

Using e-scooters: An easy way to get home or a nightmare? An orthopedic perspective on e-scooter accidents

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ABSTRACT

BACKGROUND: The percentage of e-scooter use quickly escalated in our community due to its convenience, low cost, and eases of use. The number of accidents causing high-energy traumas has also increased. This study aims to describe the demographic characteristics and fracture patterns of patients admitted to the emergency department following an e-scooter accident and to identify common, correctable factors that increased the likelihood of accidents.

METHODS: Between January 2022 and August 2022, 43 patients (20 females and 23 males) who were admitted to the emergency department after an e-scooter accident and developed extremity fractures were included. The patients were divided into 2 groups those treated surgically and conservatively. Parameters such as the time of the accident, education level of the user, alcohol use, e-scooter malfunction, and compliance with traffic rules were evaluated.

RESULTS: Accidents that led to treatment by surgery mostly occurred between 11 pm and 7 am. Surgically treated patients were mostly high school graduates. Alcohol use and recreational scooter use rates were statistically higher in the operated patients when compared to patients who were treated conservatively. The number of patients who reported a malfunction in the e-scooter was significantly lower in the operated group than in the conservative group. The rates of accidents due to non-compliance with traffic laws, driving at full speed of the e-scooter, use on the driveway, and presence of wet ground at the time of the accident were higher in the surgically treated patient group. Surgically treated patients also had a higher rate of being 1st time e-scooter users.

CONCLUSION: Although governments have introduced many regulations regarding e-scooter use, the current situation seems insufficient in solving the problem. E-scooter users should be further educated about the associated risks. Authorities should tighten their supervision of scooter rental companies and drivers. Nighttime usage conditions should be reviewed, and the use of alcohol should be controlled. The use of helmets should be mandatory. If such regulations are tightened, accident rates can be reduced or high-energy impacts from existing accidents can be avoided. The results suggest that experienced, slow, non-alcoholic, and rule-abiding drivers require less operative treatment. This article will hopefully raise awareness and improve e-scooter regulations.

Keywords: Accident; e-scooter; fracture.

INTRODUCTION

The way people move around the city has been changing rapidly in recent years. People increasingly prefer more practical and personal vehicles that are easily accessible. Since their launch in 2017, electric scooters (e-scooter) have become an

important means of transportation for city residents, and they constitute a significant part of the micro-mobility market in cities around the world.^[1]

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Cite this article as: Kültür Y, Tütüncü MN, Ulutaş S. Using e-scooters: An easy way to get home or a nightmare? An orthopedic perspective on e-scooter accidents. *Ulus Travma Acil Cerrahi Derg* 2023;29:1158-1166.

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Ulus Travma Acil Cerrahi Derg 2023;29(10):1158-1166 DOI: 10.14744/tjtes.2023.35848 Submitted: 29.04.2023 Revised: 02.07.2023 Accepted: 02.08.2023
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use. Hundreds of e-scooters can now be found on streets and walkways, in addition to drivers, cyclists, and pedestrians. Marketed as an environmentally friendly way to reduce the number of cars and thus traffic, e-scooters have become immensely popular and have spread to many cities around the

world.^[2] Unfortunately, with the popularity of e-scooters, the number of accidents has increased and some of which caused high-energy traumas.^[3]

These devices can reach a speed of 25 km/h and even higher when going downhill. They are powered by rechargeable bat-

Table 1. Personal, environmental and e-scooter dependent variables of the accident

	Total (n=43)	
	n	%
Helmet use		
Yes	2	4.7
No	41	95.3
Educational status		
High school student	5	11.6
High school graduated	17	39.5
University graduated	21	48.8
Alcohol intoxication		
Yes	15	34.9
No	28	65.1
Does he/she know how to drive a bicycle or two-wheeled vehicle?		
Yes	43	100
More than one person was using the scooter?		
Yes	19	44.2
No	24	55.8
Do you think there was any problem with the vehicle?		
Brake did not work	6	14.0
Slipped when braking	4	9.3
Handlebar was loose	10	23.3
Automatic sudden braking when out of range	3	7.0
No	20	46.5
What was the purpose of using the e-scooter?		
Recreational	16	37.2
Transportation	27	62.8
Was the accident caused by non-compliance with traffic laws?		
Yes	8	18.6
No	35	81.4
Did the accident happen while the scooter was at full speed?		
Yes	13	30.2
No	30	69.8
Where did the accident happen?		
Driveway	16	37.2
Sidewalk	27	62.8
Was the floor wet at the time of the accident?		
Yes	15	34.9
No	28	65.1
How many times has he/she driven the e-scooter so far?		
I.	11	25.6
I–10.	11	25.6
10–100	21	48.8

Table 2. Emergency Service related datas and characteristics of the fractures

	Total (n=43)	
	n	%
How did he/she admitted to the emergency room?		
Ambulance	12	27.9
Self-presented	31	72.1
The time the trauma occurred		
11 pm-7 am	19	44.2
3 pm-11 pm	13	30.2
7 am-3 pm	11	25.6
Emergency department zones		
Red	7	16.3
Yellow	30	69.8
Green	6	14.0
Time of discharge		
Under 4 h	7	16.3
More than 4 h	17	39.5
Admitted to the orthopedic unit	19	44.2
Treatment		
Conservative	24	55.8
Surgery	19	44.2

Table 3. Characteristics of the fractures and treatment modalities

Type of fracture	Conservative	Surgery
Metacarpal fracture	3	1
Hand phalangeal fracture	3	3
Proximal femur fracture	-	1
Femur shaft fracture	-	1
Distal humerus fracture	-	2
Calcaneus fracture	-	1
Clavicle fracture	7	1
Metatarsal fracture	7	-
Both bone forearm fracture	-	2
Patella fracture	-	1
Distal radius fracture	2	5
Scaphoid fracture	2	-
Ulna shaft fracture	-	1

teries that can last 6–8 h depending on the brand and model.^[4] They are also equipped with front and rear lights, as well as two brakes. In Turkey, e-scooters can be used by adults who are 18 years old or older. Helmet use is not mandatory.

Badeau et al.^[5] reported that 44% of the emergency depart-

ment (ER) admissions following an e-scooter accident were major injuries, and 14% of the patients were operated on. Approximately 40% of patients had craniocerebral trauma, and extremity fractures were the second most common injury (31%).^[2,6] Although the e-scooter may seem like an innocent micro-mobility device, it should be kept in mind that it can cause life-threatening injuries.

This study aims to describe the demographic characteristics and extremity fracture patterns of patients admitted to the emergency department following an e-scooter accident and to identify common, correctable factors that increased the likelihood of accidents. Underlying causes were also evaluated with respect to the severity of injuries. In our opinion, this study will yield important information to achieve the prevention of accidents involving both e-scooter users and pedestrians. The results of this study will be shared with government organizations that are responsible for road safety to raise awareness and help future planning.

MATERIALS AND METHODS

The study was conducted at Taksim Training and Research Hospital which is located in the heart of Istanbul- a busy city with a population of about 15 million. Location of the hospital is very close to the most crowded streets of Istanbul and the hospital often functions as a trauma Centre.

Patients with isolated extremity fractures following an e-scooter accident were included in the study. Having injuries regarding other body parts (head trauma, abdominal injury, pelvis fracture, and vertebra fracture), having injuries following electric bicycle, electric skateboard, and self-balancing scooter use were designated as exclusion criteria.

Data regarding the type of admission to the emergency department (by an ambulance or self-presented, etc.), the date and the time of the trauma, personal factors (e.g., education level, helmet use during the accident, alcohol use during the accident, number of people using the e-scooter together, past experience of e-scooter use, etc.), purpose of use (transportation or recreational), e-scooter malfunction, compliance with traffic laws, speed of e-scooter, wetness of the ground, location of the accident (sidewalk, driveway, etc.), emergency department triage level (red, yellow, and green), admission and discharge information, the type of fracture, and treatment modality (conservative or surgical) were prospectively collected and evaluated by 2 observers (YK, SU) between January 2022 and August 2022 (Tables 1-3). This study was approved by the local ethics committee of Gaziosmanpaşa Training and Research Hospital.

Statistics Analysis

SPSS 15.0 for Windows program was used for statistical analysis. Descriptive statistics; were given as numbers and percentages for categorical variables. The rates in the groups were compared with the Chi-square test. The alpha significance level was accepted as P<0.05.

RESULTS

Forty-three patients who met the inclusion criteria were included in the study. The mean age of the patients was 35.9 (16–61 years) and 46% were women (n=20). The study revealed that 65.3% of patients had upper extremity injuries, while 34.7% had lower extremity injuries and there were no patients with pelvic or spinal injuries in the dataset. The patients were divided into two groups: Group 1, consisting of fractures requiring conservative treatment, and Group 2, consisting of fractures requiring surgical treatment. There was no statistically significant relationship between the gender and Groups ($P>0.05$) likewise there was no statistically significant relationship between the age and the Groups ($P>0.05$) (Tables 4 and 5). While 31 patients (72.1%) were self-presented to the emergency department, 12 patients (27.9%) were brought by ambulance. Furthermore, 16.3% of the patients were admitted to the red zone, 69.8% to the yellow zone, and 14% to the green zone in the emergency department.

Group 2 mostly occurred between 11 pm and 7 am ($P<0.001$). Group 2 was mostly high school graduates ($P<0.001$). Alcohol use and recreational scooter use rates were statistically higher in Group 2 when compared to Group 1 ($P<0.001$ for both). The number of patients who reported a malfunction in the e-scooter was significantly lower in Group 2 compared to Group 1 ($P<0.001$). The rates of accidents due to driving at full speed of the e-scooter, use on the driveway and presence of wet ground at the time of the accident were higher in the Group 2 ($P<0.001$). Group 2 also had a higher rate of being 1st time e-scooter users when compared to the other groups ($P<0.001$) (Table 6).

DISCUSSION

The usage of e-scooters has been increasing due to their practicality, individuality, and eco-friendliness. They can be easily integrated with public transportation and can be used instead of vehicles for short-distance transportation, thus increasing micro-mobility in cities and reducing traffic congestion. In a study conducted in the US, it was found that 45% of urban trips were made for distances of 5 km or less, and 78% of these trips were made using personal vehicles. Therefore, e-scooters have become the preferred means of transportation due to their economic benefits, fast travel, and traffic reduction. After Turkey's first rentable e-scooter company

was founded in 2018, e-scooters began to appear on the streets of Istanbul in 2019. With the COVID-19 pandemic and people's desire for isolated public transportation, numerous companies began to provide services in 2020, thereby increasing their prevalence in the city. The increased usage of e-scooters has brought a new phenomenon: e-scooter accidents.^[7]

E-scooter accidents have become increasingly prevalent in emergency department over the past 3 years. Numerous studies defined these accidents as a major public health issue.^[8] According to a systematic review, the frequency of e-scooter injuries was reported to be 115 per million trips, which is higher than the rates for motorcycle, bicycle, car, and pedestrian injuries (104/15/8/2 per million trips, respectively).^[9] The mean age of the participants in our study was 35.9 years (ranging from 16 to 61 years), and the male-to-female ratio was 54:46. In many studies, the age range was between 20 and 40 years old, and the gender ratios were similar.^[10,11] Therefore, our study is consistent with the literature. E-scooter accidents mainly affect the younger population, and the age and gender ratios are similar among study groups.

According to the study, 55.8% (n=24) of the patients were treated conservatively, while 44.2% (n=19) were treated surgically. In a study on traumas and types of injuries in accidents, it was reported that fractures were detected in 46.9% of accidents, and 49.5% of these fractures were treated surgically.^[8] Another study showed that patients with extremity fractures were more likely to undergo surgery than those with cranio-cerebral fractures.^[10] Therefore, we can say that e-scooter accidents often cause orthopedic injuries and require surgery for a majority of cases. Hence, we can define e-scooter accidents as high-energy trauma (Fig. 1).^[7]

Table 4. Relationship between gender and groups

	Group		P-value
	Operated (%)	Conservative (%)	
Gender			
Female	10 (50)	10 (50)	0.683
Male	9 (39.1)	14 (60.9)	

Chi-square test. ** $P<0.01$. There was no statistically significant relationship between gender and the groups ($P>0.05$).

Table 5. Relationship between age and groups

	n	Ort±Ss	Min-Max (Median)	P-value
Age				
Operated	19	35.79±12.42	19–60 (32)	0.922
Conservative	24	36.04±14.85	16–61 (33)	

Mann Whitney U Test * $P<0.05$, ** $P<0.01$. There was no statistically significant relationship between age and the groups ($P>0.05$).

Table 6. Evaluation of personal and e-scooter-related issues according to the treatment method

	Treatment				P-value
	Conservative		Surgery		
	n	%	n	%	
How did he/she admitted to the emergency room?					
Ambulance	4	16.7	8	42.1	0.065
Self-presented	20	83.3	11	57.9	
The time the trauma occurred					
11 pm-7 am	4	16.7	15	78.9	<0.001
3 pm-11 pm	11	45.8	2	10.5	
7 am-3 pm	9	37.5	2	10.5	
Helmet use					
Yes	1	5	1	6	
No	23	95	18	94	
Educational status					
High school student	5	20.8	0	0.0	<0.001
High school graduated	3	12.5	14	73.7	
University graduated	16	66.7	5	26.3	
Alcohol intoxication					
Yes	1	4.2	14	73.7	<0.001
No	23	95.8	5	26.3	
What was the purpose of using the e-scooter?					
Recreational	3	12.5	13	68.4	<0.001
Transportation	21	87.5	6	31.6	
Does he/she know how to drive a bicycle or two-wheeled vehicle?					
Yes	24	100	19	100	-
More than one person was using the scooter?					
Yes	8	33.3	11	57.9	0.107
No	16	66.7	8	42.1	
Do you think there was any problem with the vehicle?					
Brake did not work	5	20.8	1	5.3	0.001
Slipped when braking	2	8.3	2	10.5	
Handlebar was loose	10	41.7	0	0.0	
Automatic sudden braking when out of range	1	4.2	2	10.5	
No	6	25.0	14	73.7	
Was the accident caused by non-compliance with traffic laws?					
Yes	1	4.2	7	36.8	0.014
No	23	95.8	12	63.2	
Did the accident happen while the scooter was at full speed?					
Yes	0	0.0	13	68.4	<0.001
No	24	100.0	6	31.6	
Where did the accident happen?					
Driveway	0	0.0	16	84.2	<0.001
Sidewalk	24	100.0	3	15.8	
Was the floor wet at the time of the accident?					
Yes	3	12.5	12	63.2	0.001
No	21	87.5	7	36.8	
How many times has he/she driven the e-scooter so far?					
1.	0	0.0	11	57.9	<0.001
1-10.	6	25.0	5	26.3	
10-100	18	75.0	3	15.8	

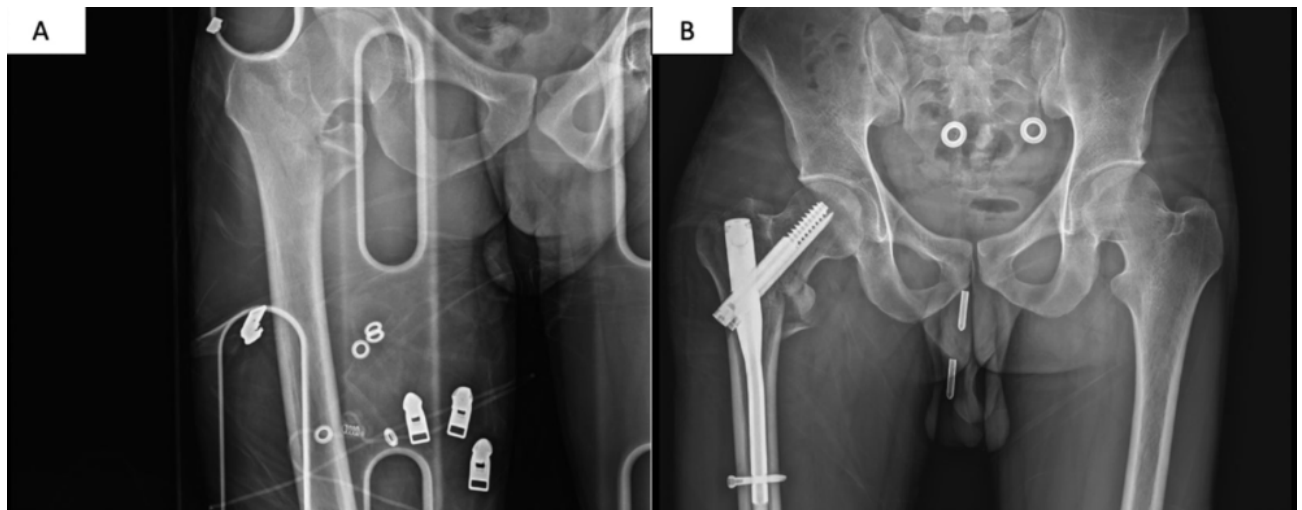


Figure 1. Radiological images of intertrochanteric hip fracture related to e-scooter accident. (a): Preoperative hip X-ray (b): Postoperative pelvis X-ray

Among our study population, 11.6% were high school students ($n=5$), 39.5% were high school graduates ($n=17$), and 48.8% were university graduates ($n=21$). In Group 1, which was treated conservatively, the ratio of high school students/high school graduates/university graduates was 20.8%/12.5%/66.7%, while in Group 2, which underwent surgery, the ratio was 0%/73.7%/26.3%. The difference in high school graduation rates between the two groups was statistically significant. Higher-educated patients were more often treated conservatively, while those with lower education were more likely to undergo surgical treatment. We believe that this could be explained by the tendency of educated individuals to follow rules related to speed regulation and to be more cautious.

While 65.1% ($n=28$) of the patients included in the study had upper extremity fractures, 34.9% ($n=15$) had lower extremity fractures. Many studies and systematic reviews have reported that upper extremity fractures are more commonly seen than lower extremity fractures in such accidents.^[7,11-13] Uluk et al. found in their study that the lower extremity was more commonly affected (soft-tissue injuries) in these accidents, but that fractures were more common in the upper extremity.^[13] This phenomenon can be explained by the fact that e-scooter accidents often result in falls onto the open hand or upper extremity due to sudden stops, loss of balance on the scooter, and similar causes, as opposed to collisions with other vehicles or stationary objects.

The time of the trauma was also recorded as an important parameter that affects the frequency of injuries. In our study, the periods were divided as 11 pm-7 am, 3 pm-11 pm, and 7 am-3 pm, and the injuries were recorded as 44.2%, 30.2%, and 25.6%, respectively. The highest frequency of injuries occurring at night is consistent with many other studies.^[7,8,10] In addition, most patients in Group 2 (78.9%) had their accidents during the night time (11 pm-7 am). The higher inci-

dence of both accidents and surgically treated injuries at night can be explained by several theories. Usually, driving during this time is for entertainment purposes, and drivers may behave more relaxed and not follow traffic rules due to reduced traffic congestion and alcohol consumption. The study reported that 34.9% ($n=15$) of the participating patients were intoxicated, but this figure was not confirmed by an ethanol test. Some patients who claimed to be sober may not have reported accurately, so this figure may be slightly lower than the actual rate. In Group 1, the rate of alcohol use was 4.2%, whereas it was 73.7% in Group 2. Many studies have indicated that alcohol consumption increases the risk of e-scooter injuries, and the rate of intoxicated drivers ranges from 5.2% to 45.8%.^[10,13,14] Furthermore, it has been reported that intoxicated patients are more likely to experience major trauma and head injuries. In our study, we believe that intoxicated patients were more frequently exposed to high-energy trauma, which led to an increased likelihood of surgical treatment. In Germany, the use of e-scooters under the influence of alcohol is prohibited, and penalties are imposed. Some publications have recommended banning e-scooters from being used at night to reduce accidents, considering the combination of night-time use and alcohol.^[7]

All patients who participated in our study stated that they knew how to ride a bicycle or a two-wheeled vehicle, but 25.6% of the patients reported riding a scooter for the 1st time. Of the patients, 51.2% reported having ridden a scooter a maximum of 10 times, indicating that more than half of the patients can be considered inexperienced in terms of e-scooter use. The 1st time usage rate was 0% in Group 1, while it was 57.9% in Group 2. It has been determined that patients who lack experience in e-scooter use require surgical treatment more frequently. Young age, lack of experience, and lack of a driver's license are reported to be risk factors for e-scooter accidents.^[13,14] In many countries, including ours, an age limit has been imposed on e-scooter use (16

years), but practices such as requiring a driver's license or a special e-scooter license are not legally mandatory. Studies have also been conducted showing that experienced patients have more severe accidents. This is attributed to their high self-confidence in driving and their travel at higher speeds, disregarding traffic rules.^[2]

53.5% of the patients participating in our study reported technical malfunctions in the vehicles they used. These were listed as brake failure, the vehicle slipping when brakes were applied, looseness of the scooter handlebars, and the vehicle automatically braking when exceeding the range. In Group 1, handlebar looseness was blamed the most (41.7%), while in Group 2, 73.7% reported no problems with the vehicle. This can be explained by the fact that patients in Group 2 were less experienced drivers. Patients who do not have sufficient knowledge about the use and operation of the scooter may not notice a problem with the vehicle. In this regard, the vehicles rented by scooter rental companies should be regularly inspected by the government.

37.2% of the patients in our study reported having had an accident while using a scooter for recreational purposes, with the rate being 12.5% in Group 1 and 68.4% in Group 2. Many studies have reported an increase in accidents during hot weather and on weekends when recreational rides become more frequent.^[2,12] We observed that patients who used scooters for recreational purposes had more frequent major fractures requiring surgery. Riding under the influence of alcohol, at night, and for recreational purposes can often have a combined effect in causing such accidents in drivers who are reckless, impaired, have low decision-making abilities, and are drowsy.^[10,14]

34.9% of our patients reported that the surface they were riding on was wet. This rate was 12.5% in Group 1 and 63.2% in Group 2 ($P < 0.001$). Patients who had accidents on wet surfaces were seen to require surgery more frequently. Wet surfaces and road defects make driving more difficult, increase the incidence of accidents, and cause existing accidents to have higher energies.^[15]

37.2% of our patients were on the driveway while riding and 62.8% were on the sidewalk. All patients in Group 1 rode on the sidewalk, while 84.2% of patients in Group 2 had accidents on the driveway. Although the use of scooters on sidewalks is prohibited in many countries, some drivers prefer to use these routes because they feel safer. It has been reported in many articles that accidents on the driveway are more energetic and often require surgery because driving is done at higher speeds.^[2,12] Indeed, 30.2% of our patients reported being at full speed during the accident. This rate was 0% in Group 1 and 68.4% in Group 2 ($P < 0.001$). High speed and low reaction time increase the likelihood of larger traumas, thereby increasing the likelihood of requiring surgery.^[16] In an article discussing computational prediction of head-ground impact kinematics related to falling off a scooter, reducing the

speed from 30 km/h to 20 km/h resulted in a 14% reduction in the mean impact speed and a 12% reduction in the mean impact force, as predicted by the models. Therefore, low-speed usage reduces the severity of accidents.^[15] Although it is limited to 25 km/h in Turkey, usage at speeds even lower than this is safer. Our study also showed that having multiple people on a scooter increased the likelihood of requiring surgical treatment.

Our study showed that only 4.7% of the participants wore helmets. In many studies, the rate of helmet use was found to be quite low.^[3,8,17] The fact that helmet use is so low suggests that drivers may not fully understand the risks they face and perceive e-scooter riding as a more innocent activity. It is a known fact that helmet use in e-scooter, bicycle, and skateboard accidents can prevent or reduce the severity of concussions and severe traumatic brain injuries.^[16] Studies conducted in Brisbane/Australia after mandatory helmet use was introduced have reported increased helmet use and decreased craniocerebral events in scooter accidents.^[7] Helmet use is strongly recommended in numerous studies.^[2,7,8,13,15]

Many countries have introduced regulations to prevent e-scooter accidents. In Turkey, the e-scooter regulation published in April 2021 prohibits riding sideways, riding with two people, carrying loads, riding with one hand or performing acrobatic maneuvers, riding two scooters side by side on the road, and using them on highways and intercity roads. In addition, the age limit is set to be 16 years and older. The required features for the e-scooters include not exceeding the speed limit of 25 km/h, having a braking mechanism, having a front light that provides at least 20 meters of light, having a rear red reflector, and including a horn. Despite all these rules and regulations, e-scooter accidents and related morbidities continue to increase. Therefore, the need for additional regulations should be discussed. As mentioned earlier, the use of helmets should be made mandatory as it reduces the likelihood of craniocerebral trauma and related morbidities. Another important issue is the increased frequency of accidents and surgical requirements during night use. Night use and alcohol consumption significantly increase accident rates. Measures such as banning night use and conducting alcohol tests on e-scooter users can be taken as preventative measures.^[7] Reducing the speed limit further and having companies reduce the speed of vehicles with the help of GPS in congested areas have also been discussed in some articles.^[2,14] Measures that municipalities can take include improving driving surfaces, increasing separated roads such as bike lanes, and encouraging e-scooter use on these roads.^[15,20] Another factor that increases the accident rate and surgical intervention needed is inexperienced drivers. Therefore, in some countries, a driver's license is mandatory.^[13] Although licensed drivers may be more knowledgeable about traffic rules and driving safety, they may be inexperienced in e-scooter use. Therefore, measures such as e-scooter-specific licenses and e-scooter driving courses before obtaining the license should be discussed by

authorities. The current rules should also be more strictly enforced by the government.

Our study has some limitations. To obtain more meaningful results, a larger number of patients would be necessary. We based some discussions on the assumption that patients requiring surgery generally suffer from higher-energy traumas, but sometimes low-energy traumas can also require surgery (such as intra-articular fractures or patient-specific factors). The patients included in our study did not have known medication use or diseases that could cause osteoporosis, but DEXA measurements were not performed on them. These factors can be considered as limitations of the study.

CONCLUSION

The use of e-scooters is increasing due to its many positive aspects. Therefore, naturally, the number of related accidents and injuries is also increasing. Although governments have introduced many regulations regarding e-scooter use, the current situation seems insufficient in solving the problem. E-scooter users should be educated about the risks associated with riding. Authorities should tighten their supervision of both scooter rental companies and drivers. Nighttime usage conditions should be reviewed, and the use of alcohol should be controlled. The use of helmets should be made mandatory. If such regulations are tightened, accident rates can be reduced or high-energy impacts from existing accidents can be avoided. It has been observed that experienced, slow, non-alcoholic, and rule-abiding drivers require less operative treatment. We hope that this article will create awareness among users and in the literature about the issues discussed.

Ethics Committee Approval: This study was approved by the Gaziosmanpaşa Training and Research Hospital Ethics Committee (Date: 19.01.2022, Decision No: 15).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: Y.K., M.N.T., S.U.; Design: Y.K., M.N.T.; Supervision: Y.K., M.N.T.; Resource: Y.K., M.N.T., S.U.; Materials: Y.K., S.U.; Data collection and/or processing: Y.K., S.U.; Analysis and/or interpretation: Y.K., M.N.T.; Literature search: Y.K., M.N.T.; Writing: Y.K., M.N.T.; Critical review: Y.K., M.N.T.

Conflict of Interest: None declared.

Financial Disclosure: The author declared that this study has received no financial support.

REFERENCES

- Liew YK, Wee CP, Pek JH. New peril on our roads: A retrospective study of electric scooter-related injuries. *Singapore Med J* 2020;61:92–5.
- Ishmael CR, Hsiue PP, Zoller SD, Wang P, Hori KR, Gatto JD, et al. An early look at operative orthopaedic injuries associated with electric scooter accidents: Bringing high-energy trauma to a wider audience. *J Bone Joint Surg Am* 2020;102:e18. [\[CrossRef\]](#)
- Trivedi TK, Liu C, Antonio AL, Wheaton N, Kreger V, Yap A, et al. Injuries associated with standing electric scooter use. *JAMA Netw Open* 2019;2:e187381. [\[CrossRef\]](#)
- Allem JP, Majmundar A. Are electric scooters promoted on social media with safety in mind? A case study on Bird's Instagram. *Prev Med Rep* 2019;13:62–3. [\[CrossRef\]](#)
- Badeau A, Carman C, Newman M, Steenblik J, Carlson M, Madsen T. Emergency department visits for electric scooter-related injuries after introduction of an urban rental program. *Am J Emerg Med* 2019;37:1531–3. [\[CrossRef\]](#)
- Trivedi B, Kesterke MJ, Bhattacharjee R, Weber W, Mynar K, Reddy LV. Craniofacial injuries seen with the introduction of bicycle-share electric scooters in an urban setting. *J Oral Maxillofac Surg* 2019;77:2292–7.
- Moftakhar T, Wanzel M, Vojcsik A, Kralinger F, Mousavi M, Hajdu S, et al. Incidence and severity of electric scooter related injuries after introduction of an urban rental programme in Vienna: A retrospective multicentre study. *Arch Orthop Trauma Surg* 2021;141:1207–13. [\[CrossRef\]](#)
- Coelho A, Feito P, Corominas L, Sánchez-Soler JF, Pérez-Prieto D, Martínez-Díaz S, et al. Electric scooter-related injuries: A new epidemic in orthopedics. *J Clin Med* 2021;10:3283. [\[CrossRef\]](#)
- Ioannides KL, Wang PC, Kowsari K, Vu V, Kojima N, Clayton D, et al. E-scooter related injuries: Using natural language processing to rapidly search 36 million medical notes. *PLoS One* 2022;17:e0266097. [\[CrossRef\]](#)
- Kim WC, Campbell AR. Common injury patterns from standing motorized scooter crashes. *Curr Surg Rep* 2021;9:8. [\[CrossRef\]](#)
- Tischler EH, Laurent Tsai SH, Wolfert AJ, Suneja N, Naziri Q, Tischler HM. Orthopedic fracture hospitalizations are revving up from E-Scooter related injuries. *J Clin Orthop Trauma* 2021;23:101607. [\[CrossRef\]](#)
- Cruz ND, Morgan C, Morgan RV, Tanna S, Talwar C, Dattani R, et al. Injury patterns of E-Scooter-related orthopaedic trauma in central London: A multicentre study. *Ann R Coll Surg Engl* 2022;104:187–94.
- Uluk D, Lindner T, Dahne M, Bickelmayer JW, Beyer K, Slagman A, et al. E-Scooter incidents in Berlin: An evaluation of risk factors and injury patterns. *Emerg Med J* 2022;39:295–300. [\[CrossRef\]](#)
- Harbrecht A, Hackl M, Leschinger T, Uschok S, Wegmann K, Eysel P, et al. What to expect? Injury patterns of Electric-Scooter accidents over a period of one year—a prospective monocentric study at a Level 1 Trauma Center. *Eur J Orthop Surg Traumatol* 2022;32:641–7. [\[CrossRef\]](#)
- Posirisuk P, Baker C, Ghajari M. Computational prediction of head-ground impact kinematics in. *Accid Anal Prev* 2022;167:106567. [\[CrossRef\]](#)
- Störmann P, Klug A, Nau C, Verboker RD, Leiblein M, Müller D, et al. Characteristics and injury patterns in Electric-Scooter related accidents—a prospective two-center report from Germany. *J Clin Med* 2020;9:1569.
- Xu J, Shang S, Yu G, Qi H, Wang Y, Xu S. Are electric self-balancing scooters safe in vehicle crash accidents? *Accid Anal Prev* 2016;87:102–16. [\[CrossRef\]](#)
- Lewis LM, West OC, Standeven J, Jarvis HE. Do wrist guards protect against fractures? *Ann Emerg Med* 1997;29:766–9. [\[CrossRef\]](#)
- Flaherty DJ, Morgan C, Dela Cruz NJ, Morgan RV, Sarraf KM, Sinnott T, et al. Foot and ankle injuries related to the use of E-Scooters—A case series and a review of literature. *Foot (Edinb)* 2022;51:101873. [\[CrossRef\]](#)
- Ahluwalia R, Grainger C, Coffey D, Malhotra PS, Sommerville C, Tan PS, et al. The E-Scooter pandemic at a UK major trauma centre: A cost-based cohort analysis of injury presentation and treatment. *Surgeon* 2022;40:1–7.

ORJİNAL ÇALIŞMA - ÖZ

E-scooter kullanımı: Eve gitmek için kolay bir yol mu yoksa bir kabus mu? E-skuter kazalarına ortopedik bakış**Dr. Yiğit Kültür,¹ Dr. Mehmed Nuri Tütüncü,² Dr. Suat Ulutaş³**¹Yeni Yüzyıl Üniversitesi, Özel Gaziosmanpaşa Hastanesi, Ortopedi ve Travmatoloji Anabilim Dalı, İstanbul, Türkiye²İstanbul Medeniyet Üniversitesi, Göztepe Eğitim ve Araştırma Hastanesi, Ortopedi ve Travmatoloji Anabilim Dalı, İstanbul, Türkiye³Taksim Eğitim ve Araştırma Hastanesi, Ortopedi ve Travmatoloji Kliniği, İstanbul, Türkiye

AMAÇ: Kullanım kolaylığı ve düşük maliyeti nedeniyle topluluğumuzda e-skuter kullanımı hızla artmıştır. Bu durumla ilişkili olarak yüksek enerjili travmalara neden olan kazaların sayısında da artış görülmüştür. Bu çalışmanın amacı, e-skuter kazası sonrası acil servise başvuran hastaların demografik özelliklerini, kırık paternlerini tanımlamak ve kaza olasılığını artıran, sık karşılaşılan, düzeltilebilir faktörleri belirlemektir.

GEREÇ VE YÖNTEM: E-skuter kazası nedeniyle acil servise Ocak 2022 ile Ağustos 2022 tarihleri arasında başvuran ve ekstremitte kırığı meydana gelen 43 hasta (20 kadın, 23 erkek) çalışmamıza dahil edildi. Hastalar cerrahi ve konservatif olarak tedavi edilenler olmak üzere 2 gruba ayrıldı. Kazanın gerçekleştiği zaman dilimi, sürücünün eğitim düzeyi, sürüş esnasındaki alkol kullanımı, e-skuter cihaz anzası, trafik kurallarına uyum gibi parametreler üzerinden değerlendirme yapıldı.

BULGULAR: Cerrahi tedavi gerektiren kazaların en sık 23.00-07.00 saatleri arasında meydana geldiği görüldü. Cerrahi tedavi uygulanan hastaların çoğunluğu lise mezunuydu. Konservatif olarak tedavi edilen hastalara göre cerrahi uygulanan hastalarda alkol kullanımı ve eğlence amaçlı scooter kullanım oranları istatistiksel olarak daha yüksekti. E-skuter'de arıza bildiren hasta sayısı opere edilen grupta konservatif olarak tedavi edilen gruba göre anlamlı olarak daha düşüktü. Cerrahi tedavi uygulanan grupta trafik kurallarına uymama, e-skuter'in son hızda kullanılması, araç yolunda kullanılması ve kaza anında ıslak zeminin bulunması nedeniyle kaza oranları daha yüksekti. Cerrahi grubun e-skuter cihazını ilk kez kullanma oranı da daha yüksekti.

SONUÇ: Yönetimler her ne kadar e-skuter kullanımına ilişkin birçok düzenleme getirmiş olsa da mevcut durum sorunların çözümünde yetersiz görünmektedir. E-skuter kullanıcıları meydana gelebilecek riskler hakkında daha fazla bilgilendirilmeli ve eğitilmelidir. Yetkililer, e-skuter kiralama şirketleri ve sürücüler üzerindeki denetimlerini sıklaştırmalıdır. Gece kullanım koşulları gözden geçirilmeli ve cihazın alkollü kullanımı kontrol altına alınmalıdır. Kask kullanımı zorunlu olmalıdır. Bu tür düzenlemeler sıklaştırılırsa, kaza oranları azaltılabilir veya yüksek enerjili yaralanmalar önenebilir. Sonuçlar deneyimli, yavaş, alkolsüz ve kurallara uyan sürücülerin daha az cerrahi tedavi gerektirdiğini göstermektedir. Bu makalenin farkındalığı arttıracağını ve e-skuter düzenlemelerini iyileştireceğini umuyoruz.

Anahtar sözcükler: E-skuter; kaza; kırık.

Ulus Travma Acil Cerrahi Derg 2023;29(10):1158-1166 DOI: 10.14744/tjtes.2023.35848