How Safe Is Your Motorcycle Helmet?

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Purpose: Motorcycle crash helmets do not totally prevent head and facial trauma. The aim of this study was to investigate if protection offered by helmets differs according to helmet type.

Materials and Methods: In this retrospective cohort study, outpatient records of motorcyclists were analyzed for the Facial Injury Severity Scale (FISS), traumatic brain injury (TBI), facial fractures, and helmet use. Statistical analysis was conducted using the Fisher and Bonferroni tests, bivariate regression analysis, and 1-way analysis of variance.

Results: There were 253 motorcyclists who sustained craniomaxillofacial injuries and were referred for outpatient treatment (men, 88.9%; mean age, 29.64 ± 11.6 yr); 60.1% had up to 9 years of formal education; 156 patients reported not using crash helmets, 51 were using open-face helmets, and 46 were using full-face helmets. The mean FISS score was significantly higher for unhelmeted riders compared with full-face helmet riders (P = .047), with no difference between unhelmeted riders and open-face helmet users (P = 1.00). Results for TBI were statistically greater for those wearing open-face helmets compared with full-face helmets (P = .035).

Conclusion: In this study, a large percentage of motorcyclists had facial fractures and TBI, and crash helmets did not always offer adequate protection against craniomaxillofacial injury, especially open-face helmets. Thus, further investigation into helmet types and quality of protection offered is recommended.

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Road traffic accidents are a major problem in public health, representing one of the predominant causes of mortality and morbidity. According to World Health Organization estimates, there are more than 1.2 million deaths related to road traffic accidents each year, and millions more are injured or disabled in these accidents.[1] This represents a heavy burden on public health services at global, national, and regional levels, costing up to 2% of the Brazilian gross national product. Preventive measures are being developed to improve road safety, but much more is required to halt or reverse the increasing trend of road traffic deaths.[1,2]

Currently, there is a global trend for motorization, which in low- and middle-income countries is represented by an explosion in the use of 2-wheel vehicles.[2] The use of crash helmets has been the subject of many studies, pointing out their efficiency in decreasing mortality and morbidity compared with motorcyclists who did not use this protective measure.[3-7] According to the WHO Statistical Information System (WHOSIS),

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Census Bureau and the Brazilian Ministry of Health, and the National Mortality Information System, mortality rates of motorcyclists in 67 countries were calculated, and Brazil ranked second place with 7.1 deaths per 100,000 inhabitants.[8]

Many countries have their own helmet laws. However, a review of the literature shows there are few studies that report the efficiency of different helmet types in decreasing the magnitude of head injuries.[9-12] From the authors' viewpoint, potential differences between helmet types have not been adequately explored to identify possible risks to users.

The purpose of this study was to compare the ability of 2 helmet types permitted by Brazilian legislation (full-face and open-face) to decrease injury.[13] A larger number of patients attended at the department of craniomaxillofacial surgery reported using open-face rather than full-face helmets; thus, the authors hypothesized that open-face helmets would offer less protection. To evaluate the different helmet types, patients were compared using the Facial Injury Severity Scale (FISS), presence and location of facial fractures, and presence of traumatic brain injury (TBI), with unhelmeted riders as the control.

Materials and Methods

STUDY DESIGN

To address the research purpose, the authors designed and implemented a retrospective cohort study. The study sample was derived from the population of all motorcycle accident victims referred to the Outpatient Clinic in the Department of Craniomaxillofacial Care and Surgery at Santa Casa de Misericórdia de Sobral Hospital (Sobral, Brazil) for the evaluation and management of craniomaxillofacial injuries from June 2010 through June 2011. This outpatient clinic at this hospital receives all patients with craniomaxillofacial injuries after discharge from the emergency department.

To be included in the study sample, motorcycle accident victims had to be referred to the outpatient clinic at the hospital. Patients were excluded as study subjects if they had incomplete hospital records or refused to participate.

STUDY VARIABLES

According to hospital records and information provided by the patients, a standardized trauma data sheet was filled in containing the following information:

- Predictor variable—use or nonuse and type of crash helmet (open-face or full-face)
- Outcome variables—FISS, presence and location of facial fracture, and TBI
- Other study variables—age, gender, and information on formal schooling

DATA COLLECTION METHODS

The FISS, elaborated by Bagheri et al,[14] was used to calculate the severity of facial injury. The FISS is represented as a numerical value according to the sum of all facial injuries, with a higher score indicating greater severity. In the FISS, the face is divided into horizontal thirds for bony injuries: *1)* mandible, *2)* midface, and *3)* upper face; in addition, the total combined length for all facial lacerations is incorporated.

The patients' trauma data sheets were analyzed using the FISS and attributed a FISS value. Two experienced and certified professionals evaluated all patient sheets 3 times, at different moments, independently. Thus, 3 different scores per professional were generated for each patient. An analyst blinded to the study calculated the mean of these 3 scores and then the mean between the 2 professionals, as seen in the following formula (a = professional 1; b = professional 2):

$$\text{Final FISS score} = \{[(a_1 + a_2 + a_3/3)] + [(b_1 + b_2 + b_3)/3]\}/2$$

The face was divided into horizontal thirds (upper face, midface, and mandible) by helmet structure[14] to identify the location of fractures (Fig 1). It was hypothesized that a full-face helmet would offer protection to all thirds, whereas the structure of the open-face helmet would offer protection only to the upper face.

In this study, the presence of TBI was classified according to the Head Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine,[15] which is defined as any period of loss of consciousness, any loss of memory for events immediately before or after the accident, any alteration in mental state at the time of the accident, or focal neurologic deficits (transient or not).

DATA ANALYSES

Statistically significant differences in study variables, namely age, gender, formal schooling, FISS scores, use and type of crash helmet, presence and area of facial fracture, and presence of TBI, were evaluated with the Fisher and Bonferroni tests for multiple comparisons. Regression analysis was used to identify relations between independent and dependent variables. One-way analysis of variance was used to test differences among the 3 groups. SPSS 17.0 for Windows (SPSS, Inc, Chicago, IL) was used for all analyses.

This study was approved by the ethics committee for research at Universidade do Grande Rio according to the ethical principles established by National Health Council Resolution 196/96 (CAAE 0033.0.317.000-10, National Commission of Ethics in Research).

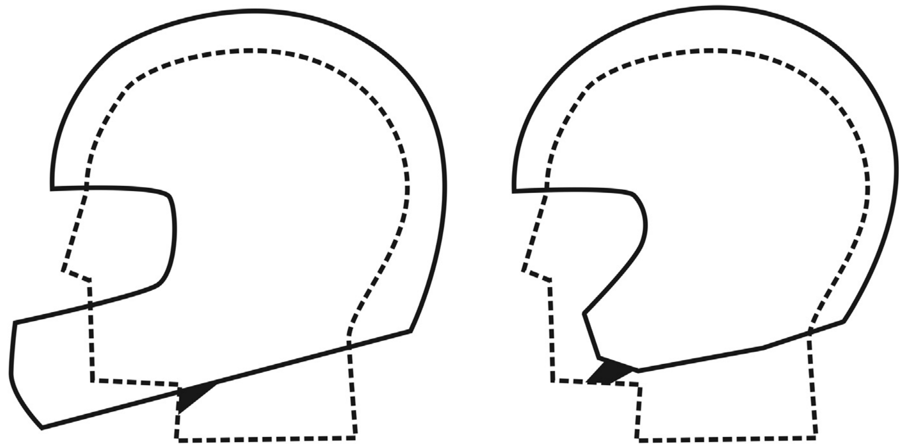

FIGURE 1. *Left,* Full-face helmet. *Right,* Open-face helmet.

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Results

Two hundred fifty-three motorcyclists who were victims of road traffic accidents and sustained craniomaxillofacial injuries were referred to the outpatient clinic at Santa Casa de Misericórdia de Sobral Hospital; 88.9% of patients were men (mean age, 29.64 ± 11.6 yr) and 60.1% had up to 9 years of formal education. Regarding the type of protection used, 156 patients (61.7%) reported that they were not using a crash helmet at the time of the accident; 51 (20.2%) were using open-face helmets; and 46 (18.2%) were using full-face helmets (Table 1).

Table 1 presents the results on the association between study variables and helmet use. Age and gender did not present a statistical association for helmet use. However, there was a statistically significant difference for schooling: motorcyclists with up to 9 years of formal schooling wore helmets less often than those with more education ($P = .0002$; Table 1).

In the regression analysis for age and FISS, there was no statistically significant association ($P = .950$). In the comparison between gender and FISS, women had higher mean FISS scores (3.95) than men (3.29), and the FISS score for patients with up to 9 years of formal schooling was higher; nevertheless, there were no statistically significant associations ($P = .335$ and .739, respectively). According to location of injury, the mean FISS score was significantly higher for those who sustained injury in the upper face ($P < .0001$; Table 2).

In the analysis for helmet use, there was a significant difference between helmet use and FISS score ($P = .05$). The mean FISS score for full-face helmet users was 2.28 ± 1.87 compared with 3.66 ± 3.76 for those

Table 1. STUDY VARIABLES VERSUS PREDICTOR VARIABLE, HELMET USE, IN MOTORCYCLISTS WHO SUSTAINED CRANIOMAXILLOFACIAL TRAUMA

Study Variable	No Helmet	Full-Faced Helmet	Open-Faced Helmet	*P* Value
Age (yr), mean ± SD	29.1 ± 11.4	31.0 ± 13.7	30.0 ± 9.8	.60*
Gender				.515†
Male	141 (62.67)	39 (17.33)	45 (20.00)	
Female	15 (53.57)	7 (25.00)	6 (21.43)	
Formal schooling				.0002†
0-9 yr	110 (71.43)	21 (13.64)	23 (14.94)	
≥10 yr	46 (46.46)	25 (25.25)	28 (28.29)	
Location of injury				
Upper face	25 (16.0)	1 (2.2)	2 (3.9)	
Midface or mandible	142 (91.03)	36 (78.26)	47 (92.12)	

Note: All numbers are absolute except those within parentheses, which represent percentages.

Abbreviation: SD, standard deviation.

* Based on 1-way analysis of variance.

† Based on Fisher and Bonferroni tests.

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Table 2. STUDY VARIABLES VERSUS PRIMARY OUTCOME VARIABLE, FISS SCORE, IN MOTORCYCLISTS WHO SUSTAINED CRANIOMAXILLOFACIAL TRAUMA

Study Variable	n (%)	FISS Score, Mean ± SD	*P* Value
Age (continuous)*			.950†
Gender			.335‡
Male	225 (88.93)	3.29 ± 3.39	
Female	28 (11.07)	3.95 ± 3.38	
Formal schooling			.739‡
0-9 yr	154 (60.87)	3.42 ± 3.72	
≥10 yr	99 (39.13)	3.27 ± 2.80	
Location of injury			
Upper face	28 (11.07)	8.76 ± 4.64	<.0001‡
Midface or mandible	225 (88.93)	3.70 ± 3.42	

Abbreviations: FISS, Facial Injury Severity Scale; SD, standard deviation.

* $R^2 = 0.000$; adjusted $R^2 = -0.004$; $F = 0.004$.

† Based on bivariate regression analysis.

‡ Based on Fisher and Bonferroni tests.

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not wearing helmets (*P* = .047). There were no significant differences between unhelmeted riders and those wearing open-face helmets or between open-face and full-face helmet users (*P* = 1.00 and .293, respectively; Table 3).

In the regression analysis for age and TBI, there was no significant relation between the variables (*P* = .768). The analysis between the study variables and the primary outcome variable TBI showed that a larger percentage of men (68.00) and patients with up to 9 years of formal schooling (68.83) had TBI. However, there were no statistically significant associations between these variables. In the analysis between location of injury and TBI, all motorcyclists with injury in the upper third of the face also had TBI compared with 65.33% of those who had injury in the midface or mandible (*P* = .0002; Table 4).

The presence of TBI differed according to helmet use (*P* = .03). One hundred eight of 156 motorcyclists (69.2%) without crash helmets had TBI compared with 24 of 46 (52.2%) who wore full-face helmets and 39 of 51 (76.5%) who wore open-face helmets. The results were significant in the comparison between open-face helmet motorcyclists and those wearing full-face helmets (*P* = .035). However, there was no statistically significant difference between open-face helmet users and unhelmeted riders (*P* = 1.00) and between unhelmeted and full-face helmet riders (*P* = .094; Table 5).

The regression analysis between age and fracture in the upper third of the face did not show any significant relation between the variables (*P* = .103). In the comparison between gender and formal schooling with the presence of fracture in the upper third of the face, there were no significant associations (*P* = .485 and .226, respectively). There was no significant association between age and fracture in the midface or mandible in the regression analysis (*P* = .877), between gender and fracture in the lower two thirds (*P* = .181), or between formal schooling and fracture in the lower two thirds (*P* = .424; Table 6).

After analysis for the presence of facial fracture in the horizontal thirds of the face, there was a significant association between the primary predictor variable and the presence of fracture in the upper horizontal third (*P* = .006). According to type of protection, the results were as follows: 25 of 156 patients (16.0%) without crash helmets had fractures to the upper face compared with 2 of 51 patients (3.9%) with open-face helmets and 1 of 46 patients (2.2%) with full-face helmets. The results were statistically significant for facial fracture in the upper third in the comparison between unhelmeted and full-face helmet riders and between unhelmeted and open-face helmet motorcyclists (*P* = .025 and .049, respectively); there was no significant difference between open-face and full-face helmets. In the comparison

Table 3. PRIMARY PREDICTOR VARIABLE, HELMET USE, VERSUS PRIMARY OUTCOME VARIABLE, FISS SCORE

Primary Predictor Variable	n	FISS Score, Mean ± SD	*P* Value: a × b × c	a × b	a × c	c × b
No helmet	156	3.66 ± 3.76				
Full-face helmet	46	2.28 ± 1.87				
Open-face helmet	51	3.42 ± 3.10	.050*	.047†	1.00†	.293†

Abbreviations: a, motorcyclists without helmets; b, motorcyclists with full-face helmets; c, motorcyclists with open-face helmets; FISS, Facial Injury Severity Scale; SD, standard deviation.

* Based on 1-way analysis of variance.

† Based on Fisher and Bonferroni tests.

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Table 4. STUDY VARIABLES VERSUS SECONDARY OUTCOME VARIABLE, TBI, IN MOTORCYCLISTS WHO SUSTAINED CRANIOMAXILLOFACIAL TRAUMA

Study Variable	n	TBI (Binary) (%)	*P* Value
Age (continuous)*			.768†
Gender			.694‡
Male	225	153 (68.00)	
Female	28	18 (64.29)	
Formal schooling			.600‡
0-9 yr	154	106 (68.83)	
≥10 yr	99	65 (65.66)	
Location of injury			.0002‡
Upper face	28	28 (100.0)	
Midface or mandible	225	147 (65.33)	

Abbreviation: TBI, traumatic brain injury.
* $R^2 = 0.001$; adjusted $R^2 = -0.004$; $F = 0.087$.
† Based on bivariate regression analysis.
‡ Based on Fisher and Bonferroni tests.

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between helmet use and fracture in the middle and lower thirds of the face, statistical significance was identified in the comparison between the groups (*P* = .038) and between no helmet and full-face helmets (*P* = .049; Table 7).

In the comparison between the study variables and the presence of facial fracture concomitantly with TBI, there was no significant relation between age and the presence of fracture (*P* = .571), gender and fracture (*P* = .540), and formal schooling and fracture (*P* = .856; Table 8). However, when helmet use was analyzed for the presence of facial fracture with TBI, significant associations were identified between the groups (*P* < .001), in the comparisons between no helmet and full-face helmets (*P* = .002), and between open-face helmets and full-face helmets (*P* = .003), but there was no statistical difference between open-face helmets and no helmets (*P* = 1.00; Table 9).

Discussion

The objective of this study was to compare the protection offered by 2 helmet types commonly used in Brazil (full-face and open-face helmets) using data from unhelmeted motorcyclists as the control. The results indicated that the protection offered varied according to helmet type, and in some situations, this protection was minimal or nonexistent.

Helmet distribution was as follows: 61.7% of motorcyclists were not wearing helmets at the time of accident, 20.2% were wearing open-face helmets, and 18.2% were wearing full-face helmets. In this study, the variable formal schooling was associated with helmet use: motorcyclists with more than 10 years of schooling wore helmets more frequently. However, the number of motorcyclists not wearing helmets is a serious matter that requires further investigation, because this is a legal requirement according to Brazilian traffic laws.

The FISS, which represents the severity of craniomaxillofacial injuries, indicated that patients with open-face helmets and without helmets had more severe injuries, with higher mean FISS scores of 3.42 and 3.66, respectively. However, the mean FISS score for riders wearing full-face helmets (2.28) was significantly lower than that for unhelmeted riders (*P* = .047), indicating that motorcyclists wearing full-face helmets develop less severe facial injuries. These results provided evidence that open-face helmets offered less protection against craniomaxillofacial injures.

The authors also identified inadequate protection when they analyzed for the presence of TBI. Patients who were not wearing helmets or who were wearing open-face helmets had equally bad outcomes (higher rates of TBI) compared with patients with full-face helmets. This is shown in the statistical differences between open-face helmet and no helmet (*P* = 1.00) and between open-face and full-face helmet (*P* = .035). These data show that open-face helmet users are at risk for TBI, providing evidence that this type of helmet

Table 5. PRIMARY PREDICTOR VARIABLE VERSUS SECONDARY OUTCOME VARIABLE, TBI

			P Value			
Primary Predictor Variable	n	TBI (Binary) (%)	a × b × c	a × b	c × a	c × b
No helmet	156	108 (69.2)				
Full-face helmet	46	24 (52.2)				
Open-face helmet	51	39 (76.5)	.030*	.094†	1.00†	.035†

Abbreviations: a, motorcyclists without helmets; b, motorcyclists with full-face helmets; c, motorcyclists with open-face helmets; TBI, traumatic brain injury.
* Based on 1-way analysis of variance.
† Based on Fisher and Bonferroni tests.

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Table 6. STUDY VARIABLES VERSUS OUTCOME VARIABLE, PRESENCE OF FRACTURE IN THE UPPER FACE AND MIDFACE OR MANDIBLE

Study Variable	n	Location of Injury	Presence of Fracture (Binary) (%)	P Value
Age (continuous)*		upper face		.103†
Gender		upper face		.485‡
Male	225		26 (11.56)	
Female	28		2 (7.14)	
Formal schooling		upper face		.226‡
0-9 yr	154		20 (12.99)	
≥10 yr	99		8 (8.08)	
Age (continuous)§		midface or mandible		.877†
Gender		midface or mandible		.181‡
Male	225		198 (88.00)	
Female	28		27 (96.43)	
Formal schooling		midface or mandible		.424‡
0-9 yr	154		135 (87.66)	
≥10 yr	99		90 (90.91)	

* $R^2 = 0.011$; adjusted $R^2 = 0.007$; $F = 2.677$.
† Based on bivariate regression analysis.
‡ Based on Fisher and Bonferroni tests.
§ $R^2 = 0.000$; adjusted $R^2 = -0.004$; $F = 0.024$.

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did not offer adequate protection against this type of lesion.

By dividing the face into horizontal thirds, the authors were able to identify which thirds received or did not receive protection from the different types of helmet, with unhelmeted motorcyclists as the control. Data showed that the helmet types provided protection to the upper third compared with patients without helmets. However, this protection did not extend to the midface and mandible. Patients with open-face helmets and without helmets exhibited similar fracture rates in these regions (92.2% and 91%, respectively). Motorcyclists with full-face helmets had significantly fewer fractures in the midface and mandible, providing evidence that full-face helmets offered more protection against fractures in these areas.

After analyzing the motorcyclists who had facial fractures, the authors found that motorcycle riders with open-face helmets and those with no helmets had more TBIs than riders with full-face helmets. This evidence supports the idea that the open-face helmets offer little or no protection against TBI, probably because the structure of the helmet does not absorb enough energy from the impact; thus the energy is dissipated directly onto the face.

Table 7. PRIMARY PREDICTOR VARIABLE VERSUS OUTCOME VARIABLE, FRACTURE IN THE UPPER FACE AND MIDFACE OR MANDIBLE

				P Value			
Primary Predictor Variable	n	Location of Injury	Presence of Fracture (Binary) (%)	a × b × c	a × b	a × c	c × b
No helmet	156	upper face	25 (16.0)				
Full-face helmet	46	upper face	1 (2.2)				
Open-face helmet	51	upper face	2 (3.9)	.006*	.025†	.049†	1.00†
No helmet	156	midface or mandible	142 (91.03)				
Full-face helmet	46	midface or mandible	36 (78.26)				
Open-face helmet	51	midface or mandible	47 (92.16)	.038*	.049†	1.00†	.093†

Abbreviations: a, motorcyclists without helmets; b, motorcyclists with full-face helmets; c, motorcyclists with open-face helmets.
* Based on 1-way analysis of variance.
† Based on Fisher and Bonferroni tests.

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Table 8. STUDY VARIABLES VERSUS OUTCOME VARIABLE, FACIAL FRACTURE WITH TBI

Study Variable	n	Facial Fracture With TBI (Binary) (%)	P Value
Age (continuous)*			.571†
Gender			.540‡
Male	225	131 (58.22)	
Female	28	18 (64.29)	
Formal schooling			.856‡
0-9 yr	154	90 (58.44)	
≥10 yr	99	59 (59.60)	

Abbreviation: TBI, traumatic brain injury.
* $R^2 = 0.001$; adjusted $R^2 = -0.003$; $F = 0.322$.
† Based on bivariate regression analysis.
‡ Based on Fisher and Bonferroni tests.

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Data from the Centers for Disease Control and Prevention (Atlanta, GA) show that there are approximately 290,000 motor vehicle traffic-related TBIs annually, with more than 200,000 emergency department visits and more than 56,000 hospitalizations in the United States.[16] In another study conducted in 5 European countries, the investigators analyzed demographic, severity, and outcome measures of 5 types of road users (car drivers, car passengers, motorcyclists, bicyclists, and pedestrians) and concluded that TBI is significantly associated with road traffic accidents.[17]

Several investigators have identified that the use of motorcycle helmets is associated with lower injury severity, mortality, and resource usage.[3,7,18,19] In a Cochrane systematic review of 61 studies, Liu et al[3] concluded that motorcycle helmets decrease the risk of mortality and head injury in accidents; however, this review provided insufficient evidence to estimate the effect of motorcycle helmets compared with no helmets on the risk of facial and neck trauma. In addition, there was no differentiation between helmet types. Oginni et al[20] reported that most motorcycle crashes involved head-on collisions (58.5%), with a higher mean FISS score than for other forms of collision.

Cook et al[21] examined the relation between motorcycle helmet use and motorcycle crash outcomes and concluded that motorcyclists wearing crash helmets were less likely to have facial and head injuries compared with nonhelmeted riders. In addition, helmeted motorcyclists were less likely to have TBI. In Italy, Servadei et al,[22] in a retrospective review of TBI, found a decrease from 63 to 43 per 100,000 patients with head injury–related admissions 1 year after the implementation of a universal motorcycle helmet law. In a study that examined the association between facial fractures and TBI, Keenan et al[23] concluded that an impact strong enough to cause facial fractures is also likely to produce brain damage. Therefore, a facial fracture is a potential marker for TBI or brain damage.

Few studies have compared the levels of protection offered by different types of motorcycle helmet. Yu et al[9] analyzed 3 helmet types and improper helmet use and concluded that open-face and half-coverage helmets offered less protection against TBI and head injuries than full-face helmets. In a case-control study with 1,351 victims of motorcycle accidents, Tsai et al[24] concluded that the relative risk of head injury in motorcycle riders was significantly decreased with full-face helmets compared with open-face helmets.

In Brazil, the Associação Brasileira dos Fabricantes de Motocicletas, Ciclomotores, Motonetas, Bicicletas e Similares and the Instituto de Ortopedia e Traumatologia at Hospital das Clínicas de São Paulo have formed a partnership to analyze the consequences of traffic accidents involving motorcyclists. Preliminary findings report that the head and neck are the second most affected regions in accidents (21.7%). Motorcycle accidents were the major cause of hospital admissions

Table 9. PRIMARY PREDICTOR VARIABLE, HELMET USE, VERSUS OUTCOME VARIABLE, FACIAL FRACTURE WITH TBI

Primary Predictor Variable	n	Facial Fracture With TBI (Binary) (%)	P Value			
				a × b	c × a	c × b
No helmet	156	98 (62.82)				
Full-face helmet	46	16 (34.78)				
Open-face helmet	51	35 (68.83)	<.001*	.002†	1.00†	.003†

Abbreviations: a, motorcyclists without helmets; b, motorcyclists with full-face helmets; c, motorcyclists with open-face helmets; TBI, traumatic brain injury.
* Based on 1-way analysis of variance.
† Based on Fisher and Bonferroni tests.

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from trauma for men at Hospital das Clínicas de São Paulo in 2010. This is linked to a 246% increase in the number of motorcycles on the streets during the past decade and an 846.5% increase in the number of deaths from 1996 to 2010.[25]

Many confounding factors, other than those studied, affect the outcome of motorcyclists in accidents. These include helmet conservation, whether the helmet is fitted or fastened correctly, different helmet designs and energy-absorbing liners, velocity, point of impact, and alcohol or drug use. In addition, the number of patients in the full-face and open-face helmet groups was small; the differences between the groups might have been more significant if the groups had been larger. Nevertheless, the present study indicated a difference in the results obtained from open-face helmets, full-face helmets, and unhelmeted riders.

Use of the FISS in this study provided an insight to the kind of protection each type of crash helmet provided. It also enabled the authors to understand the seriousness of the injuries sustained. Using this valuable tool, they were able to identify the limited protection offered by open-face helmets. This is a serious matter, because motorcycle riders believe they are wearing effective protection devices. Authorities, when enacting laws on motorcycle helmets, should refer to studies on the levels of protection offered by each type of crash helmet.

Crash helmets must provide adequate protection against TBI and craniomaxillofacial injuries. In the present study population, full-face helmets offered more protection than open-face helmets, and motorcyclists wearing open-face helmets and unhelmeted riders had more severe facial injuries. In conclusion, the use of full-face helmets to prevent or decrease craniomaxillofacial injuries is recommended.

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Press Release

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