economic loss to both the individual and to the country.

Conflict of Interest: None

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