ORIGINAL ARTICLE

Electric scooters as a silent source of danger in increasing use among young people: a single-center in-depth accident analysis

Necdet Demir, M.D.,[1] Mehmet Dokur, M.D.,[2] Özgür Agdoğan, M.D.,[3] Suna Koc, M.D.,[4] Mehmet Karadağ, PhD,[5] İbrahim Fikri Dokur, BSc,[6]

[1]Department of Orthopaedics and Traumatology, Biruni University Faculty of Medicine, Istanbul-*Türkiye*
[2]Department of Emergency Medicine, Biruni University Faculty of Medicine, Istanbul-*Türkiye*
[3]Department of Plastic and Reconstructive Surgery, Biruni University Faculty of Medicine, Istanbul-*Türkiye*
[4]Department of Anesthesiology and Reanimation, Biruni University Faculty of Medicine, Istanbul-*Türkiye*
[5]Department of Biostatistics, Hatay Mustafa Kemal University, Faculty of Medicine, Hatay-*Türkiye*
[6]Department of Electrical and Electronics Engineering, Bogazici University, Istanbul-*Türkiye*

ABSTRACT

BACKGROUND: The reasons for the increase in accidents involving shared stand-up e-scooters in recent years may be the widespread use of e-scooters among young people, especially in metropolitan areas with heavy traffic, non-compliance with traffic rules, and insufficient legal regulations. In this study, we analyzed in detail the typical features of rider-sharing e-scooter-related injuries brought to the emergency department of our hospital in the light of current literature.

METHODS: The clinical and accident characteristics of 60 patients with surgical requirements who were brought to the emergency department of our hospital due to e-scooter-related accidents between 2020 and 2020 were analyzed using statistical methods retrospectively.

RESULTS: The majority of the victims were university students and the number of victims of the male gender was slightly higher and the mean age was 25.3±13.0 years. Most e-scooter accidents occur on weekdays. Most of the e-scooter-related accidents happen on weekdays and are non-collision type accidents. The majority of e-scooter-related accident victims were in the minor trauma group (injury severity score <9), predominantly had extremity and soft-tissue injuries and needed radiological examination (44 patients, 73.3%), and only eight victims (13.3%) required surgical operation and also all of the e-scooter victims were discharged fully healed.

CONCLUSION: Among the more common collision-free e-scooter-related accidents that have a lower trauma severity score or cause minor soft-tissue injury, mono-trauma occurs more commonly than multisystem trauma; likewise, radius and nasal-weighted monofractures occur more commonly than multiple fractures, according to this study. Besides, effective measures and legal regulations should be put in place to prevent e-scooter-related accidents.

Keywords: Accident; characteristics; E-scooter; injury, micromobility vehicles.

INTRODUCTION

In the developing and changing world, people have tried to fulfill their transportation needs by developing faster and cheaper methods. Today, efforts to search for more practical methods for the ever-increasing need of individual transportation continue. Nowadays the electric scooters (e-scooters or motorized scooters) are one of the most popular and

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Address for correspondence: Necdet Demir, M.D.
Biruni University Faculty of Medicine, Istanbul, Türkiye
E-mail: drnecdetdemir28@gmail.com

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widely used solutions. Research suggests that by 2024, 4.6 million shared e-scooters will be in operation worldwide, up from 774,000 in 2019.[1] According to the data of the commercial research company, it is noteworthy that the number of shared e-scooter users in Turkey reached 4.4 million for only the first three brands of e-scooters between March 14, and April 14, 2022.[2] An e-scooter functions with the help of an electric motor and a battery which supplies energy to the motor. The scooter is designed for one standing driver.

All controls of the vehicle are in the handlebar which is also used to steer the vehicle. In the handlebar, exist a gas pedal, one or two brake pedals, and a bell. Headlight is used to have a better vision in dark, and it is often self-controlled in shared scooters. The vehicle has two wheels and hard tires can be used. Rear light or reflector is generally on the rear wheel for increased visibility of the scooter.[3] According to the current legal regulations in Turkey, e-scooters cannot exceed 25 km/h speed[4] and when this speed is exceeded while going downhill, there are systems in e-scooters that usually warn the driver and slow down the vehicle by automatically braking. Shared scooters systems serve their user with a renting software. Electric rental scooters can be unlocked by scanning the QR code of the scooter or writing the code manually in the mobile application of the system and after use, scooters are locked back through mobile application.[5]

Ricardo Nimrod Sapir designed the world's first folding motorized e-scooter in 2009 and started production the following year. First, worldwide introduction of e-scooter rentals occurred in 2017 and dramatically dockless e-scooter-sharing systems are rolled out especially in metropolitan areas of the U.S. largely as expansions of bike-sharing systems in 2018. After that, shared e-scooters started to be used widely around the globe.[6-8] In Turkey, the first use of e-scooter was in 2019 and the first fatal rideshare e-scooter accident occurred on February 26, 2020. Following this, on April 14, 2021, the e-scooter regulation was published in Official Gazette of the Republic of Turkey.[4,9,10] With electric scooters becoming an increasingly popular mode of transport in most countries, many e-scooter-related injuries are also recorded, often affecting the head, face, and extremities.[11-14]

In this study, we analyzed the traumatic characteristics of victims brought to the emergency department of our hospital after a stand-up e-scooter-related accident and also with this analysis, we evaluated anatomical locations and severity scores of injuries with typical traumatic characteristics, causes of the accidents, requirements for surgical treatment, radiological examination of the victims, and the clinical outcomes of e-scooter-related injuries, along with important messages on safe e-scooter use in the light of current literature.

MATERIALS AND METHODS

Study Design

Study type: This study was retrospective clinical study (Original Research).

Level of evidence: Three (according to SIGN100).[15]

Patients, Data Collection, and Setting

A total of 60 victims with e-scooter-related injuries who admitted to the Emergency Department of Biruni University Hospital between August 2020 and July 2022 were included in our study. The clinical characteristics of cases injured (demographics, injury characteristics, according to accident mechanisms, treatment modalities, and outcomes) due to electric scooter accidents were retrospectively analyzed using the electronic patient information registration system of our hospital. We also used injury severity score (ISS) to assess trauma severity in the victims.

Exclusion Criteria

During this study, cases of non-electric scooter accidents, electric bicycle accidents, and motorcycle accidents admitted to our emergency department were excluded in the study.

Statistical Analyses

The Shapiro–Wilk test was used to test the distributions of continuous variables for normality in this clinical trial. Descriptive statistics for continuous data are shown as mean ± standard deviation or median (Q1-Q3), as applicable. Categorical data are shown as numbers and percentiles. The differences between groups were compared using Mann–Whitney U-test or Kruskall–Wallis test (post hoc: Dunn test) for medians. Categorical data were analyzed using Pearson's Chi-square or Fisher's exact test, as appropriate.

Ethical Statement

Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki, "Ethical Principles for Medical Research Involving Human Subjects." This clinical study protocol was approved by Ethics Committee of X University (Permit number: 2021/66–36). Informed consent was received from the patients or their legal representatives.

RESULTS

Characteristics of the Victims Involved in e-Scooter-related Accidents

In this study, we determined that most of the cases involved in the accident were between the ages of 15 and 24, the male gender was observed slightly more frequently and the mean age was 25.3±13.0 (min-max: 6–62) years, and also, we did not find any significant difference between the gender dis-

Table 1. Characteristics of the victims involved in e-scooter accident

Variable	n (%)
Gender	
Male	31 (51.7)
Female	29 (48.3)
Age (year)	
5–14	10 (16.7)
15–24	26 (43.3)
25–34	11 (18.3)
35–44	7 (11.7)
45–54	3 (5.0)
55–64	3 (5.0)
Occupation	
Student	33 (55.0)
Worker	22 (36.6)
Housewife	4 (6.7)
Pensioner	1 (1.7)
Weekday-weekend distribution	
Weekdays	45 (75.0)
Monday	13 (21.7)
Weekend days	15 (23.3)
Sunday	9 (15.0)
Time of day	
06–12	14 (23.3)
12–18	31 (51.7)
18–24	11 (18.3)
24–06	4 (6.7)
Accidents in urban setting	60 (100.0)
Alcohol use while driving	0 (0.0)
Unhelmeted riders*	59 (98.3)
Arrival by ambulance	23 (38.3)
Scooter rider status	
Riding single	51 (85.0)
Riding double (tandem)	8 (13.3)
Non-riding (pedestrian)*	1 (1.7)
Total victims	60 (100.0)

*After the accident, only one victim was brought to the emergency department of our hospital alone, without the other victims

tributions of the student groups involved in e-scooter accidents, while the total number of students was 33 (55.0%), the number of male students was 17 (28.3%), and the number of female students was 16 (26.7%). We also found that all scooter accidents occurred in urban or metropolitan setting, just over half of the victims being students, almost all the drivers involved in accidents riding the scooter alone (51 riders,

Table 2. General traumatic characteristics of e-scooter accidents

	n (%)
Property	
Total victims	60 (100.0)
Total accident	56 (100.0)
Operational properties of e-scooters	
Shared e-scooter systems (through mobile app.)	56 (100.0)
Stand-up e-scooter	56 (100.0)
Protective equipment obligation	0 (0.0)
Accident mechanism	
Collision-free accident	41 (68.3)
Collision to road structures	9 (15.0)
Collision with motor vehicle	6 (10.0)
Collision to pedestrian	1 (1.7)
Collision with another scooter	1 (1.7)
Collision to scooter stationary objects	1 (1.7)
Scooter malfunction	1 (1.7)
Trauma classification	
Mono-trauma	57 (95.0)
Multi system trauma	3 (5.0)
Injury type	
Soft-tissue injury	90 (100.0)
Traumatic skin incision	21 (23.3)
Traumatic brain injury	3 (5.0)
Traumatic subluxation (shoulder)	1 (1.7)
Bone fracture	
Mono fracture	18 (30.0)
Double fracture	1 (1.7)
Injury severity score (ISS=0–75)	
Minor (ISS<9)	45 (75.0)
Moderate (ISS=9–15)	12 (20.0)
Severe (ISS=16–24)	3 (5.0)
Critical (ISS ≥25)	0 (0.0)
Side of body affected by trauma (laterality)	
Unilateral trauma	
Left-sided	27 (45.0)
Right-sided	18 (30.0)
Midline trauma	7 (11.7)
Generalized trauma	8 (13.3)
Radioimaging requirement	
X-ray	44 (73.3)
Non-contrast CT	21 (35.0)
Cranial CT	15 (25.0)
MRI (for the knee joint)	1 (1.7)
Outcomes	
Required surgical operation	8 (13.3)
Fracture reduction (closed)	10 (16.7)
Velpeau bandage (clavicle)	1 (1.7)
Required ICU admission	0 (0.0)
Healing	60 (100.0)
In hospital mortality	0 (0.0)

ICU: Intensive care unit; CT: Computed tomography; MRI: Magnetic resonance imaging.

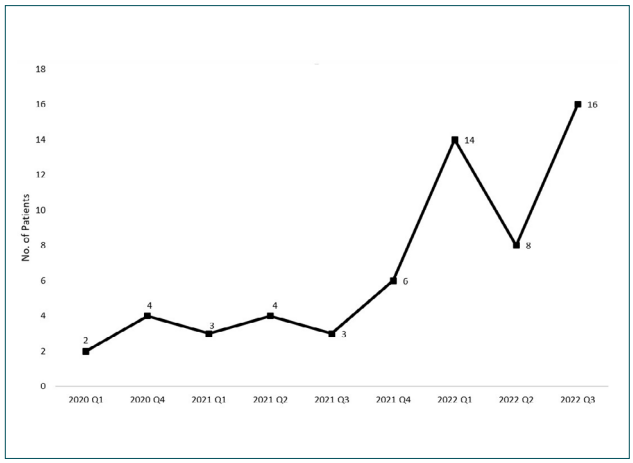

Figure 1. Time trends of e-scooter-related accidents
(Q: Quarter of the year); Q1: January-February-March; Q2: April-May-June; Q3: July-August-September; Q4: October-November-December

85.0%) while fewer were riding doubles (8 riders, 13.3%), and one of them was a pedestrian collision (1.7%). None of them were under the influence of alcohol or any substance during riding, and none of them were helmeted. Furthermore, less than half of these patients arrived at our hospital by ambulance (Table 1).

Time Trends and Rhythmicity of e-Scooter-related Accidents

We have determined that e-scooter accidents have increased gradually since the last quarter of 2021 and peaked in the first (January-February-March) and third quarters of 2022, respectively (Fig.1). It is noteworthy that the cumulative incidence of e-scooter accidents is higher on week days than on the week end, and it peaks on Sunday and Monday. The distribution of e-scooter accidents during the day is most frequently between noon and 6 pm (Table 1).

Table 3. Distribution of e-scooter-related trauma by body regions

Body regions	n (%)
Craniomaxillofacial	29 (30.2)
Maxillofacial	23 (23.9)
Neck	3 (3.1)
Chest	4 (4.2)
Abdomen	2 (2.1)
Back (dorsolomber)	1 (1.0)
Extremity	
Upper	29 (30.2)
Lower	28 (29.2)
Total	96 (100.0)

Table 4. Distribution of e-scooter-related soft-tissue injuries by body regions

Region	n (%)
Maxillofacial	23 (25.5)
Forehead	5 (5.5)
Periorbital	1 (1.1)
Cheeks	2 (2.2)
Eyelids	1 (1.1)
Eyebrows	4 (4.4)
Malar	1 (1.1)
Nose	2 (2.2)
Mandible	3 (3.3)
Upper lip	2 (2.2)
Philtrum	1 (1.1)
Lower lip	1 (1.1)
Scalp	3 (3.3)
Neck	3 (3.3)
Torso	8 (8.9)
Chest	4 (4.4)
Abdomen	2 (2.2)
Lumbosacral	2 (2.2)
Upper extremity	26 (28.9)
Shoulder	4 (4.4)
Upper arm	1 (1.1)
Elbow	6 (6.7)
Fore arm	1 (1.1)
Wrist	8 (8.9)
Hand	5 (5.5)
Finger	1 (1.1)
Lower extremity	27 (30.0)
Thigh	4 (4.4)
Knee	13 (14.4)
Ankle	9 (10.0)
Toe	1 (1.1)
Total	90 (100.0)

Operational Features of e-Scooters

It is remarkable that all of the e-scooters included in our study are of stand-up type and shared through mobile application. Although there is a speed limit in all e-scooters involved in the accident, we have determined that there is no obligation to use protective equipment (Table 2).

The Mechanisms of e-Scooters-related Accidents

It is noteworthy that the majority of e-scooter accidents are collision-free accidents or loss of balance for any reason in our study (Table 2).

Table 5. Distributional characteristics of e-scooter-related bone fractures

Bone	Fracture	n (%)	
	Open	Closed	Total
Nasal bone		4	4 (21.0)
Clavicle		1	1 (5.3)
Humerus		2	2 (10.6)
Proximal		1	1 (5.3)
Distal		1	1 (5.3)
Radius (distal)		5	5 (26.2)
Ulna (proximal)		1	1 (5.3)
Phalanx (distal)	1		1 (5.3)
Tibia (proximal)		3	3 (15.7)
Fibula (distal)		1	1 (5.3)
Metacarp (proximal)		1	1 (5.3)
Total	1	18	19 (100.0)

General Traumatic Properties of e-Scooter-related Accidents

We found that most of the victims involved in e-scooter-related accidents were in the minor trauma group (ISS <9), had predominantly soft-tissue injury, left-sided body affected by trauma), and mono-trauma. Besides, it is noteworthy that one-fifth of soft-tissue injuries are skin incisions and almost all bone fractures are mono fractures. We noticed that, although the majority of e-scooter-related accident victims (44 patients, 73.3%) needed radiological examination, only eight victims (13.3%) required surgical operation and also all of the e-scooter victims were discharged fully healed (Table 2).

Anatomical Locations of e-Scooter-related Injuries

We found that slightly mildly upper extremity-weighted extremity injuries were the most frequent, followed by maxillofacial injury mostly consisting of craniomaxillofacial traumas in this study (Table 3). In addition, we determined that the lower extremity, upper extremity, and maxillofacial region were the most frequently affected soft-tissue injuries, respectively, and it is noteworthy that the specific locations are knee, wrist, and forehead in order of frequency (Table 4). It is noteworthy that almost all bone fractures are closed fractures and the frequency order is distal radius, proximal tibia, and nasal bone (Table 5).

Outcomes of the Victims

In our study, most of the victims (52 victims, 86%) were discharged from the hospital with outpatient treatments.

DISCUSSION

Among the novel micromobility vehicles, e-scooters are one of the most widely used solutions as an alternative travel method in heavy urban traffic, especially in major metropolitan areas.[16-18] However, the measures taken for its reliability are still controversial and the use of e-scooters is not approved by the government of every country due to the risks they pose to both e-scooter riders, pedestrians, and other motor vehicle drivers.[19-21] The widespread use of electric scooters has increased these risks even more.[22,23] As a natural consequence of all this, various e-scooter-related accidents, which are frequently encountered in daily life, have been included in international classification of diseases (ICD) list since 2016 (ICD. Codes/ICD-10-CM (2016)/Chapter 20/Section V00-V09/Code V00.83: "Accident with motorized mobility scooter").[24] If adequate precautions are not taken under these conditions, it is an inevitable result that motorized e-scooter accidents will increase over the years.[25]

According to the results of our study, the gradual increase in e-scooter accidents since the last months of 2021 can be explained by the increase in the use of e-scooters, especially among young people, as an alternative to the heavy city traffic in metropolitan areas. Innovations that facilitate access to shared e-scooters by electric rental scooter companies may also be an important factor in this increase.[26,27] Besides, just as in our study, almost all of the other studies on rider-sharing e-scooter accidents also report that they occur in metropolitan areas with heavy traffic and that the majority of victims are among the young population, which may be related to the purpose of preference of e-scooters.[1,12,28]

Contrary to most articles on e-scooter accidents in the current literatures, the absence of a significant difference between gender distributions and a relatively low age range of victims in our study can be explained by the fact that e-scooter use in our study was more common especially among university students regardless of gender. Benhamed et al., in a multicenter cross-sectional study comparing e-scooter and bicycle-related traumas, found that e-scooter and bicycle-riding victims were slightly predominantly male and the mean age of e-scooter riders was lower than bicycle-related victims, interquartile range (IQR):24 (20–32) and 29 (20–45), respectively.[29] Siow et al., in their study on orthopedic injuries due to e-scooter accident brought to Level 1 trauma center, reported that the peak of frequency of accidents by age was between 19 and 24.[17]

All of this may also explain why none of the e-scooter victims were drinking alcohol at the time of the accident in our study. The results of our study show similarities with the results of the study of Genç Yavuz et al. in 2020 in terms of age and gender distribution of e-scooter accident victims, the very low rate of being drunk at the time of the accident, and features such as common unhelmeted riding.[30] Badeau et al.,

in their study of emergency department visits for electric scooter-related injuries, found that all victims were unhelmeted and there was no difference in gender distribution, along with that, the rate of minor injuries was slightly higher than the major ones.[20] In their study, Kim et al. highlighted that the use of unhelmeted e-scooter was associated with increased maxillofacial injuries.[14] Aulino et al. emphasized the importance of legal regulations to reduce cranioencephalic traumas that may be caused by the use of helmetless e-scooters in their a case study.[31] Similarly, Kappagantu et al., and Kobayashi et al., in their studies on the widespread use of e-scooters emphasized that it is important to investigate injury patterns in e-scooter-related accidents, to make legal regulations related to helmeted e-scooter use, in reducing intracranial hemorrhage and fractures requiring operative and severe neck injuries accidents respectively.[27,28]

According to the data of our study, it is remarkable that almost half of the victims of e-scooter accidents were brought to hospitals by ambulance. Siow et al. and Badeau et al., in their study on e-scooter accidents, reported the rates of victims brought in by ambulance to hospital as 179 (36.9%) and 12 (24%), respectively.[17,20] English et al. reported that approximately half (51.6%) of the victims arrived through ambulance in their study.[25] In our study, as in the study of Siow et al. and English et al., the reason why the victims were found to be arriving to the hospital by ambulance in high rates can be explained by easy activation of emergency response or access to ambulance in metropolitan areas where most of the e-scooter accidents occur. Besides, although almost half of the e-scooter accidents were a collision-free accident resulting in an isolated fall from the e-scooter due to the loss of balance of the accident mechanism, it is noteworthy that the collision to pedestrian rate was quite low.[17,25]

In their study, Nielsen et al. reported the collision-free accident rate as 93.5% (43 victims) in e-scooter accidents, while Dhillon et al. reported it as 23% (20 victims) and they also reported the collision rate of e-scooters with another vehicle as 50 (57.5%.[23-32] While English et al. reported pedestrian struck by e-scooter riders rates as 2 (1.6%) in their study, Ishmael et al. reported these rates as 2 (2.7%).[18,25] The fact that Dhillon et al. reported the mechanisms of e-scooter accidents as predominantly colliding with another vehicle may be related to the fact that this study was conducted in six trauma centers (Levels 1, 2, and 3) with victims with more serious injuries.[32] The results of our study are consistent with the results of both Ismael et al. and Nielsen et al.[18-23]
In some studies on e-scooter accidents, Hennocq et al. and Navarro et al. reported tandem or double e-scooter ride rates as 12 (14%) and 20 (1.8%), respectively.[13,33] The tandem e-scooter driving rates in our study are consistent with the study results of Hennocq et al. Although the frequency is not very high, it can be said that double riding or tandem use of e-scooters is quite risky especially in terms of difficulty in controlling traffic. Recently, severe or fatal e-scooter accidents have been reported in Turkey as a result of such inappropriate use.[13,34,35]

After the increase in fatal or serious e-scooter accidents, some countries, including our country, have recently declared some new regulations regarding e-scooter safety.[4,36,37] The declaration of some new regulations regarding e-scooter safety by some countries, including our country, may be related to the gradual increase in accidents, which can be serious or fatal, mostly due to the careless use of e-scooters without precaution. In our study, almost half of the victims having left-sided weighted body affected by the trauma can be considered as a remarkable entity in trauma epidemiology. In most of the studies including ours on stand-up e-scooter-related accidents, it has been emphasized that the accidents occur mostly on week days and working hours. It has also been reported that e-scooter accidents peak especially in spring and summer.[14,18,29,33] However, Williams et al., in their study, reported that e-scooter accidents peak in December.[22] The fact that e-scooter accidents are mostly seen on week days and the 1st day of the week can be explained with e-scooters are frequently preferred by young age groups when they go to work or school and it is the busiest day in terms of traffic in metropolitan areas. The reason why the increase in e-scooter accidents on Sunday can be attributed to some of the young people meet their increasing travel needs on weekends through e-scooters, which they can access more easily.

According to the results of our study, it is noteworthy that almost three-quarters of e-scooter victims require X-ray and cranial computed tomography (CT)-weighted radioimaging. Lavoie-Gagne et al. reported that X-ray or direct radioimaging was performed in 333 patients (75%) and non-contrast CT was performed in 260 patients (58.8%) who were brought to a level I trauma center after an e-scooter accident and most of them had orthopedic and maxillofacial trauma.[38] Considering that the majority of e-scooter accident victims in our study had extremity and head trauma, our X-ray and cranial CT radioimaging rates were found to be high, which is consistent with the study results of Lavoie-Gagne et al.[38]

Trauma severity score of almost half of the e-scooter accident victims in our study was categorized as minor (ISS <9). This can be explained by the relatively low number of serious monotrauma and multitrauma requiring open surgery, although most trauma patients have soft-tissue injuries. This may also explain the lack of mortality in e-scooter accident victims brought to our hospital. English et al. and Benhamed et al., in their study on e-scooter-related injuries, reported that minor ISSs of victims were IQR ISS: 5 (4–9) and 2 (1–4) and also in hospital mortality rates were 0 (0%) and 1 (0.1%) respectively.[25,29] Williams et al., in their study on electric rental scooter accidents, reported that the accidents mostly resulted in minor injuries when a helmet was used by riders.[22] Choi et al., in their study on e-scooter-related accidents,

reported that riders using helmets had lower ISS and lethality.[39] The latter can be important as it demonstrates a strong correlation between low ISS or minor injuries and mortality. Although the distribution rates are different in many studies, it can be said that e-scooter accidents result in extremity and maxillofacial injuries most frequently. Besides, it was emphasized in e-scooter-related injuries that unhelmeted and careless stand-up e-scooter use may be a cause of severe cranimaxillofacial trauma and it was also stated that severe skeletal injuries were more common in high kinetic energy e-scooter injuries.[12,14,17,18,20,23,27,30,32,33,38,40]

Considering the distribution of e-scooter-related injuries by body regions in our study, the higher incidence of upper-extremity-weighted extremity injuries than maxillofacial-weighted craniomaxillofacial injuries and also the distributional characteristics of soft-tissue injuries, it is noted that knee-weighted lower extremity injuries are slightly more common than wrist-weighted upper extremity injuries and forehead-weighted maxillofacial injuries, with one-fifth of all these injuries being traumatic skin incision and a little more than half being mono-trauma. This may be related to the typical kinematic features of e-scooter accidents. Posirisuk et al., in a study on different types of e-scooter fall kinematics, showed that e-scooter speed has a significant effect on head-to-ground impact speed in the model pothole and they also sent a message to the authorities and e-scooter rental companies to take more informed action about speed limits and road surface conditions and to raise awareness among riders of the importance of wearing helmets.[41] Ptak et al., also in a scenario study on three-dimensional models on the analysis of standing e-scooter user kinematics after a collision, emphasized that e-scooters can make users vulnerable to traumatic injuries of various severity and also that there are concerns and doubts about the safety of e-scooters.[42] Besides, Dozza et al., stressed in a their framework study on comparing bicycles and scooters in data-driven field trials for the safe integration of micromobility into the transportation system, that stand-up e-scooters may be more maneuverable and comfortable than bicycles, although the former require longer braking distances. They also suggest that data about kinematics and controls from micromobility vehicles may help safely integrate these new vehicles into urban transport.[40] Considering the fractures that develop in victims, closed radius fractures are followed by nasal and tibial fractures and forehead and eyebrow injuries are important details in maxillofacial soft-tissue injuries. Namiri et al., in their study on trends in number and type of electric scooter injuries over the years, showed that head and lower extremity injuries are increasing compared to upper extremity and torso injuries.[26]

In their study on dockless electric rental scooter-related injuries, English et al. emphasized that upper extremity, head, face, and lower extremity injuries are common, respectively, and such as lacerations, abrasions, and contusions were the most frequent type of injury, followed by fractures, sprains, and strains. However, penetrating injuries and internal organ injuries were rare.[25] Kobayashi et al., reported that in their mild ISS-weighted (59 victims, 58%) e-scooter epidemic study, tibia/fibula fractures were the most common, followed by facial and radius/ulna fractures, respectively.[28] In a study conducted by Ismael et al. on injuries associated with e-scooter accidents in two trauma centers (Levels 1 and 2), lower extremity injuries were more common than upper extremity injuries, and radius-ulna fractures were frequently observed.[18] Similarly, the results of our study are compatible with study of Ismael et al., in terms of higher incidence of orthopedic injuries and distal radius-ulna fractures. A study conducted by Dhillon et al., reported that maxillofacial traumas are slightly higher than extremity traumas, although extremity fractures are seen in approximately one fifth of the victims.[18-32] The results of our study are compatible with the study of Dhillon et al., in terms of rate of e-scooter-related extremity fractures and maxillofacial traumas.[32]

Hence, the increase of e-scooter accidents resulting in injuries in recent years may be not only due to the popularity of e-scooter use but also to the fact that the use of personal protective equipment is not yet mandatory or there is not enough regulation in many countries. Along with the lack of awareness on this issue, the last statement can help us understand the fact that all e-scooter riders involved in the accidents were without helmets.

Conclusion

Even e-scooter-related accidents, which we analyzed in a short time and in a single center, showed that serious extremity and maxillofacial injuries can occur in young people, most of whom included in this study being students. It is noteworthy that none of the victims used helmets and that fatal accidents were few. Soft-tissue injuries on the knee, wrist, and forehead are more common, while the frequency of closed distal radius fracture and nasal fracture is remarkable. It is remarkable that collision-free accidents and soft-tissue injury-weighted minor mono-system traumas are seen more frequently in stand-up e-scooter riders.

Limitations

Limitations of this clinical study include its retrospective design, single-center patient population, and its limited research period.

Ethics Committee Approval: This study was approved by the Biruni University Clinical Research Ethics Committee (Date: 21.02.2022, Decision No: 2022/66-36).

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Literature search: N.D., M.D., İ.F.D.; Writing: N.D., M.D., M.K., İ.F.D.; Critical revision: N.D., M.D., Ö.A., S.K., M.K.; Resource: N.D., M.D., S.K.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Gençler arasında kullanımı giderek artan sessiz bir tehlike kaynağı olarak elektrikli scooter: Tek merkezli detaylı bir kaza analizi

Dr. Necdet Demir,[1] Dr. Mehmet Dokur,[2] Dr. Özgür Agdoğan,[3] Dr. Suna Koc,[4] Dr. Mehmet Karadağ,[5] Dr. İbrahim Fikri Dokur[6]

[1]Biruni Üniversitesi Tıp Fakültesi, Ortopedi ve Travmatoloji Anabilim Dalı, İstanbul
[2]Biruni Üniversitesi Tıp Fakültesi, Acil Tıp Anabilim Dalı, İstanbul
[3]Biruni Üniversitesi Tıp Fakültesi, Plastik ve Rekonstrüktif Cerrahi Anabilim Dalı, İstanbul
[4]Biruni Üniversitesi Tıp Fakültesi, Anestezi ve Reanimasyon Anabilim Dalı, İstanbul
[5]Hatay Mustafa Kemal Üniversitesi Tıp Fakültesi, Biyoistatistik Anabilim Dalı, Hatay
[6]Boğaziçi Üniversitesi Mühendislik Fakültesi, Elektrik ve Elektronik Mühendisliği Bölümü, İstanbul

AMAÇ: Son yıllarda kullanıcı paylaşımlı, ayakta durularak sürülen e-scooter ilişkili kazalardaki artışın nedenleri özellikle yoğun trafiğin olduğu metropollerde gençler arasında e-scooter kullanımının yaygınlaşması ile birlikte trafik kurallarına uyulmaması ve yasal düzenlemelerin yetersizliği olabilir. Biz bu çalışmada, hastanemizin acil servisisine getirilen binici paylaşımlı e-scooter ilişkili yaralanmaların tipik özeliklerini güncel literatür ışığında detaylı olarak analiz ettik.
GEREÇ VE YÖNTEM: 2020-2020 yılları arasında e-scooter kazası nedeniyle hastanemizin acil servisine getirilen 60 hastanın kaza ve klinik özellikleri cerrahi gereksinimleriyle birlikte geriye dönük olarak istatistiksel yöntemler kullanılarak incelendi.
BULGULAR: Kurbanların çoğunluğu üniversite öğrencisi iidi ve erkek cinsiyet hafifçe fazla ve yaş ortalaması 25.3±13.0 olarak bulundu. E-scooter ile ilgili kaza mağdurlarının çoğunluğu minör travma grubundaydı (ISS<9), ağırlıklı olarak ekstremite ve yumuşak doku yaralanması ve radyolojik muayene ihtiyacı (44 hasta, %73.3), sadece 8 kurban (%13.3) cerrahi operasyon gerektirdi ve ayrıca tüm e-scooter kurbanları tamamen iyileşmiş olarak taburcu edildi.
TARTIŞMA: Daha yaygın görülen travma ciddiyet skoru daha düşük veya minör olan çarpışmasız e-scooter ilişkili kazalarda, tek organ yaralanmaları, çoklu sistem yaralanmalarından ve radial ve nazal kemik ağırlıklı tekli kırıklar ise çoklu kırıklardan daha sık görülür. Ayrıca e-scooter ilişkili kazalarının önlemesi için yasal düzenlemelerle birlikte etkili önlemler alınmalıdır.
Anahtar sözcükler: E-scooter; kaza; mikro-mobilite araçları; tipik özellikler; yaralanma.

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