

The immediate impact of mandatory helmet law on maxillo-facial trauma: A comparative study in a major trauma center, Uttar Pradesh

ABSTRACT

Aim: To analyze the effect of the mandatory helmet rule in helmet usage among motorcycle riders and on facial trauma and to determine the significance of difference in the possibility of facial trauma between the helmeted and non-helmeted motorcycle riders.

Setting and Design: A retrospective comparative study conducted in a major trauma center at Uttar Pradesh.

Material and Method: Data for the present study was obtained from records of the Emergency Department of Trauma Center, for a period of two months before and after the implementation of The Motor Vehicles Act in UP. The study included patients with a history of non-fatal motorcycle accidents who sustained facial injuries regardless of the presence of injuries to other areas of the body during the study period. Information regarding helmet usage during the accident was also recorded. The results were compared between the pre-law period and post-law period.

Statistical Analysis Used: Sample *t*-test was applied to find the level of significance.

Results: Out of 219 injured patients, 152 (69.40%) subjects were not wearing helmets, whereas only 67 (30.59%) subjects were wearing helmets. It was observed that around 68.18% of people stated wearing helmets after law implementation with a statistical significance (P value < 0.05).

Conclusion: Our study shows that the mandatory helmet rule with elevated penalty rates has significantly increased the usage of helmet among the motorcycle riders, and it also proves that the possibility of facial trauma is significantly higher in non-helmeted riders when compared to helmeted riders.

Keywords: Mandatory helmet law, The Motor Vehicle Act, trauma center, Uttar Pradesh

INTRODUCTION

According to WHO in 2018, every year the lives of approximately 1.35 million people are cut short as a result of a road traffic crash. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury.^[1] Motorcyclists and pedestrians comprise the majority of road-traffic victims in low- and middle-income countries, therefore, majority of the road-traffic victims globally.^[2] The National Crime Records Bureau (NCRB) 2016 report states there were 496,762 roads, railways, and railway crossing-related traffic collisions in 2015.^[3] Of these, road collisions accounted for 464,674 collisions which caused 148,707 traffic-related deaths in India.^[3] The three highest total number of fatalities were

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reported in Uttar Pradesh, Maharashtra, and Tamil Nadu, and together they accounted for about 33% of total Indian traffic fatalities in 2015.^[3] Adjusted for 182.45 million vehicles and its 1.31 billion population, India reported a traffic collision rate of about 0.8 per 1000 vehicles in 2015 compared to 0.9 per 1000 vehicles in 2012, and an 11.35 fatality rate per 100,000 people in 2015.^[3] As it is widely known, RTA is the most common cause of maxillofacial trauma. The victim may encounter with many psychosocial problems like unemployment, lower education level, and poor social support leading to post-traumatic stress disorder.^[4] Most of the factors responsible for road traffic accidents and its consequences are preventable. Simple measures can be taken to make travel safer on the roads, which include enforcement of safety measures like seat belt and helmets. Helmets are effective in preventing or reducing the severity of motorcycle-related injuries,^[5-9] and in a developing country like India, enforced mandatory motorcycle helmet laws are potentially one of the most cost-effective interventions available. According to the Motor Vehicles Act, 1988, it is mandatory for the rider and pillion to wear helmets while riding two wheelers. Not wearing a helmet while riding a two-wheeler is a crime under Section 188 of the India Penal Code and can land a person in jail for six months. In the past, several measures taken to enforce the law for the rider and pillion to wear helmets while riding two wheelers have not succeeded completely. The UP-state cabinet, in 2019, decided to strictly enforce the law once again with hard-line rules, which came into effect from September 1, 2019. The new Motor Vehicles Act had enhanced the penalties for driving errors. According to the transport ministry's press release explaining the summary of changes in the Motor Vehicles Act, it has enhanced penalty for offences where no penalty is specifically provided for first offence from up to Rs 100 to Rs 500 and second/subsequent offence from up to Rs 300 to Rs 1,500. Additionally, new penalties have been introduced in case of violation of road regulations. The new penalty can be between Rs 500 and Rs 1,000. Stricter penalty laws will become applicable in case of dangerous driving. First-time offenders will face imprisonment of six months to one year and/or fine of between Rs 1,000 and Rs 5,000. For the second offence, the offender will be imprisoned for up to 2 years and/or will have to pay a fine of up to Rs 10,000. In an attempt to analyze the effect of the mandatory helmet rule in helmet usage among motorcycle riders and on facial trauma, a retrospective comparative study was conducted in a major trauma center in UP. The purpose of the study was to determine the immediate effect of the mandatory helmet rule on facial trauma in a major trauma center in UP and also the significance of difference in the possibility of facial trauma between the helmeted and non-helmeted motorcycle riders.

MATERIALS AND METHODS

Data required for the study was obtained from records of the Emergency Department of Trauma Center, for a period of two months (July and August 2019) before and two months (September and October 2019) after the implementation of The Motor Vehicles Act in UP. Ethical Clearance was obtained from the Institutional Ethical Committee with Ref no Dean/2022/EC/3448 dated 20.08.2022. For this study, we collected data including the patient's age, sex, date, time, place, and nature of the incident. From this, we extracted data of only the patients with a history of non-fatal motorcycle accidents who sustained facial injuries regardless of the presence of injuries to other areas of the body. Further details recorded of these patients selected for the study were helmet use, injuries sustained, and patient being the driver or pillion rider. The injuries were classified as soft tissue laceration, maxillary fracture, mandibular fracture, zygomatic complex fracture, nasal bone fracture, and panfacial fracture. The pattern of injury to the soft tissue, teeth, and facial bones was compared between helmeted and non-helmeted individuals. The diagnosis was based on clinical and radiological findings. In relevant cases, CT scan was also taken. The results of the pre-law period were compared with that of the post-law period. The data obtained was computerized and analyzed with SPSS software.

RESULTS

A total of 219 patients were included in the study according to the exclusion and inclusion criteria. Out of which, 131 (59.8%) patients were from the pre-law period and 88 (40.2%) patients were from the post-law period. Maximum number of patients were reported in the month of July and least in September [Figure 1]. Out of total study subjects, 89.95% were male and 10.04% were females. Mean age of patients reported in four months was 30.34yrs, with mean age of males being 30.15yrs and 31.58yrs of females.

The number of study subjects was distributed according to the type of rider in all the months. It was found that 89.04% of injured subjects were riders, whereas 10.9% of patients were pillions [Table 1]. ANOVA statistical analysis was done to find correlation between both the type of riders among all

Table 1: Distribution of study subjects according to ride among different months

Ride	July	August	September	October
Rider	60	56	36	43
Pillion	6	9	4	5
Total	66	65	40	48

months. It was found to be an insignificant relation between the type of riders (P value > 0.05).

It was also found that out of 219 injured patients, 152 (69.40%) subjects were not wearing helmets, whereas only 67 (30.59%) subjects were wearing helmets. In month of October, maximum number of study subjects wore helmets, whereas, in August, minimum number of subjects wore helmets [Figure 2]. It was observed that around 68.18% of people stated wearing helmets after law implementation, in comparison with 5.34% people before law implementation [Figure 3]. A sample t -test was applied to find the level of significance of helmet wearing after the implementation of law. It was observed that a significant difference (P value < 0.05) was observed in helmet wearing pre- and post-law implementation.

Among 219 patients, eight types of injuries were observed and recorded among four months [Figure 4]. The mandibular

fracture was the most common injury observed (45.67%) among all patients, followed by laceration (25.57%) and maxillary fractures (10.04%). The less common fracture injuries were zygomatic fractures (8.22%), panfacial fractures (5.02%), whereas least common injury was found to be nasal and NOE fractures (2.74% each).

In helmeted patients, most common injury observed was mandible fractures in 34 patients (50.74%), whereas least common were nasal bone and NOE fractures (1.49%). In non-helmet wearer, mandible fractures (65 patients, 42.76%) were most common, whereas least common were nasal bone and NOE fractures (3.29%) [Table 2].

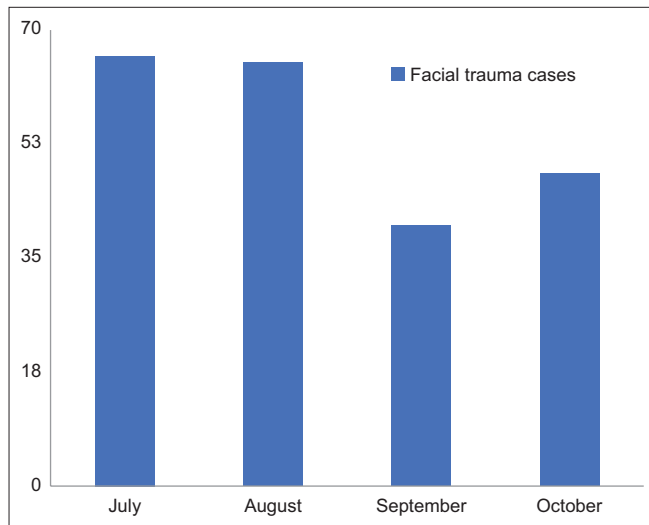


Figure 1: Incidence of cases in the pre-law (July and August) and post-law (September and October) period

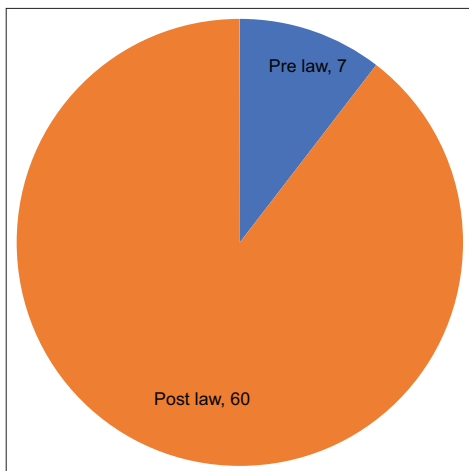


Figure 3: Percentage of helmet usage in pre- and post-law

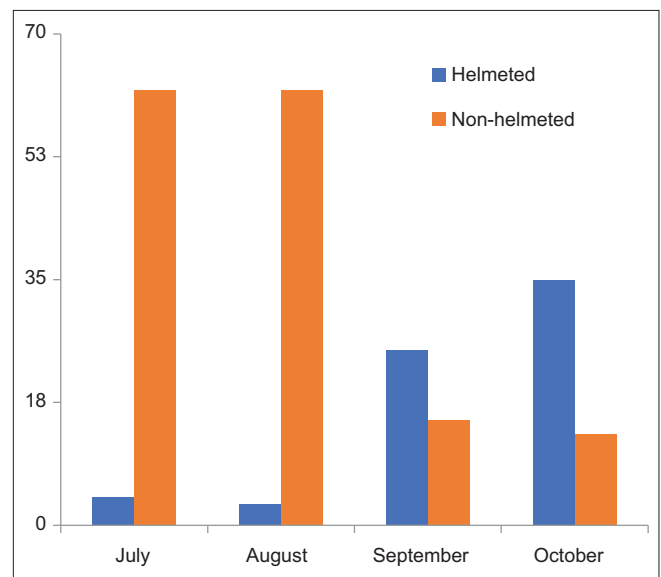


Figure 2: Distribution of study subjects according to helmet usage among different months

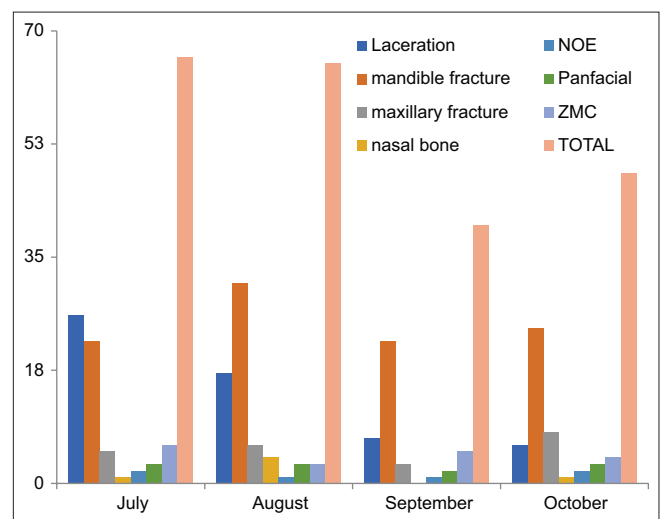


Figure 4: Distribution of study subjects according to type of fracture among different months

Table 2: Incidence of injuries among helmet and non-helmet wearer

Fracture	Laceration	Mandible fracture	Maxillary fracture	Nasal bone	NOE	Panfacial	ZMC	Total
Helmet wearers	14	34	10	1	1	2	5	67
Non-helmet wearers	42	66	12	5	5	9	13	152
Total	56	100	22	6	6	11	18	219

It was observed that around 219 patients got facial injuries; out of those, 152 (69.41%) non-helmet wearers got facial injuries, as compared to 67 helmet wearers (30.59%), who suffered from injuries. One sample *t*-test was applied to find the level of significance of helmet usage in facial trauma. It was observed that a significant difference (*P* value < 0.05) was present, proving the fact that helmet wearers had a lesser possibility of facial trauma.

DISCUSSION

The Indian Motor Vehicles Act-1988 in its section 129 mentions that the driver and the person riding pillion on a motorized two-wheeler (except in sidecar) in a public place shall wear a helmet (Protective headgear) that conforms to the specifications of the Bureau of Indian Standards. On September 1, 2019, Uttar Pradesh State Government re-enforced the Motor Vehicles Act, with elevated penalties this time. With general observation, it seems that there is considerable increase in the usage of helmet, after the enforcement of the law. However, an evidence-based study was required to confirm this observation. To our knowledge, this is the first work to evaluate the effectiveness of mandatory helmet law, through a level 1 trauma center in UP. This study also identifies other important findings associated with facial trauma and helmet use. This study was mainly an effort to identify the immediate effect of the mandatory helmet law on facial trauma. We decided to compare the status of facial trauma at our trauma center during two months of pre-law period (July and August 2019) and two months of post-law period (September and October 2019). The incidence of road traffic accidents was higher in males and in second to third decades of life, which is similar to most of the studies by various authors.^[10] There was considerable decrease in the number of patients who reported to the trauma center for facial injury in the post-law period, lowest being in September 2019, immediately after the law came to force [Figure 1]. However, apart from helmet rule, there are other factors that could have been responsible for this decrease, such as reduction in risk behavior of drivers or reduced the number of motorcycle sales due to the rule.^[10] According to our study, the riders were commonly injured, in comparison to pillion riders, which is also in common with a similar type of study conducted by Usha *et al.*^[10] in Kerala. In our study, it was also observed that 68.18% of the injured patients were helmet wearers in the post-law

period, whereas it was 5.34% in the pre-law period. The difference was statistically significant, indicating that there is considerable increase in helmet usage in the post-law period, which is similar to the results of studies conducted in other countries such as California (50 to 99%),^[8] Texas (50 to 90%),^[11] Taiwan (2.9 to 41.6%),^[12] and Italy (20 to 96%).^[9] Out of the 219 injured patients, it was found that 69.4% were non-helmeted, while rest of the 30.6% were helmeted. The *P* value was less than 0.05, which makes it highly significant, showing helmeted patients have less possibility of facial trauma when compared to non-helmeted patients. This result is similar to a study conducted in Connecticut by Wiznia *et al.*^[13] in 2016, which concluded that the incidence of head and face injuries was significantly higher in non-helmeted patients and also that non-helmeted patients required more surgical care, owing to the higher rate of oro-maxillofacial procedures. There are various other studies in literature, which has also arrived at similar conclusion.^[6,7,14] These results make the point clear that helmet plays a commendable role in reducing the possibility of facial trauma. In both helmeted and non-helmeted patients, the most common type of fracture was mandibular fracture and the least common fracture was nasal bone/NOE fracture. Therefore, there was no significant difference in the pattern of fracture between the two groups.

The shorter study period and smaller sample size is a major limitation of the study. However, the main aim of the study was to determine the immediate effect of mandatory helmet rule in facial trauma. Another limitation of the study is that the number of patients walking into our trauma center might not be truly representative of the number of patients being attended by the other centers of the state. Therefore, the result cannot truly predict the effect of the rule on the state. Added to these, the various unmeasured factors which might have placed the patient at lesser risk for the accident can also be considered as a limitation factor.

Our study shows that the mandatory helmet rule with elevated penalty rates, that came into force from September 2019, has significantly increased the usage of helmet among the motorcycle riders. The study also proves that the possibility of facial trauma is significantly higher in non-helmeted riders when compared to helmeted riders. However, our study has its own limitations as mentioned earlier. Although the high penalty rates and strict enforcement of the law have helped the rule in producing

positive results, continuous public campaigns to motivate riders to wear helmet, strong and consistent enforcement of law by traffic personnel without leniency and public support are necessary to maintain consistency in helmet usage among motorcyclists.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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