The Impact of E-Scooter Use on Orthopaedic Trauma in Denver, Colorado

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INTRODUCTION:

Electronic application-based scooters (e-scooters) have been introduced to major United States cities in the past several years. In Denver, Colorado, scooters were introduced on a large scale in July of 2018. Preliminary studies in other cities have identified that motorized scooters are the source of major orthopaedic injuries, with the most common fracture locations being the distal upper extremity, proximal upper extremity, distal lower extremity, and face.

Our study aimed to characterize the types of orthopaedic injuries that occur, and of those, which were operative. We hypothesized that e-scooter accidents would pose a significant economic burden in terms of hospital charges, Emergency Department (ED) visits, and surgical interventions related to the treatment of injuries sustained from e-scooters. Specifically, we predicted an overall increase in Emergency Department visits related to scooter accidents, and an increase in both nonsurgical and operative orthopaedic fractures as well as other injuries after the widespread introduction of app-based scooters to Denver. We also predicted that of those patients tested, a large proportion would be intoxicated despite the explicit prohibition of substance use while using a scooter.

METHODS:

A retrospective review of electronic medical records from a level 1 trauma center was performed. We identified all patients presenting to the ED with scooter-related injuries during two time periods: August 1, 2016-February 1, 2018 (prior to introduction of e-scooters) and August 1, 2018-February 1, 2020 (after widespread introduction of e-scooters). Data collection included patient demographics, intoxication status, injury characteristics, operative intervention, admission length of stay, and hospital charges accrued.

RESULTS:

A total of 197 included patients sustained scooter-related injuries after the introduction of e- scooters, compared to 23 patients prior to their introduction. Hospital charges for treatment of all injuries increased from $1.8M to $7.6M in the time periods reviewed. After the introduction of e-scooters, 34% (n=66) of patients incurred a hospital stay (average length of stay 11 days) and 40% (n=78) required a related surgery. The majority of injured patients were male (63%) and 6.3% (n=8) sustained open fractures. The most common fractures observed after introduction of e-scooters included those of the upper extremity (Table 1), comprising 64% of total orthopaedic injuries. Distal radius, proximal radius, and metacarpal fractures were the most common upper extremity fractures, comprising 14.4%, 11.8%, and 6.5% of orthopaedic injuries. The most common lower extremity injuries included: proximal tibia fractures, ankle fractures, and tibial shaft fractures, comprising 7.8%, 7.2%, and 3.3% of orthopaedic injuries, respectively (Figures 1 and 2). Patients were not routinely tested for intoxication. However, of the 28% of patients tested for substance use upon admission, 73% met criteria for intoxication.

Among orthopaedic only injuries, we found a significantly higher rate of intra-articular fractures (66 patients, 51.6% vs. 5 patients, 25%) after the introduction of e-scooters. We did not find that e-scooter introduction increased the rate of open fractures, operative fractures, or average cost of hospital stay. Average length of stay in days trended higher in the more recent group, though it did not reach significance (8.6 days in first group, 15.5 in second group, P= 0.62). Additionally, the first group had a statistically higher rate of hospital admission than the second group (50% vs. 27.3% requiring admission). Patients were not routinely tested for intoxication; only 40% of patients were tested pre-initiation (with 66.7% of those intoxicated) and only 28% were tested post-initiation (with 73% of those intoxicated.

DISCUSSION AND CONCLUSION:

The introduction of e-scooters to a major metropolitan city has resulted in a significant health burden to the population, particularly with respect to orthopaedic injuries. The study highlights significant cost associated with scooter-related injuries, which could potentially guide policies surrounding personal protective equipment and safety while riding.

Figure 1: Scooter Injuries from August 1, 2016-February 1, 2018

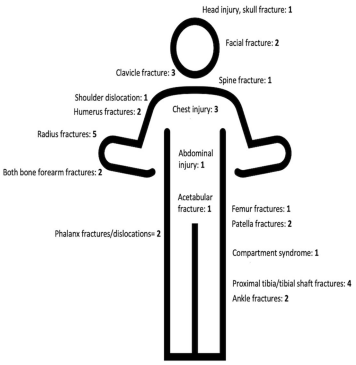

Table 1. Demographics and impact of upper extremity injuries related to e-scooters

Isolated upper extremity injuries	Pre-initiation Aug 1 2016-Feb 1 2018	Post-initiation Aug 1 2018-Feb 1 2020	p-value
n	13	84	
Male (%)	10 (77%)	49 (58%)	0.2381
Average age (STD)	21 (22)	33 (12)	***0.0066**
Open fractures (%)	1 (8%)	5 (6%)	0.5887
Intra-articular (%)	2 (15%)	40 (48%)	***0.0361**
Operative fractures (%)	3 (23%)	43 (51%)	0.0762
Admission (%)	4 (31%)	16 (19%)	0.4593
Average LOS (STD)	7.5 (7.4)	78 (91)	0.3754
Average ISS (STD)	1.4 (0.9)	3.6 (3.1)	***0.0151**
Average cost/injury	$15,782	$25,190	0.4494
Total cost	$189,392	$2,115,954	

STD, standard deviation
LOS, length of hospital stay
ISS, injury severity score
*p-value <0.05

Figure 2: Scooter Injuries from August 1, 2018-February 1, 2020 (After E-Scooter Introduction)