THE DENTAL CLINICS OF NORTH AMERICA

Dent Clin N Am 47 (2003) 127–139

Orofacial injury in underserved minority populations

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Low-income minority populations traditionally have not been included in research studies, but have historically suffered poorer health and experienced higher rates of premature death and disability [1]. For many illnesses, such as cardiovascular disease, diabetes, lupus, and HIV/AIDS, there is an increasing base of knowledge that demonstrates the disproportionate burden borne by minority and low-income populations [1]. Orofacial injuries and associated problems also create significant health and social challenges in minority populations. Although significant gaps exist in the understanding of such injuries, advances in orofacial injury prevention and treatment that are based on sound clinical and behavioral research have been slow in the past decades.

The purpose of this article is to report the results of several studies carried out at the Regional Research Center on Minority Oral Health (RRCMOH)—a partnership between the University of California in Los Angeles (UCLA) and the Charles R. Drew University of Medical Sciences (CDUMS), on the topic of orofacial injury and repair. Characteristic features unique to injury victims of the inner-city hospital will be discussed in the context of Los Angeles County (LAC) and nationwide.

This work was supported by grant P50 DE10598 (University of California at Los Angeles/Drew University Research Center for Minority Oral Health) from the National Institute of Dental and Craniofacial Research of the National Institutes of Health, grant #RR03026 from the Research Centers for Minority Institutions, and grant RR11145 from the National Center for Research Resources.

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PII: S0011-8532(02)00053-8

Background

Profile of an inner-city public hospital

The King/Drew Medical Center (KDMC), the only minority school of medicine west of the Mississippi River, is a typical, urban, public safety net hospital. It was designated a level 1 trauma center in 1983 and includes a 450-bed acute care academic medical facility that currently serves 9.6 million residents. Located in the south central (Watts/Willowbrook) area of LAC, it is one of six major LAC-operated safety net hospitals providing care predominately for the poor. It serves an ethnically/racially diverse catchment area of 1.5 million people—largely socioeconomically disadvantaged, underserved minorities. Currently, only 13 trauma centers in LAC are responsible for treating over 16,500 patients for traumatic injuries annually from a population base of 9.6 million residents [2]. The majority of these centers are privately owned, but the three public hospitals operated by the LAC that serve as level 1 trauma centers (KDMC, Harbor UCLA Medical Center, and LAC–University of Southern California Medical Center) treat well over 50% of trauma victims for the entire county. An estimated 37% of trauma patients at public hospitals are indigent and unable to pay for their care. Victims with severe injuries are brought to 1 of the 13 major trauma centers serving the 4012 square-mile area of LAC. Patients of less severe injuries may present directly to the emergency medical department of local hospitals, and are triaged or referred to private or public facilities for care.

Profile of the population

LAC

LAC is the most ethnically diverse, populous county in the nation, and has a population larger than that of 42 states. The majority of the state's minority population is concentrated in Southern California: Los Angeles is home to 43.6% of all Latinos, 33% of all Asians and Pacific Islanders, and 44.7% of all African Americans residing in the state [3]. Accounting for more than a third of California residents, LAC has the nation's largest single emergency medical service system.

KDMC service area

The racial/ethnic makeup of Drew University's service area is 60% Hispanic, 23% African American, 12% non-Hispanic white, and 5% Asian American. Nearly 32% of the patients live below the federal poverty level, and nearly 46% have less than a high school education. Compared with the average for LAC, South Central Los Angeles has significantly fewer physicians and hospital beds per capita and a significantly greater overall age-adjusted mortality rate. This population manifests a high morbidity and mortality rate in areas recognized by the National Institutes of Health as priority national health concerns, and has suboptimal participation in clinical

research studies and clinical trials. Although KDMC serves only 17% of LAC's population, it treats 23% of the patients triaged through the Emergency Medical System (EMS) for traumatic injuries and other life-threatening emergencies. The level of poverty and violence seen in communities served by KDMC has significant and far-reaching health and social implications [4–7].

Spectrum of orofacial injuries

The prominence of the face predisposes it to frequent injury from both intentional and unintentional causes. The inappropriate use or nonuse of protective devices during contact sports, biking, skating, skiing, operating a motorized vehicle (on-road or off-road), or in areas at high risk (eg, playgrounds and certain workplaces) and involving individuals who are at risk for falls frequently exposes the face to multiple injuries. Additionally, the psychological impact and the potential for inflicting more severe damage makes the mouth and facial area a prime target in cases of violence and abuse. During the period of 1996 to 1999, there were 9734 patients brought in by paramedics to the KDMC Emergency Department. Among patients presenting to the Emergency Department with blunt versus penetrating injuries, 5555 (59.96%) patients were injured as a result of blunt trauma, and 3709 (40.04%) injuries were a result of penetrating trauma. Orofacial injuries, predominantly blunt trauma, occured in 3% to 5% of trauma victims brought in by EMS paramedics. Facial injuries not requiring EMS transport or admission to the hospital include lip lacerations, luxated teeth, avulsed teeth, and minor mandible and facial bone fractures. Over 10,000 annual patient visits are provided in the dental outpatient department of KDMC; a significant number of these visits are devoted to the treatment of orofacial injuries.

Orofacial injury profiles of an inner-city hospital

Although orofacial injury makes up a significant component of the trauma treatment provided at our inner city hospital, little information exists on the sociodemographic aspects of the patient population, causative factors, complications, and associated risk factors.

Methods

To examine the sociodemographic characteristics of the population, the nature of injuries, associated risk factors, and the socioeconomic impact of mandible fractures sustained by the underserved minority population at KDMC, a prospective clinical study was undertaken from January 1996 to December 1999 under the aegis of the RRCMOH at UCLA/CDUMS. Individuals older than 18 years who had at least one mandible fracture were included in the study. Patients who presented to the outpatient clinic for elective removal of third molar teeth served as the comparison or control

cohort group. The nature of injuries was categorized using a classification scheme (FLOSID) that is predicated on key clinical and radiographic criteria (fracture type, location, occlusal status, soft tissue involvement, infection, and displacement). Based on the severity of the injuries, patients were assigned to two major surgical treatment groups: maxillomandibular fixation or rigid internal fixation. Data were collected on patients' associated risk behaviors, nature of injuries, and the socioeconomic impact on the health care system.

A total number of 509 mandible fractures, 117 midface injuries, and 67 gunshot wounds to the face were managed by the Oral and Maxillofacial Surgery Service. Trauma, in general, was the major problem associated with injuries.

Results

Patient sociodemographics

The sociodemographic characteristics of the patient population recruited for our study are summarized in Table 1 that are consistent with the demo-

Table 1
Sociodemographic characteristics

Variables	% Injury cohort (n = 336)	% Comparison cohort (n = 119)	Chi-square *P* value
Gender			
Male	89	74.8	0.001[a]
Age group			
18–29	35.4	55.5	
30–39	35.7	22.7	
≥40	28.9	21.8	0.001[a]
Race			
African American	72.6	63.9	
Hispanic American	22	26.9	
Other	5.4	9.2	0.140
Marital status			
Married	15.5	17.6	
Never married	66.7	70.6	
Widows/separated/other	17.9	11.8	0.292
Employment status			
Unemployed	68.5	60.5	0.115
Educational background			
Less than high school	38.7	30.3	
High school graduate	51.5	45.4	
Beyond high school	9.8	24.4	0.001[a]

[a] $P < 0.05$.

graphic features of the catchment area of the inner-city hospital located in South Central of Los Angeles. Although the majority of patients treated for orofacial and other traumatic injuries at the KDMC were predominantly minorities, there is no evidence suggesting that race/ethnicity alone is a significant risk factor for orofacial injuries. The racial/ethnic makeup of the injury cohort group was 72.6% African American, 22% Hispanic American, and 5.4% other ethnicity. A similar racial distribution was observed in the comparison cohort. The majority of the victims of injury were male (89%), single (84.6%), and over 30 years of age (64.6%). In comparison with the control cohort group, victims of injury hade less educational background: only 9.8% had greater than 12 years of education in the injury cohort group versus 24.4% in the control group (chi-square test, $P = 0.001$). In terms of employment status, no significant difference was reported between the injury and comparison cohort groups (68.5% versus 60.5%, respectively).

In a previous study [8], we reported a significant difference between African American and Hispanic American patients with regard to education and employment status. Although Hispanic American patients reported fewer years of education than did African American patients (61% of the Hispanic Americans did not finish 12 years of education compared with 28% of the African Americans), a significant larger percentage of Hispanic American patients were employed (29% versus 13%, respectively).

The sociodemographic profile of victims afflicted with orofacial injuries at our inner-city community differed from that reported elsewhere. In common with a previous study [9], males were the predominant victims of injury. The finding that more than 60% of our injury patients were older that 30 years contrasted with other reports in which the most vulnerable victims of trauma were between 18 and 28 years [10,11]. The apparent low percentage of younger victims suffering mandible fracture in our community may not be a surprise to inner-city health professionals, because individuals in the younger age group are more likely to be victims of more violent injuries, for example, from firearms.

Nature of injuries

As an exposed structure, the craniofacial region is more vulnerable to traumatic injury than are other parts of the body and contributes the more afflicted sites treated at the KDMC. There is evidence to suggest that patterns of orofacial injury treated at urban hospitals differ from those reported by other trauma centers. Unintentional or accidental injuries—especially those resulting from motor vehicles—account for a larger portion of injuries seen in most major medical centers; but the vast majority of injuries seen in low-income minority populations are the result of intentional injuries, that is, assaults and interpersonal violence [8,12–14].

At KDMC, intentional injuries outnumbered accidental injuries by at least 4-fold (83% intentional versus 17% accidental injuries) (Table 2).

Table 2
Nature of injury, reinjury, and costs of providing care

Nature of injury	N (%)	Previous injury	Mean inpatient days	Mean cost per patient	Cumulative costs
Assaultive	277 (83)	31.4%	2.78	$10,790	$2,988,830
Accidental	56 (17)	25%	2.83	$11,065	$619,640

Among victims of intentional injuries, 31.4% had suffered previous injuries compared with 25% in victims of accidents.

In a previous study [8], injuries associated with interpersonal violence—including domestic violence (10%), assault (73%), and gunshot (5%)—were nearly 10 times more likely than were injuries related to motor vehicle accidents (7%). The overwhelming high incidence of intentional injuries in our inner-city population underscores their preventable nature and the necessity for the incorporation of an educational screening and interventional program in the standard protocol of trauma management.

Socioeconomic impacts

The surgical approach to the treatment of mandible fractures via the open reduction and internal fixation techniques yielded more favorable positive outcomes by decreasing the number of complications associated with lack of patient compliance [15]. The open reduction technique is carried out through an extraoral subcutaneous skin incision followed by rigid fixation of the fractured segments with a vitalium or titanium plate. Patients who underwent the open reduction surgical approach were able to function immediately after surgery, whereas those who were treated via the closed reduction approach remained fixated with the maxillomandibular arch bar system.

The amount of resources required to treat patients with orofacial injury is best illustrated by comparing the cost of managing mandible fractures in patients injured as a result of intentional/assaultive injuries with the cost of unintentional/accidental injuries (Table 2). Because of the high proportion of intentional/assaultive injuries treated at KDMC (83% intentional injuries versus 17% unintentional injuries), the cumulative cost of treatment for assault victims averaged four to five times more than did the cost of treatment for accident victims ($2,988,830 for intentional injuries versus $619,640 for unintentional injuries).

Associated risk factors

Nationwide nearly 50% of trauma patients are injured while under the influence of alcohol; however, addressing alcohol problems is not considered a routine component of trauma care [16]. Alcohol-associated injuries are a major problem faced by the inner-city minority population, particularly in recurrent injuries. In a recent report to Congress [17], the Department of

Health and Human Services stated that efforts to reduce death and disability from injuries must be combined with efforts to reduce alcohol abuse, and called for an increase in the use of alcohol interventions in trauma patients. The statistics that link alcohol and injury are overwhelming. Alcohol plays a major role in approximately 30% of motor vehicular accidents, 40% to 56% of falls, and 56% of assaults [18]. The National Academy of Sciences asserts that the responsibility of providing counseling for patients with mild to moderate alcohol abuse lies with physicians and other health care staff in general hospital settings who are trained to provide brief interventions that are suitable for trauma care use.

The prevalence of alcohol and drug abuse was investigated in a number of recent prospective studies conducted at KDMC. In the first study [12], 336 patients in the injury cohort and 119 patients in the comparison group were interviewed for history of alcohol and drug use using the CAGE Questionnaire (an acronym for questions about *C*utting down on drinking, *A*nnoyance at others' concern about drinking, feeling *G*uilty about drinking, and using alcohol as an *E*ye-opener in the morning) [19]. The CAGE is a brief scale for the detection of alcohol drinking problems. Item responses on the CAGE are scored 0 or 1, with a higher score being an indication of alcohol problems; a score of 2 or greater is considered clinically significant. Table 3 summarizes the self-report results of these patients with regard to alcohol and drug use. A significantly higher percentage of injury victims were positive for the CAGE as compared with the comparison cohort (31.3% in injury cohort versus 9.2% in comparison cohort). Of the injury victims, 23.8% and 17% reported regular use of alcohol and drugs, respectively. In comparison with the control cohort, a significantly higher percentage of injury victims used alcohol or street drug regularly.

Table 3
Substance use

Self-report	% Injury cohort (n = 336)	% Comparison cohort (n = 119)	Chi-square *P* value
Alcohol use			
Never used	15.8	32.8	
Used previously	10.1	21	
Used occasionally	50.3	40.3	
Used regularly	23.8	5.9	0.001[a]
Drug use			
Never used	46.7	71.4	
Used previously	19.6	20.2	
Used occasionally	16.7	5.9	
Used regularly	17	2.5	0.001[a]
CAGE Questionnaire ≥ 2	31.3	9.2	0.001[a]

[a] $P < 0.05$.

A previous study by Black et al [12] was conducted to examine the relationship between orofacial injuries and alcohol/street drug intoxication in an inner-city population during the period of 1994–1995. Of the 207 patients enrolled in the study, 88% were males with an average age of 33.3 years. The minority distribution was 73% African American and 25% Hispanic American. The majority of the patients were unemployed (71%) with less than 12 years of education (73%). About 83% of the African American patients reported regular use of alcohol, and 48% reported regular use of street drugs. Among the Hispanic American patients, 80% reported regular alcohol use and 18% reported regular drug use. Of the 119 patients screened by the CAGE test, 60% of the African American patients and 46% of the Hispanic American patients answered affirmatively for one or more items, which indicated the potential for alcoholism. A significantly greater proportion of patients with a positive CAGE score had a history of previous head trauma (80% in CAGE-positive patients versus 50% in CAGE-negative patients) and a history of orofacial trauma (77% versus 2%, respectively) or both. The increased incidence of recurrent injuries or recidivism in CAGE-positive patients suggests a strong association between alcohol and drug abuse and the rate of orofacial injury in the inner-city minority populations.

Women accounted for nearly 40% of all Emergency Department visits for violent victimization in 1994 [20]. Homicides and unintentional injuries are prominent causes of death and disability for women of color (especially African Americans, Hispanic Americans, and American Indian/Alaskan women) [21]. Multiple studies identify the use of illicit drugs and alcohol abuse as factors associated with violence injuries among women in inner-city communities [22,23].

A current study [24], performed in collaboration with the Collaborative Alcohol Research Center at the KDMC, examined the prevalence of alcohol consumption and the impact of a brief intervention to reduce alcohol use among inner-city Emergency Patients utilizing the Alcohol Use Identification Test (AUDIT) and Composite International Diagnostic Interview (CIDI) instruments. The AUDIT measures the likelihood of harmful alcohol consumption. This instrument assesses alcohol dependence (three items), the amount and frequency of alcohol use or binge drinking (three items), and problems caused by alcohol (four items). The alcohol section of the CIDI uses *Diagnostic and Statistical Manual of Mental Disorders*–fourth edition (DSM-IV) and *International Classification of Diseases*, tenth edition criteria to measure alcohol dependence. This instrument includes six domains related to tolerance, physical or psychological withdrawal, continued use despite problems, craving, impaired capacity to control, and neglect of interest. A positive score in three of the six domains is diagnostic of dependence. The patient sample was 47% African American and 50% Latino. Eighty-eight percent reported consuming alcohol in their lifetime, 45% reported drinking during the last 3 months, and 12% reported that they had

consumed a drink in the last 6 hours. Of the individuals who drank during the last 3 months, 53% were classified as hazardous drinkers (based on AUDIT 8 or greater) and 55% were alcohol abusers (based on DSM-IV diagnosis on the CIDI). Preliminary data for the first phase of the study (Table 4) revealed an association between alcohol use in the last 6 hours and injuries admitted to the Emergency Department (Fisher's test, $P = 0.0149$). Fifty-four percent of alcohol drinkers were treated for an injury in the Emergency Department compared with 35.4% of nondrinkers (Table 4). A similar association was observed between individuals who reported drinking in the last 12 months and injuries treated in the Emergency Department (Fisher's test, $P = 0.0266$).

The data gathered in this study provide compelling evidence that alcohol and drug abuse are strongly associated with trauma, particularly orofacial injuries. Understanding associated risk factors and the nature of injuries is fundamental to the development of sound screening and interventional programs aimedng at reducing the high burden of preventable orofacial injuries in the inner-city population.

Recurrent injury

Recidivism, or reinjury, is a common problem faced by orofacial injury patients. Characteristic features of reinjury involve trauma to the orofacial areas. The high incidence of previous injury in victims of assaults (Table 2) mandates a more careful assessment of risks associated with the injuries treated by health professionals in trauma. Compared with the incidence of previous injury in victims of unintentional injuries/accidents (25%), victims of intentional injuries/assaults suffered a significantly higher incidence of previous injuries (31.4%) (see Table 2). A previous study [8] that looked at the sociodemographic, behavioral, and interpersonal characteristics among orofacial injury patients identified regular alcohol use as a high risk for reinjury. In this study, logistic regression analysis was used to examine whether previous injury was associated with various predictors including age, gender, employment status, ethnicity, alcohol use, street drug use, social support, marital separation within the past year, and feelings of hostility.

Table 4
Alcohol use and injury

Frequency	One injury	Probability
Drink in the last 6 hours		
No	35.40	0.0149
Yes	54.76	
Drink in the last 12 months		
No	31.82	0.0266
Yes	43.09	

Patients who regularly use alcohol should be considered at risk for reinjury. Multidisciplinary health professionals should be educated to recognize the relationship between alcohol and substance abuse and facial injury, and should be able to screen for covert alcohol abuse, recognize subtle signs of domestic abuse, and arrange for social support and intervention to reduce the risk of recurrent injuries in this sociodemographic disadvantaged inner-city patient population.

Discussion

The Emergency Department and Outpatient Dental Clinic at KDMC manage the full spectrum of orofacial injuries. The increase in the number of assault-related injuries in the last few decades has burdened our public health resources raised significant concerns among health care professionals and taxpayers. Concern over the high frequency of intentional/assaultive injuries in comparison with unintentional/accidental injuries in the inner-city minority population warrants further investigation into associated risk factors and preventive intervention. Multiple studies addressing risk factors for recurrent injury among orofacial injury patients have identified regular use of alcohol as a major risk [15]. These findings suggest that screening and intervention approaches for alcohol-associated violence should be incorporated into the routine protocol of management of orofacial injuries in high-risk inner-city communities. In Britain, Smith, Shepherd and Hodgson [25] found that oral and maxillofacial injury patients who received a brief motivational enhancement intervention during their initial outpatient follow-up clinic visit reported reduced alcohol consumption at the 3-month follow-up. They asserted that outpatient clinics provide a unique opportunity (ie, ''Teachable Moment'') for encouraging patients to review their alcohol consumption at a time when their facial injury makes them more receptive to advice. Dyehouse and Sommers [18] agree that an alcohol-related injury severe enough to warrant care by a health professional presents a ''Window of Opportunity'' or ''Teachable Moment'' to make the patient more receptive to modification of his or her drinking behavior. At KDMC, as an extension to the current project with the RRCMOH, and in collaboration with the Collaborative Alcohol Research Center, a prospective study on ''The Prevalence of Alcohol Consumption and the Impact of a Brief Intervention to Reduce Alcohol Use Among Inner City Emergency Patients'' has been initiated by Bazargan and Black [24] The brief intervention is a simple, quick, and clinically effective strategy that motivates patients to consider the consequences of their behavior after an alcohol-related injury, and to move toward new behaviors. Brief interventions are designed to increase the person's motivation and enhance the probability that the individual will examine his or her current drinking patterns. In the context of alcohol-related injury, a brief intervention is a particularly promising strategy for trauma practitioners who do not specialize in alcohol treatment [24].

The increase in intentional or assaultive injuries afflicting women in inner-city communities calls for an increased awareness among health care professionals to better understand the interrelations among violence, mental status, substance abuse, and other associated risk factors among victimized women, especially minority women. Women accounted for nearly 40% of all Emergency Department visits for violent victimization in 1994 [18]. Homicides and intentional injuries are prominent causes of death and disability for women of color (especially African Americans, Hispanic Americans, and American Indian/Alaskan women) [21]. In a study conducted at the Emergency Departments of an inner-city community in Philadelphia [23], the use of illicit drugs and alcohol abuse were identified as factors associated with both violence on the part of partners and violence on the part of other persons. In the process of developing a more effective preventive intervention to reduce alcohol-related intentional injuries in women of inner-city communities, a better understanding of the causes of violent behavior and associated risk factors that are characteristic of these high-risk populations should be considered.

The escalating impact of interpersonal violence due to alcohol and drug abuse on orofacial injuries sustained by our inner-city minority population should alert health professionals and educators in multiple disciplines to critically assess current protocol of health care delivery —in particular trauma management. Issues that relate to modification of high-risk behaviors, psychosocial intervention, financial support, and counseling should be included as components of trauma care.

The lack of adequately trained trauma specialists to serve this segment of socioeconomically disadvantaged minorities remains a challenge. Health professional students and residents in postgraduate training should be educated with regard to the psychosocial issues related to orofacial injuries. They should be sensitized to the relationship between alcohol and substance abuse and orofacial injuries, and should be trained to screen for covert alcohol abuse and provide interventional strategies that will decrease risky behavior in their at-risk patient population, including recognizing the subtle signs of domestic abuse and arranging for social support and intervention to reduce the risk of recurrent injuries in this vulnerable group. Further research and training programs aimed at recognizing factors associated with orofacial injuries should be instituted to reduce the disproportionate burden of orofacial injuries in the inner-city minority populations.

Summary

The translation of clinical and epidemiological research findings into clinical practice in the management of orofacial injuries at an inner-city community promises a reduction in the incidence and severity of orofacial injuries. This article reports on the sociodemographic characteristics,

economical impact, nature of injuries, and associated risk factors of mandible fractures sustained in the inner-city community treated at KDMC. An overwhelmingly high incidence of intentional/assaultive injuries were treated at KDMC that contribute to the escalating cost of medical care provided at the public county hospital. Knowledge of associated risk factors and nature of injuries is fundamental to the development of a sound screening and interventional program tailored to the high-risk minority groups, to reduce the high burden of preventable orofacial injuries in this community.

Multidisciplinary health professionals should recognize the relationship between alcohol and substance abuse and orofacial injuries and the subtle signs of domestic abuse, and should provide social support and counseling intervention to reduce risk of recurrent injuries in abused victims.

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