

# CDA

Pediatric Trauma

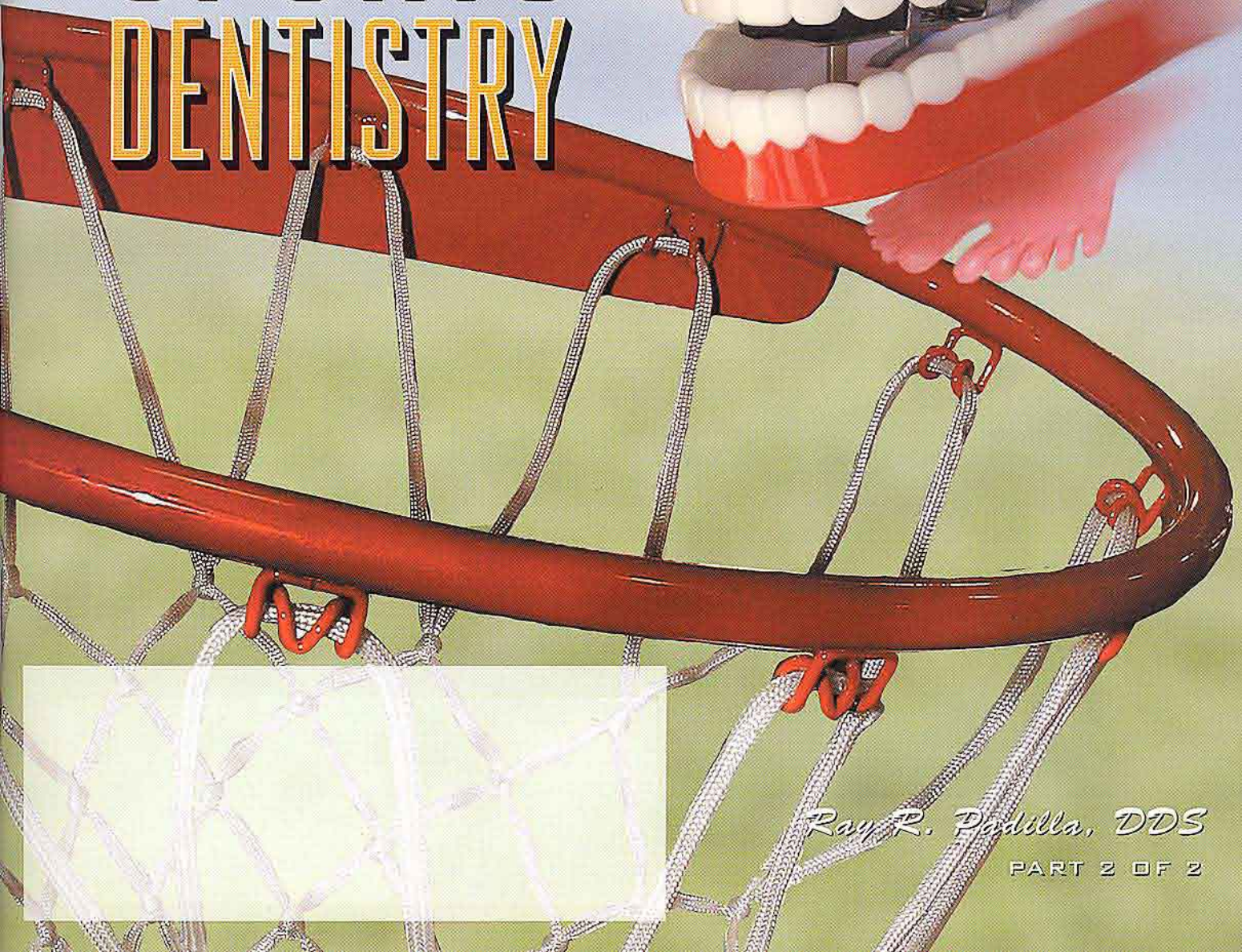
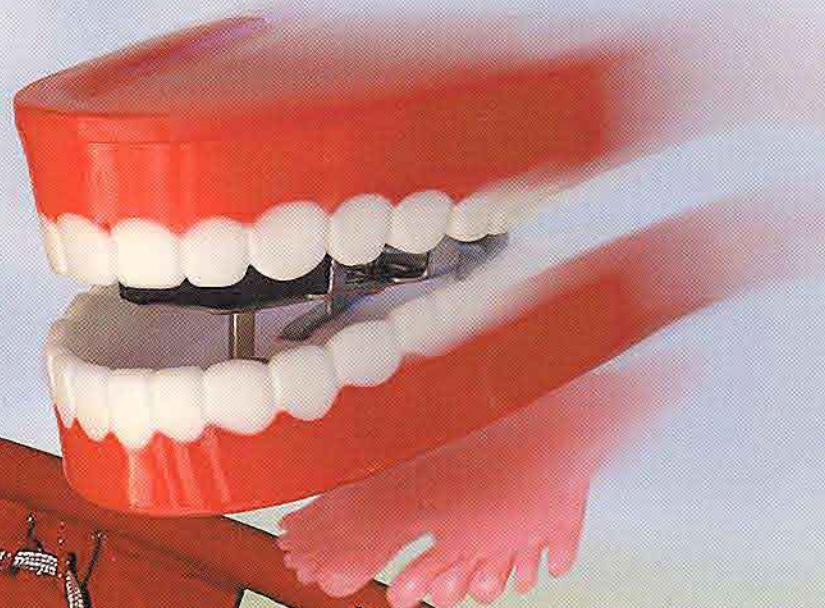
Mouthguards

The Olympics

JOURNAL OF THE CALIFORNIA DENTAL ASSOCIATION VOL. 33 NO. 6

June 2005

## SPORTS DENTISTRY



*Ray R. Padilla, DDS*

PART 2 OF 2



OF THE CALIFORNIA DENTAL ASSOCIATION

# Journal

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CDA Journal  
Volume 33, Number 6  
JUNE 2005

## DEPARTMENTS

- 438** *The Editor/Am I Too Old?*  
**441** *Feedback/Staying Current*  
**445** *Impressions/Test Developed for Forecasting Caries in Children*  
**510** *Dr. Bob/The Raid on Heteropterans*

## FEATURES

- 457** **DENTAL TRAUMA DUE TO SPORT IN THE PEDIATRIC PATIENT**  
Helen Cornwell, BDS, MDSc
- 463** **ARE MOUTHGUARDS NECESSARY FOR BASKETBALL?**  
David Kumamoto, DDS, and Yoshinobu Maeda, DDS, PhD
- 471** **SPORTS DENTISTRY AND THE OLYMPIC GAMES**  
Paul M. Piccininni, BSc, DDS, and René Fasel, DMD

## Am I Too Old?

**T**he Federal Aviation Administration mandates that pilots of scheduled air carriers (pick your favorite airline) retire after reaching the age of 60. In response to this, a number of pilots working for Southwest Airlines are challenging this rule, which was instituted approximately 50 years ago. Southwest Airlines supports the pilots and therefore, its attorneys will file a “friend of the court” brief with the U.S. Supreme Court claiming this regulation violates age discrimination standards. The reasoning is that it would be more appropriate that competency and health determine a pilot’s ability to fly rather than his or her age.

It might make an interesting academic exercise to determine the original rationale behind this regulation. One could presuppose, and the FAA has commented, that retirement at age 60 is a safety measure. Loss of cognitive and motor skills occurs as pilots age. Senescence is a recognized physiologic phenomenon, one that affects all of us, and is the basis for much research in the area of aging. As we grow older, it is apparent we lose some of the acuity we possessed when we were younger. The likelihood of a significant cardiac or neurologic event, or death, also increases as we age.

If the FAA reinforces its somewhat arbitrary determination that 60 is indeed when pilots experience a diminution of cognitive abilities and gross motor skills, at what age then do we begin to lose the fine motor skills so intrinsic to the practice of dentistry? A pilot who has a fatal myocardial infarction or cerebrovascular accident puts not only himself at risk, but also the remainder of the crew and passengers. The sudden death or total disability of a dentist would not create an analogous, acute high risk, but it still is of great impact. The loss of fine motor skills is however, critical in

the provision of quality care for our patients.

In this issue is a letter to the editor from a 72-year-old practitioner. He makes the point that he and several of his friends are still practicing after many, many years, but that they are practicing in a contemporaneous fashion. His argument is that although we age, we must continue to stay current and not practice outdated dentistry. This individual is a good colleague who has done it all — a successful dental practice over the years, activity at many levels in organized dentistry, and a teacher at one of our dental schools. On a personal basis, he has been a friend, mentor, colleague, referral source and, most significantly, my dentist for many years. There is no doubt in my thinking he is still practicing at a high level of proficiency. But what of our peers who are not? It is uncomfortable to think and to know that several of our older dentists may not be doing the same quality of dentistry as they did many years ago. Many of us are aware of colleagues who may be in such a situation.

Individuals who do not rely on delicate hand skills for the pursuit of their profession, such as an attorney or a businessperson, have less to be concerned about relative to the loss of fine motor coordination. History recounts many individuals who have contributed despite being disabled by conventional standards. Actor Christopher Reeve’s leadership in the fight to raise consciousness about spinal cord injuries was an inspiration. Equally impressive is the brilliance of theoretical physicist Stephen Hawking, who, despite his physical limitations, is a major influence in his field. Dentists, however, spend the bulk of their

*Continued on Page 440*



Senescence is a recognized physiologic phenomenon, one that affects all of us, and is the basis for much research in the area of aging.

practices doing intricate procedures, ones that require coordination and fine motor skills.

I can think of two of our contemporaries who have been impressive in their decisions about their decreasing physical acuity. One of them was a general dentist who had a full-scope general practice for many years. He recognized an element of burnout, accompanied by the physical diminution of his skills. To continue his practice, he limited his patient contact to removable prosthodontics. His reasoning was that his ability to damage a patient on an acute basis was minimal, and that his dexterity was sufficient to do dentures. A second individual, a successful orthodontist, retired from his practice prematurely by most standards. He pursued an advanced degree, and came

back to school to teach and do research without patient care. When questioned, he admitted he still maintained his clinical skills, but was beginning to become less tolerant of his patients, and felt he was failing them. Both of these dentists deserve commendations for considering the greater implications of their continued practice as compared to selfish motivation or financial gains.

Dental societies at local, state, and national levels have committees and programs for members who are impaired by drugs or alcohol. Is the physical impairment that comes with age any different in terms of delivering quality care to our patients? Much time is spent by our young students in preparation for the start of their careers. Attaining entrance into school, completing requirements, getting specialty education,

and starting their practice are only a few of the factors dentists consider at the beginning of their professional lives. Perhaps they, and we, should spend a comparable amount of time planning the completion of our practices. Self-assessment, retirement planning, and developing potential alternatives for self-satisfaction and fulfillment need to be part of our long-range goals. It is my hope all of us will recognize we no longer do our patients justice when we lose the skills they deserve. It is important to me that I see that in myself. It is more important that we recognize it in our colleagues and be strong enough to tell them. **CDA**

*Comments, letters or questions can be addressed to the editor at [alan.felsenfeld@cda.org](mailto:alan.felsenfeld@cda.org).*



Illustration: Dan Hubig

## Test Developed for Forecasting Caries in Children

**I**s it possible that an uncomplicated saliva test can be a highly accurate prognosticator of whether children will get caries, how many cavities, and which teeth are most at risk? The answer is yes and the future is now, say researchers at the University of Southern California School of Dentistry.

The test quantifies the genetic component of caries and can be used to determine early on who's most at risk so that preventive measures can be taken.

"When we apply this to young children, it allows us to predict what might be their future caries history — the number of cavities that they'll get by, say, their late 20s or early

*"If we can identify those people who are at risk and put in place preventive measures, it is going to prevent them from suffering."*

MAHVASH NAVAZESH

30s," said Paul Denny, USC researcher.

According to researchers, the financial and physical burden of caries escalates with the aging process. Dental care costs, which Medicare doesn't cover, can be pricey. As one ages, larger fillings may need to replace deteriorated ones, potentially leading to root canals, crowns, and unfortunately, tooth loss.

It's why preventing caries is important, said Denny, who led the USC research team. "It's the initial cavity or caries that we're worried about," he said. "If we can prevent that, then we prevent this whole lifelong process from occurring."

The Caries Assessment and Risk Evaluation test measures the proportions in saliva of the various types of oligosaccharides, also known as sugar chains. Identical sugar chains are present on tooth surfaces.

The sugar chains' effect on the tooth's ability to ward off disease is similar to that of blood vessels, and the impact of "good" and "bad" cholesterol. The "good" sugar chains are predisposed to fend off caries-causing bacteria, while the "bad" sugar chains permit the bacteria bond to the tooth, thus starting the process of decay.

Unfortunately, the makeup of a human's sugar chain cannot be changed as it is genetically set. Even in areas with fluoridation and adequate oral hygiene education, there are people who are prone to have bad teeth.

Researchers found that the sugar chain makeup in saliva could forecast a child's cavity history — plus or minus one cavity — with more than 98 percent certainty. Children, particularly those with strong or weak nutritional and oral hygiene practices, may develop fewer or more caries than the test predicts.

While poor oral care can lead to tooth decay, it has been shown, according to researchers, that eliminating sugar from one's diet may not prevent cavities and enamel erosion can be caused by over-brushing.

The USC test indicates tooth decay is influenced largely by genetics. As such, it is now possible to determine a child's dental future. Another version of the test is able to identify certain teeth at risk, offering an opportunity to boost the effectiveness of prevention.

"It's possible that in the future, even though a kid might be at very high risk for getting a large number of caries, with the proper preventive dental care he or she can arrive at adulthood without any," Denny said.

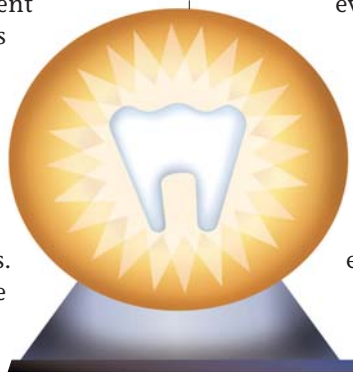
The research was supported by a grant from the National Institute of Dental and Craniofacial Research, part of the National Institutes of Health.

An advanced version of the test also can identify children with current tooth decay. Considering there are areas where families cannot afford routine dental exams, this is an important development.

"This is going to help people who are not dental professionals," said Mahvash Navazesh, DMD, associate professor in the USC School of Dentistry and co-inventor of the Caries Assessment and Risk Evaluation test with USC research scientist Patricia Denny.

Navazesh said school nurses could administer the test, emphasizing that any of the tests do not replace good dental care.

"This is not a test to diagnose caries," Navazesh said. "This is a test that can be used to evaluate susceptibility and risk. If we can identify those people who are at risk and put in place preventive measures, it is going to prevent them from suffering."



## Patients Can and Do Change Their Minds

Dental professionals shouldn't assume a patient will stick to a low dental budget, noted Sandy Roth, a dental communications specialist, in the winter issue of *The Journal of Cosmetic Dentistry*.

Assumptions "are mistakes because they deny the patient the opportunity to consider accepting your best care," Roth said.

She recounted a story of a woman who sought treatment for several dental problems, including cosmetic, because she had a new job and wanted to feel better about herself. The patient told her dentist she was ready to pay "about \$500 or \$600."

At a subsequent treatment planning session, the dentist explained every option and that full treatment was estimated at

\$30,000.

Initially shocked at her own cost underestimation, she opted for the treatment and arranged two loans to pay for it.

"When you make assumptions based on a patient's preliminary statements, you limit that patient's choices," Roth said. "The dilemmas they face are theirs to resolve, not yours. You can help patients best by identifying those dilemmas and remaining supportive and nonjudgmental throughout."



## Dental Mission to Belize

Now in its 12th year, the Belize Mission Project is planning a dental mission trip for Oct. 21-29.

Volunteers will set up clinics in various areas in Belize, both on the mainland and on island locales, to perform preventive and restorative dentistry. An average of 50 volunteers, including dentists, dental lab technicians, dental assistants and hygienists; physicians, physician assistants and nurse practitioners; and general helpers, travel with each program.

For more information about the program, history and mission, or to download an application, visit [www.belizemissionproject.com](http://www.belizemissionproject.com), or call Frank Whipps, DMD, (618) 532-1821.

Additionally, the ADA Center for International Development and Affairs offers a new 78-page guide, "International Dental Volunteer Organizations: A Guide to Service and a Directory of Programs." The guide contains an in-depth introduction to overseas volunteerism for dental professionals, plus listings of some 80 international programs for dental professionals. The guide is free to ADA Members and available to nonmembers for \$15. To request a copy of the guide, contact the ADA Center for International Development and Affairs, (800) 621-8099, Ext. 2726 or via e-mail, [szymczyk@ada.org](mailto:szymczyk@ada.org).

Indoor radon is the second-leading cause of lung cancer in the United States, and breathing it over prolonged periods can present a significant health risk to families all over the county."

U.S. Surgeon General  
Richard H. Carmona

## National Health Advisory Issued on Radon

U.S. Surgeon General Richard H. Carmona recently issued a warning about the risks of breathing indoor radon.

The advisory was issued to prevent the silent radioactive gas from seeping into American homes and reaching dangerous levels. The warning came on the heels of the surgeon general's workshop on healthy indoor environments.

"Indoor radon is the second-leading cause of lung cancer in the United States, and breathing it over prolonged periods can present a significant health risk to families all over the county," Carmona said. "It's important to know that this threat is completely preventable. Radon can be detected with a simple test and fixed through well-established venting techniques."

Odorless, tasteless and invisible with no immediate health symptoms, the gas comes from the breakdown of uranium inside the earth. According to estimates by the Environmental Protection Agency, one in every 15 homes nationwide have a high radon level at or above the recommended action level of 4 picoCuries (pCi/L) per liter of air.

Radon indoors poses serious health risks. More than 20,000 Americans die of radon-related lung cancer annually. Smokers who have elevated radon levels in the home have a higher risk for lung cancer.

Nationally, one in five schools have indoor air quality problems, which can trigger asthma and various allergies. Asthma alone accounts for 14 million missed school days each year. In the last 15 years, the asthma rate in young children has increased 160 percent. One out of every 13 school-age children has asthma. Promoting 2005 as The Year of the Healthy Child, Carmona is especially focusing on how unhealthy indoor environments affect children.

Test kits can reveal the amount of radon

in any building, and those with high levels can be fixed with simple and affordable venting techniques. Testing for radon is recommended every two years, and retesting any time residents move or make structural changes to the home.

"Americans need to know about the risks of indoor radon and have the information and tools they need to take action," said Jeffrey R. Holmstead, assistant administrator, Office of Air and Radiation, U.S. Environmental Protection Agency. "If families do find elevated levels in their homes, they can take inexpensive steps that will reduce exposure to this risk."

For more information about radon, go to the EPA's Web site, [www.epa.gov/radon](http://www.epa.gov/radon). In California, call (800) 745-7236; or the national toll-free hotline, (800) SOS-RADON.



## Frequent Fast-Food Dining Increases Risk for Type 2 Diabetes

Recurrent cholesterol- and caloric-laden dining habits of today's youth will lead to health problems years later.

After 15 years, those who ate fast food more than twice a week (compared to once-a-week-dieters), each gained an extra 10 pounds and had twice the chance to develop insulin resistance, a risk factor for Type 2 diabetes, a major cause for heart disease.

"Obesity and diabetes are on the rise in this country and this important study highlights the value of healthy eating habits," said Barbara Alving, MD, acting director of the National, Heart, Lung and Blood Institute.

A contributing factor for weight gain may be that just one fast-food meal frequently contains a person's entire caloric requirement for the day. Fast-food consumption has increased in the United States over the last 30 years.

"It's extremely difficult to eat in a healthy way at a fast-food restaurant. Despite some of their recent healthful offerings, the menus still tend to include foods high in fat, sugar and calories and low in fiber and nutrients," said Mark Pereira, PhD, lead author and assistant professor of epidemiology at the University of Minnesota.

The multicenter study, published in the January issue of *The Lancet*, was funded by the National, Heart, Lung and Blood Institute.

Participants were asked during the physical examinations how often they dined at fast-food restaurants for breakfast, lunch or dinner. Even after adjustments for other lifestyle habits, researchers found the weight gain and insulin resistance was seen in both blacks and whites who regularly ate fast food.

Study participants included 3,031 young white and black adults between the ages of 18 and 30 in 1985-1986. The participants,

who

were part

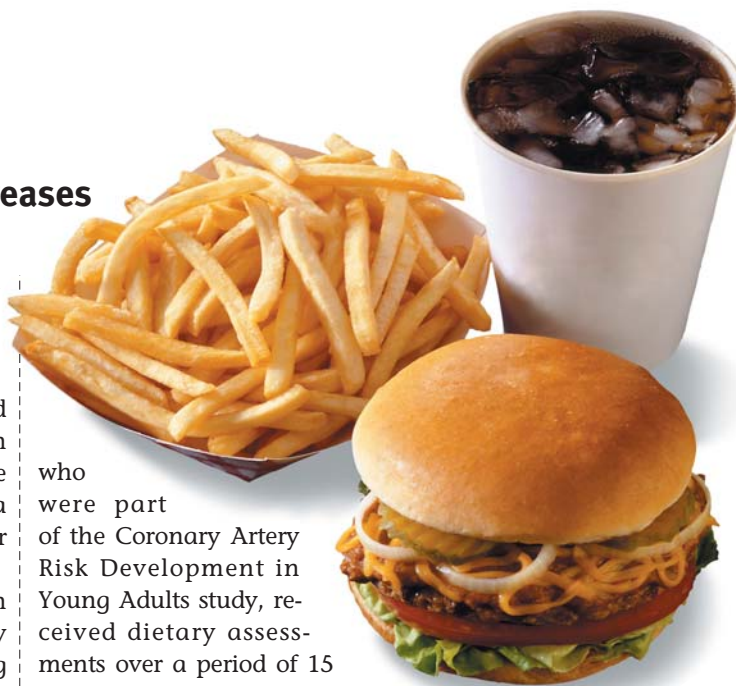
of the Coronary Artery Risk Development in Young Adults study, received dietary assessments over a period of 15 years. Coronary Artery Risk Development in Young Adults centers are in Birmingham, Ala.; Chicago; Minneapolis; and Oakland, Calif.

The study also found that men frequented fast-food eateries more than women; and blacks more than whites. Black men reported an average frequency of 2.3 visits per week in 2000-01. In the same period, white women had the lowest frequency, an average of 1.3 weekly visits.

"It is important to watch carefully what you eat, especially at a fast-food restaurant," said Gina Wei, MD, National, Heart, Lung and Blood Institute's project officer for Coronary Artery Risk Development in Young Adults. "Knowing the nutritional content is important. Consumers may want to ask for this information."

Wei also recommended smaller portion sizes, asking that high-fat sauces and condiments, such as mayonnaise and salad dressing be served on the side, and that the sauces be used sparingly to reduce calories.

For more information, visit the Aim for a Healthy Weight web site at [www.nhlbi.nih.gov/health/public/heart/obesity/lose\\_wt/patmats.htm](http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/patmats.htm); and Portion Distortion, <http://hin.nhlbi.nih.gov/portion>.



Just one  
fast-food meal  
frequently  
contains  
a person's  
entire caloric  
requirement  
for the day.

## Honors

Elisa Chavez, DDS, of Redwood City, assistant professor of removable prosthodontics at University of the Pacific, Arthur A. Dugoni School of Dentistry, was named a fellow of the Health Care Leadership Program by the California Health Care Foundation.

## ADA Report Needs Member Input

The American Dental Association Council on Scientific Affairs is seeking feedback for its new evaluation program for professional products.

"Clinical input from members will be critical to the success and credibility of the new ADA Professional Product Report," says Domenick Zero, DDS, MS, Council on Scientific Affairs chair.

"Each quarterly report will review three product categories and we want the recommendations in each report to reflect the most accurate and up-to-date scientific and clinical data," Zero said.

As a clinical group member, you would be asked to answer telephone, online or written product-use surveys.

To participate, e-mail your name and contact information to [pprclinical@ada.org](mailto:pprclinical@ada.org) or fax to (312) 440-2536.



## Delivering Messages Electronically

Good communication between patients and their dentists has always been important in ensuring proper oral hygiene. The advent of the Internet now provides another way for dental practitioners to get the word out.

In the fall issue of *Colorado Dentistry*, practice management specialist Penny Reed noted a number of Internet-based ideas, including an "E-newsletter" to patients. Routine e-mails to patients could help a dentist deliver a message about dental procedures and oral hygiene care, for example. This method helps keep up the professional, yet friendly, relationship treasured by doctors and patients.

To start an e-mail list, simply include a place for an e-mail on a new, patient form with a box asking if the patient is interested in receiving e-mail messages.

## Upcoming Meetings 2005

|                    |                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Aug. 17-20</b>  | Sixth Annual World Congress of Minimally Invasive Dentistry, San Diego, (800) 973-8003.                                                                                |
| <b>Sept. 9-11</b>  | CDA Fall Scientific Session, San Francisco, (866) CDA-MEMBER (232-6362).                                                                                               |
| <b>Sept. 25-28</b> | Pacific Coast Society of Orthodontists/Rocky Mountain Society of Orthodontists Joint Annual Session, San Diego, <a href="http://www.pscortho.org">www.pscortho.org</a> |
| <b>Oct. 6-9</b>    | ADA Annual Session, Philadelphia, (312) 440-2500.                                                                                                                      |

## 2006

|                    |                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------|
| <b>April 27-30</b> | CDA Spring Scientific Session, Anaheim, (866) CDA-MEMBER (232-6362).                                           |
| <b>Sept. 15-17</b> | CDA Fall Scientific Session, San Francisco, (866) CDA-MEMBER (232-6362).                                       |
| <b>Oct. 16-19</b>  | ADA Annual Session, Las Vegas, (312) 440-2500.                                                                 |
| <b>Dec. 3-6</b>    | International Workshop of the International Cleft Lip and Palate Foundation, Chennai, India, (91) 44-24331696. |

To have an event included on this list of nonprofit association meetings, please send the information to Upcoming Meetings, *CDA Journal*, 1201 K St., 16th Floor, Sacramento, CA 95814 or fax the information to (916) 554-5962.

# Staying Current

**O**ccasionally, in the life of a dentist who has been through the hoops, there are magic moments. Last Friday was one of those.

I'm no spring chicken when it comes to our profession. I have been through the political wringer on my local level, served as a CDA trustee, got my feet wet on the national level as an ADA delegate, and been involved with the Academy of General Dentistry on those same levels. I sincerely believe that last week's lunch was one of the highlights of my professional life.

There were four of us dining. The combined ages of this foursome was 309 years old. Dividing this equally, we come up with a mean age average of 77.25 years. I'm not telling age secrets, but I was the youngest at 72. All dining at the table were still practicing. Lest I seem to be tooting my own horn in the above paragraph, at the table was a past president of his local component who had chaired the CDA Council on Insurance. Another of the diners is an evaluator for Gordon Christensen's prestigious CRA. Rounding out the group is a popular essayist that all California dentists have grown to love.

Other than a smattering of talk about our latest PSA scores, the conversation was about the latest innovations of restorative dentistry, and how we have evolved in our dental practices. It was truly inspirational to me to see the enthusiasm of my fellow practitioners who were engrossed in the relative merits new techniques.

We dentists have a wonderful profes-

sion. There is such an explosion of restorative possibilities that it takes constant study and a renewal of technical skills to keep up. Please, you dentists of a more mature nature, strive to stay current. Don't throw out the baby with the bath water (gold castings are still the benchmark of quality posterior restorations) but look at alternative procedures that are now available. I always look at each case and say, "If this was my, or my wife's, mouth how would I best proceed?"

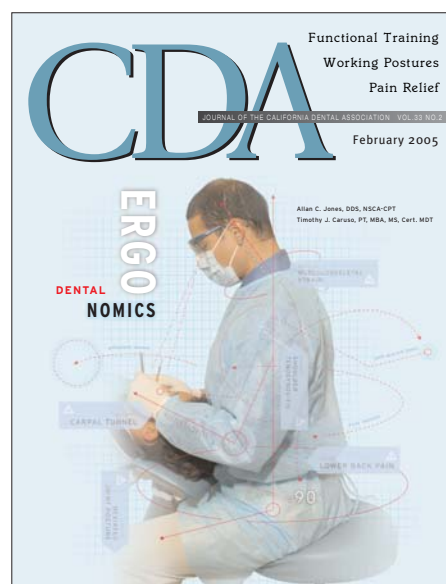
**Bruce Schutte, DDS**  
Covina, Calif.

## Using Loupes

This is my first "Letter to the Editor." I am writing about the cover photo of the February 2005 issue of the *Journal of the California Dental Association*. I was very surprised to notice that the model on the cover is not wearing loupes. I teach part time at USC and I have never seen a student sit correctly without wearing loupes. I'm sure there are some practitioners who do not use loupes and whose vision and posture are perfect but they must be the exception and not the rule.

I can show you photo after photo of students who don't use loupes who are way too close, and photo after photo of students who do use loupes who sit properly since the loupes force the user not to invade the personal space.

**Rich Hirschinger, DDS, MBA**  
Beverly Hills, Calif.



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### Access to Care

The March 2005 *Journal of the California Dental Association* again raised the discussion about the topic "Access to Care." The opening paragraphs of the editorial reviews the topic as though this is something absolutely irrefutable, understood, and supported by our overwhelming membership majority. I respectfully voice a contrary view. Quoting the following from the editorial, "A litany of buzzwords is associated with the political aspects of dental care, but among the more popular is access." I cannot think of any substantial issue in my lifetime that has the adjective "popular" attached to it. In fact, the term "popular" is more commonly associated with "fads" and I believe the expression "political fad" can justly be associated with the issue of "access to care."

Recently, many recommendations and changes within our profession have been promoted under the umbrella of the need for access to care, such as changes in California's dental licensure policies. I believe the editor does a good job of reviewing our pending licensure issues, but I have concerns with the initiating engine being our so-called "access to care" problem. The editorial goes on to discuss the fact that our economically underprivileged cannot gain dental care without state-funded programs. Assumptions are being made here without thorough understanding of the priorities and actual economic habits of our underprivileged. There is no mention within the entire access editorial about the failure of our organized dentistry to educate society toward understanding and reviewing their priorities and individual responsibilities for their family's well-

being. There is no mention about the lack of motivating individuals and families to make dentistry anything more than a social entitlement. In most instances, dentistry is by and large a quality of life issue, not generally a life and death issue. On this point you may disagree and therein lays the divergence of purpose among our members and our current leadership. The editorial goes on to note, "politicians consider access to care a high priority in serving their constituents, or at least they articulate that concern." These words properly elucidate our

**The study seems to sustain the concept that given what you want to prove, you can devise a study to support your premise.**

current dilemma when we fail to appropriately enlighten our politicians before seeking political alignment. Organized dentistry has supported the entitlement climate of our society, which has been so richly rewarded by our politicians. Much of our search for access solutions has fallen on the coat-tails of dental insurance and social welfare programs while we completely ignore free-market value systems. We have been guilty of feeding our politician's concerns instead of setting our record straight. Simple-minded solutions often seek to throw money at complex problems. The recent geo-

graphic distribution of dentists study used to support the notion of an access problem in California was done by UCSF and was mentioned at the House of Delegates as being fundamentally flawed. As I have read the study, I support that notion. The study seems to sustain the concept that given what you want to prove, you can devise a study to support your premise. In this case, the study seemed to be developed to hold up the idea that government programs are needed to bring dentistry to California's underserved areas, regardless of the natural economic and quality of life forces that are at work in our California marketplace or our actual dentist to patient ratios.

The catalyst that gave momentum to the whole concept that there is an existing crisis brewing around access to dental care in California was a recently published report that noted the caries rate in California children is much higher than the rest of the nation. Never mind the cause, reporters of this study were happy to imply that California's dentists weren't doing their job. Meanwhile, our CDA *Journal* statistics from February 2003 shows more than 46 percent of California's children are immigrants. This fact has been somewhat ignored as though it is irrelevant to the conditions found within these children's mouths. Do we need to deal with the problem? Absolutely. Knowing it is neither a result of the failure of California's dentists, or truly caused by limited access to care, and recognizing the true origin of the problem is important when seeing the most effective, long-term remedies. Is there actually a shortage of dentists? The facts seem to indicate otherwise. The same recent geographic

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report from UCSF reports statistics that show the ratio of patients to dentists has actually improved from 1930 to 1995 to 1998. Could dentistry provide greater outreach to a multicultural society if more dentists were fluent in more languages? I believe the answer is an obvious yes, based on the fact that good communication is imperative in the practice of dentistry. Are there some access to care issues that have been ignored and need greater review? I believe the situation with oral care for our hospitalized elderly and home care facilities top my list of people who have a legitimate dental care access problem. Our current policies appear to be weighted toward the induction of more driller and filler dentists for children and low-income families. Many of the dental debates surrounding quotas for various ethnic groups to serve our multicultural society should be labeled appropriately as "affirmative action" and recognized as a failed a democratically defeated system.

CDA, lets embrace the free-market system that has made our country competitive and great. Let's stop being defensive about the value of our services. Let's choose a worthwhile long-term solution for parents and young to actually want and make dental services a cherished priority of their lives. Let's recognize the importance of multilingual communications when seeking to deliver dental care to a color-blind society. Let's seek a proper system of delivery for our elderly infirmed and let's stop chasing after our politicians seeking handouts that all too often backfire and place us under their socialistic control and autocratic regulations.

**Robert D. Shorey, DDS**  
Roseville, Calif.



# Dental Trauma Due to Sport in the Pediatric Patient

Helen Cornwell, BDS, MDS

## Abstract

Dental trauma due to sport is devastating to any athlete but is made worse when the athlete is young and still growing. Orofacial trauma is relatively common in the pediatric population and can have significant management problems. Continued maxillary and alveolar growth, development, and maturation of individual teeth, as well as behavioral considerations create unique challenges in the management of this population. Children and youths have increased risk factors for dental trauma due to sports, including untreated malocclusions, an increase in risk-taking behavior, and undeveloped coordination and skill levels. This review article aims to increase awareness as to the role of sports in dental and orofacial injuries, discuss risk factors for this trauma as well as its prevention, and outline risk minimization for the pediatric athlete.

Dental trauma is relatively common in the pediatric population with dental injuries occurring with a prevalence of 6 percent to 19 percent for all children and adolescents.<sup>1-4</sup> Injuries are described as occurring predominantly during the late primary school years to early teenage years when risk-taking behavior is more likely to occur.<sup>1-3,5</sup> It is often reported that there is a significantly greater tendency for injuries to occur in males than females (ratios of 1.8-2.7:1).<sup>2,6</sup> This timing of injuries creates significant long-term management problems due to continued growth and maturation of the dentoalveolar and facial complex.

## Etiology of Orofacial Trauma in the Pediatric Population

Traumatic injuries to the face and teeth may occur due to a number of etiological factors, including motor vehicle accidents, acts of violence, accidents at home, during play, as well as those occurring during organized sporting activities. The relative weight of each of these etiological factors varies depending on the population, mode of data collection, and category definitions. The description of injuries in the pediatric population often cites "play" as the etiology of an injury. Informal sporting activities may be considered "play" in the pediatric population. Informal sport is recognized as a time when injuries often occur, and by the use of the definition "play" in this situ-

ation may lead to an underestimation of the relative role of sport as an etiological factor for dental trauma.<sup>7</sup>

The availability of central databases for the recording and reporting of dental injuries, and the nature and etiology of these injuries varies between regions and populations. Individuals presenting to private dentists, medical practitioners, public dental hospitals, and community dental clinics are often not reported to a central register accessible by sporting bodies or government agencies. This situation is made worse as the peak incidence for dental trauma coincides with weekend sports training or competitive games.<sup>7</sup> Statistics often used are those provided by insurance companies, which represent only those injuries for which compensation has been sought. This lack of reported data might further lead to considerable underestimation of dental injuries occurring in sports.<sup>7,8</sup>

The role of sports as an etiological factor in dental trauma varies in the literature. The contribution of sporting activities to the reason for presentation within the maxillofacial unit of an Austrian university hospital was reported to be 36 percent of all presenting with orofacial injuries.<sup>6</sup> Other authors



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have reported that of all dental trauma requiring professional attention, approximately 10 percent to 30 percent have been due to sporting injuries.<sup>2,3</sup> One pediatric study in Norway reported that sporting activities were responsible for 8 percent of injuries within a population of seven to 18 year olds.<sup>9</sup> When this population was considered in age groups, the role of sports, as an etiological factor for trauma varied, with figures for 13 to 15 year olds (28 percent) and 16 to 18 year olds (23 percent) as the highest.<sup>9</sup>

When looking at the risk of a dental injury due to sports, the National Youth Sports Foundation for Prevention of Athletic Injuries, Inc. (United States), estimated a one in 10 risk of orofacial injury for athletes during a single athletic session.<sup>10</sup> It, therefore, may be hypothesized that the relative risk of receiving an orofacial injury, and the etiology of that injury due to a sporting activity, is high in the pediatric population.

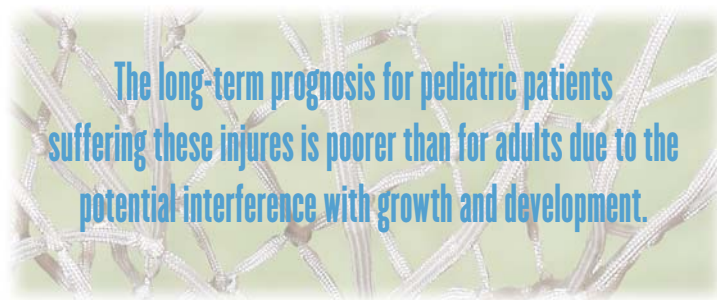
## Pattern of Injuries in the Pediatric Population

Injuries frequently resulting from sporting accidents range from soft tissue lacerations and contusions; dental fractures, concussions, luxations and avulsions; dentoalveolar fractures; and mandibular dislocations and fractures.<sup>8,12</sup> These injuries have been described in both the pediatric and adult populations, however, statistically significant differences in the nature of injuries between these populations have not yet been described.<sup>8,12</sup> The long-term prognosis for pediatric patients suffering these injuries is poorer than for adults due to the potential interference with growth and development.

Traumatic injuries to the teeth, due to contact team sports, most frequently

include the maxillary incisors.<sup>9,12,13</sup> Anatomical features, which may increase the risk of these injuries, include an Angle Class II malocclusion, prominent incisors and lip incompetence.<sup>14</sup> Burden described inadequate lip coverage as the most important of these factors.<sup>14</sup> This pattern of malocclusion is often seen in children in the late mixed dentition prior to orthodontic correction.<sup>15</sup>

The presence of impacted mandibular third molars have been demonstrated as increasing the risk of fracture at the angle of the mandible.<sup>16,17</sup> While



these injuries tend to occur in an older population, pediatric patients should undergo an assessment of third molar teeth such that removal can be timed around athletic activity.

Orofacial injuries in the growing patient are recognized as being difficult to manage with the long-term prognosis of teeth, as well as retardation of growth being significant problems for the clinician. Severe injuries to the periodontal structures such as luxation, intrusion, and avulsion injuries can result in the ankylosis of a tooth.<sup>18,19</sup> Growth of the maxilla, particularly in a vertical direction, complicates the management of these injuries due to the potential for infrapositioning of a tooth or teeth.<sup>18</sup> If these injuries occur prior to the onset of puberty or in early adolescence, the consequences can be the severe infraposition of teeth, up to 1 millimeter per year prior to the cessation of growth in early adulthood.<sup>18,19</sup>

## Sports Responsible for Dental Trauma

Few studies have assessed the relative risk of individual sports, and again, regional variations in the implementation of rules, as well as requirements for protective equipment, make it difficult to make comparisons between individual sport activities. Ball sports and stick-and-ball sports are, however, considered to be responsible for most orofacial injuries in sports, 59 percent.<sup>9</sup> Sports recognized as a significant risk for dental trauma include soccer, football, Australian Rules football, rugby union and rugby league, cycling, basketball, wrestling, hockey, cricket, and baseball.

The frequency of orofacial injuries in contact team sports has been best described in the various football codes. In a U.S. study of 2,470 high school football players, 9 percent reported a dental injury requiring medical or dental attention.<sup>20</sup> In Australia, both rugby union and Australian Rules football have been investigated and injury rates described.<sup>21,22</sup> In a survey of Victorian football players, Jolly and coworkers noted that injuries were common, with 25 percent to 31 percent of athletes reporting a previous orofacial injury due to Australian Rules football.<sup>22</sup>

Basketball has a high injury rate when compared to other sports activities.<sup>23-25</sup> Of all injuries occurring in basketball and requiring medical/dental attention, a significant proportion have been reported to have occurred to the oral and facial region, ranging from 7.6 percent to 40 percent.<sup>26-29</sup>

Dental trauma to the pediatric population is relatively common in basketball.<sup>20,28,30,31</sup> In an Australian survey of 208 youths, 12-16 year olds, participating in competitive basketball, 11 percent reported an orofacial

injury while playing basketball.<sup>8</sup> In another study, 315 (30.9 percent) out of 1,020 U.S. high school varsity basketball players sustained an orofacial injury.<sup>11</sup> These players reported a total of 633 orofacial injuries to both the soft and hard tissues, of which 140 required professional care.<sup>11</sup> Another prospective study using a sample of high school students in the United States recorded 18.3 orofacial injuries per 10,000 athletic exposures, representing 34 percent of all injuries in basketball.<sup>32</sup> A similar prospective study of Minnesota high school athletes reported an extremely high orofacial injury experience rate — 55.4 percent in basketball per playing year.<sup>33</sup>

### **Injury at Training, Games, and Play**

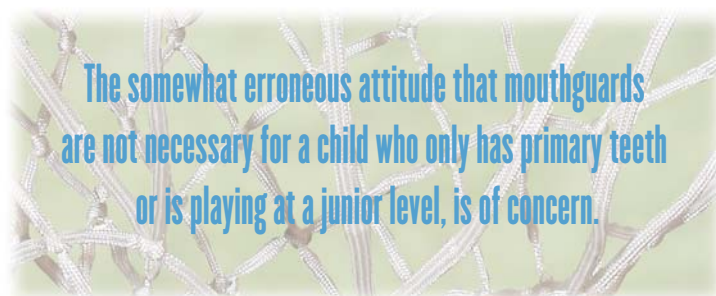
The timing and location of orofacial injuries due to sports includes games, organized training sessions, and outside of organized sessions. One study of injuries in basketball suggested that the majority, up to 80 percent, of these injuries occurred outside of organized sessions, during recreational time or “play.”<sup>34</sup> Studies that separated training and competition when analyzing when injuries occurred due to sports, reported similar numbers between the two time periods.<sup>27,33</sup> Differences in the location and timing at which injuries occurred between these studies may be influenced by the way data was collected. As injuries occurring outside of organized training and competition are unlikely to be reported, their significance may be underestimated.

### **Orthodontics and Dental Trauma**

Orthodontic treatment is often a consideration for the pediatric athlete. Case reports within the literature indi-

cate that the presence of orthodontic appliances may change the risk and nature of dental injuries. In a prospective study into the incidence of orofacial injury in Minnesota, an increased risk was reported for participants with fixed orthodontic appliances.<sup>33</sup>

Case reports of injuries to athletes undergoing orthodontic treatment include lip entrapment over an orthodontic bracket following tackle in football, as well as the avulsion of two teeth due to a collision in basketball.<sup>35,36</sup> Of concern is the fact that while mouthguards can be constructed



for the orthodontic patient, “orthodontic treatment” has been given as a reason for not wearing a mouthguard during contact sports.<sup>8,35</sup>

### **Injury Prevention for the Pediatric Patient**

Mouthguards have been repeatedly demonstrated as an effective and efficient method of reducing the severity and modifying the nature of orofacial injuries in sports. This reduction in dental injuries has been clearly demonstrated where mouthguard use has become mandatory, such as in American football and ice hockey.<sup>35,20,22,37,38</sup> Laboratory studies, using animal models, have established the dramatic effect a mouthguard has on the force required to damage dental and alveolar structures.<sup>39</sup> In an in vitro animal model, the level of force increase required to result in damage to the dentoalveolar structures with a mouthguard in situ was demonstrated at 24-fold for the

primary dentition and 14-fold for the permanent dentition.<sup>39</sup>

The timing of when mouthguard wear should begin has been a point of confusion among parents. In particular, the somewhat erroneous attitude that mouthguards are not necessary for a child who only has primary teeth or is playing at a junior level, is of concern. The role of trauma to the primary dentition in causing defects of the developing permanent dentition is recognized.<sup>40</sup> Developmental defects to teeth may be severe, requiring complex management, particularly if the defects involve the morphology of the tooth, such as a dilaceration. Early introduction of mouthguards may therefore assist in the reduction of injuries due to sports and potential damage to succedaneous teeth.

If introduced early, children may more readily accept and form a positive habit of wearing a mouthguard.<sup>41</sup> In a study of international rugby union players, Chapman and Nassar found much variation in the average age at which the athletes began wearing mouthguards: from 12.7 years for an Australian team to 18.1 years for a Welsh team.<sup>41</sup>

Mouthguard use in the pediatric patient population was reported as low when compared to adults both at training and at competition.<sup>7,8,20,22</sup> Studies of mouthguard use in children have described a higher use of Type II (mouth-formed or “boil and bite”) mouthguards compared to adults, who tend to use a greater proportion of custom-fitted mouthguards.<sup>8</sup> Mouth-formed guards are recognized as having a poorer fit compared to custom-made guards and as such, the comfort level and oral function are reduced.<sup>11</sup> Discomfort due to bulk and inappropriate fit are two of the most-cited reasons as to why mouthguards are not worn.<sup>8,11,42</sup>

Advice about wearing mouthguards comes mainly from coaches, family and friends, not dental professionals.<sup>8,43</sup> This source of advice may adversely influence the type of mouthguard selected due to a lack of understanding about the differences between mouthguards.<sup>8,43</sup> Limited understanding as to the different types available, as well as their comparative costs, may be the reason why certain guards are selected for children.<sup>8</sup> A lack of professional understanding about the construction of mouthguards for children also may be responsible for the low promotion of use in this population.<sup>35,37,44</sup>

Guidelines for the replacement of mouthguards for children have been vague and may require more regular replacement than for adults due to changes in growth and mixed dentition.<sup>45,46</sup> Dentoalveolar and palatal growth are recognized as occurring with greatest velocity at a similar time to peak vertical growth in height.<sup>47</sup> This oral growth is up to 1 millimeter per year. Therefore, it is recommended that mouthguards be assessed by a dental practitioner every athletic season and in conjunction with regular dental inspections. Additionally, during periods of peak growth, the mouthguard should be replaced to ensure maximum comfort and fit.

## Summary

Orofacial injuries are common in the pediatric population. Organized sports, as well as informal sporting activities, are significant etiological factors for dental trauma, particularly during adolescence. Risk factors for trauma include untreated malocclusions; a lesser developed skill level and physical coordination; and a higher level of risk-taking behavior of children.

To minimize the risk of dental trauma, it is important to promote the teaching of sporting skills and safe play for young children. Safety equip-

ment, including mouthguards, should be introduced as soon as children are participating in a sport, with mouthguards considered part of the team uniform. Dental professionals should promote custom-fitted mouthguards for children and check them regularly for integrity and fit. Dentists should promote mouthguard wear by providing information to parents, coaches and other people involved in youth sports, as well as asking their patients about their sports involvement. Dentists also can be involved by educating parents and coaches on dental first-aid and the immediate management of dental trauma.

Injury prevention for pediatric patients should also include timely orthodontic management, particularly in children with prominent maxillary incisor teeth and a high lip line. Prior to discharge, the pediatric patient should be assessed for the presence and status of mandibular third molars.

Future research to assist in the understanding of dental trauma due to sport in the pediatric population should include a prospective study to assess potential risk factors, both individual and sports-related, and develop predictive factors for analysis and discussions. **CDA**

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# Are Mouthguards Necessary for Basketball?

David Kumamoto, DDS, and Yoshinobu Maeda, DDS, PhD

## Abstract

This literature review evaluates the significance of dental injuries and their relationship to a specific sport — basketball. Many studies have been published on individual sports or groups of sports, but most pertain to specific age groups or levels of competition. Research suggests that many sports that do not require mouthguards should encourage male and female participants to use orofacial protectors.

Athletes, coaches, athletic directors, athletic trainers, parents, and members of the dental community should be aware of how individuals who participate in sporting activities are at risk for dental trauma.

Any sport where the potential for dental trauma can exist, such as basketball, soccer, or wrestling, should consider utilizing mouthguards to protect the competitors. The establishment of mouthguard programs for athletes of all ages and genders who participate in basketball may help to reduce the incidence of dental trauma.

**A**lthough mouth protection was introduced to athletes more 100 years ago, only a few sports, including football, boxing, field hockey, ice hockey, and lacrosse, require participants to use mouthguards.

Orofacial/dental trauma reporting systems indicate that dental injuries occur in conjunction with athletic activities, particularly the collision and contact sports. Athletes, coaches, and parents continually question the need for protective mouthpieces during sporting activities. As the number of individuals participating in sports has increased, particularly with the enforcement of Title IX (Department of Labor, Education amendments, 1972), the number of athletes with dental injuries also has increased.



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**Table 1****Orofacial Injury Studies**

| Author                       | Percentage of injury                                                                                    |
|------------------------------|---------------------------------------------------------------------------------------------------------|
| Levin et al. (2003)          | 27 percent reported sports-related dental trauma                                                        |
| Gassner et al. (2003)        | 31 percent of sample had oral trauma                                                                    |
| Ferrari et al. (2002)        | 28.8 percent of study reported trauma                                                                   |
| Tuli et al. (2002)           | 31.3 percent of dentofacial trauma                                                                      |
| Gabris et al. (2001)         | 29 percent sports-related dental injuries                                                               |
| Takigawa et al. (2001)       | 17.9 percent sports-related trauma                                                                      |
| Uchida (2001)                | 10 percent sports-related trauma                                                                        |
| Marcenés et al. (2000)       | 19.2 percent of dental trauma sports-related                                                            |
| Gassner et al. (1999)        | 50.1 percent of sample sports-related                                                                   |
| Kanoh et al. (1999)          | 11.7 percent sports-related injuries                                                                    |
| Okabe (1999)                 | 9.1 percent sports-related trauma                                                                       |
| Iida et al. (1998)           | 9.7 percent sports-related injuries                                                                     |
| Berg et al. (1998)           | 71.5 percent of coaches reported a dental injury during the course of a season                          |
| Kumamoto et al. (1998)       | 15.4 percent of dentists in survey                                                                      |
| Okamoto (1998)               | 1.3 percent sports-caused trauma                                                                        |
| Borssen and Holm (1997)      | 35 percent sports-related                                                                               |
| Noda (1997)                  | 8.4 percent sports trauma                                                                               |
| Nukata (1997)                | 24.1 percent pediatric sports-related injuries                                                          |
| Suzuki et al. (1997)         | 11.8 percent sports injuries                                                                            |
| Takeuchi (1997)              | 14.8 percent sports facial fractures                                                                    |
| Ichikawa et al. (1996)       | 12.3 percent sports-related trauma                                                                      |
| Ito et al. (1996)            | 14 percent chipped teeth sports-related                                                                 |
| Moshy et al. (1996)          | 8.6 percent of facial fractures from sports                                                             |
| Kumamoto (1996)              | 37.4 percent of athletes in city mouthguard program                                                     |
| Nishimura et al. (1996)      | 24.2 percent sports-related trauma                                                                      |
| Petti and Tarsitani (1996)   | 20.26 percent sports-related                                                                            |
| Petti et al. (1996)          | 17.4 percent sports-related                                                                             |
| Rodd and Chesham (1996)      | 26 percent sports-related                                                                               |
| Hayashi et al. (1995)        | 9 percent sports-related maxillofacial trauma                                                           |
| Hirade et al. (1995)         | 13.80 percent trauma from sports                                                                        |
| Ninomiya (1995)              | 8.8 percent sports dental injuries                                                                      |
| Nukata (1995)                | 2.5 percent pediatric maxillofacial fractures                                                           |
| Soporowski et al. (1994)     | 37.5 percent sports-related                                                                             |
| Forsberg and Tedestam (1993) | 18.2 percent boys' sports-related dental injuries;<br>8.2 percent girls' sports-related dental injuries |
| Bhat and Li (1987)           | 25.1 percent sports and play                                                                            |
| Garon et al. (1986)          | 12 percent of sample reported a dental injury                                                           |

Title IX states that “no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving federal financial assistance.” Title IX mandates that female athletes receive funding in educational and athletic programs equal to that of their male counterparts. Not only do male athletes sustain sports-related dental injuries, female sports participants also are being injured in increasing numbers.

The injury rates cited by the studies in this article vary greatly from region to region. For example, more information pertaining to dental injuries resulting from basketball accidents was available from the United States, where basketball is a dominant national sport, than from any other country in the world. Dental trauma data also was gathered by different methods in many of the cases, making quantitative comparisons difficult. Many surveys were based on prospective questionnaires given to selected groups of athletes and coaches while other studies collected data from hospital emergency rooms and dental clinics, retrospectively.

With the information provided in this article, dentists should gain the knowledge and confidence to make the appropriate recommendation to their patients regarding wearing mouthguards in basketball.

**Orofacial Sports Injury Studies**

Because there is no central data-gathering center for sports-related dental injuries, reports concerning orofacial athletic injuries are scattered throughout the dental literature. The reports presented in this article review some of the studies that have been published in the last 20 years pertaining to basketball. As the number of individuals involved in sports activities increases, so does the number of athletic den-

tal injuries.<sup>1</sup> Orofacial injuries include soft tissue lacerations, chipped or avulsed teeth, and mandibular/maxillary fractures.

Many of the published studies regarding dental injuries and participation in sports are listed in **Table 1**. Injury rates vary for a number of reasons; some studies looked at specific groups of athletes and a small sample size caused injury rates to appear high.<sup>2-7</sup> Berg et al. reported a high incidence of injury rates due to the number of coaches who reported an injury rather than the true number of injured athletes.<sup>8</sup>

Geographical location resulted in different injury frequencies. For example, Tuli et al. reported a high incidence of sports-related dental trauma; alpine

skiing accounted for nearly one-third of the oral injuries reported.<sup>9</sup> While Gassner et al. confirmed these statistics regarding alpine skiers and maxillofacial trauma, studies by Tanaka et al. reported a slightly lower percentage of trauma in Japan.<sup>2,10-12</sup> In Israel, Levin, et al. reported a dental injury rate of 27 percent in a group of 850 sports participants ranging in age from 6 to 18 years old.

Sample size also affected the results of the reports. Smaller sample groups were affected more by a slight increase in injury reports compared with a larger pool. For example, Takigawa et al. used a sample group of 161 and reported an injury rate of 17.9 percent, while Nishimura et al. reported a higher injury rate (24.2 percent) using a sample

size of 184.<sup>13,14</sup> Other researchers in the same geographical area, whose sample groups ranged from 200 to 1,502, reported injury rates ranging from 9 percent to 13.8 percent.<sup>1,3,15-18</sup>

Although athletes may expect to be injured while participating in a specific sport, many of the studies reported that dental/orofacial trauma occurred with some regularity in basketball.<sup>10,19-22</sup> The injury rate varied greatly depending upon the ages of the members of sample group, the level of competition (grade school, high school, and college) involved in the study, and the sample group's geographical location.<sup>20-31</sup>

The studies cited in this article were conducted in the United States (grammar, high school, and college age stu-

dents); Australia (average age 13.5 years and 30 years); Finland (20- to 24-year-olds highest injury rate); Sweden (16-year-olds); Italy (6- to 11-year-olds); Austria (mean age 17.8 years); Canada (Olympic competitors); Hungary (7- to 14-year-olds); Israel (6- to 17-year-olds); Japan (10- to 30-year-olds); Brazil (12-year-olds, 18- to 30-year-olds); Chile (10- to 12-year-olds highest rate); Singapore (average age 13.8 years old); Tanzania (21- to 30-year-olds); New Zealand (5- to 13-year-olds); and Great Britain (14 to 15-year-olds).

## Basketball

Basketball accounts for many of the orofacial injuries reported to dentists and hospital emergency rooms each year.<sup>29</sup> The enforcement of Title IX in the United States has led to a dramatic increase in the number of female collegiate athletes. This increased participation led to more dental injuries in female competitors.<sup>8,32-35</sup> Age-specific studies demonstrate that injury rates in basketball surpass those of collision sports such as football and ice hockey.<sup>9,28,36-39</sup> (Table 2). Dental injury rates among basketball players tended to be lower in countries where basketball is not a major sport than they are in the United States.<sup>40</sup>

In a survey of Australian basketball players, Cornwell et al. reported a high percentage of oral injuries (23 percent).<sup>41</sup> Of the 114 players who reported an orofacial injury, 21 percent stated a mouthguard was worn at the time of injury. Although athletes who had previous dental trauma while playing basketball were 2.77 times more likely to wear a mouthguard than nonusers, the overall rate of mouthguard usage did not increase in this sample group. Younger players tended to wear mouthguards more than older players, and mouthguards were worn more frequently during games than at practice.

Of the 427 individuals who reported

playing basketball in Levin's study in Israel, 7 percent sustained dental trauma; 30.2 percent of the basketball players were aware of mouthguards as protective devices, but only 1.9 percent actually wore a mouthguard. The authors advocated the promotion of mouthguard usage for all sports with an emphasis on basketball and soccer.

Studies conducted by Garon et al. in 1986 and Soporowski et al. in 1994 reported respective injury rates of 11.8 percent and 12.1 percent.<sup>27,28</sup> A 1988 study of Finnish athletes reported a basketball injury rate of 5.8 percent, while a 1995 study by Kujala et al. reported a rate of 5.2 percent.<sup>7,42</sup> More recently, Nakanishi et al. reported that Japanese

**Table 2**

## Basketball Orofacial Injury Studies

| Author                   | Percentage of injuries                                                 |
|--------------------------|------------------------------------------------------------------------|
| Levin et al. (2003)      | 7 percent reported basketball-related dental trauma                    |
| Cornwell et al. (2003)   | 23 percent had orofacial injury; 36.4 percent of study reported trauma |
| LaBella et al. (2002)    | 0.67/1,000 injuries — no mouthguard; 0.12/1,000 injuries — mouthguard  |
| Nakanishi et al. (1999)  | 2.3 percent of study reported dental injury                            |
| Kvittem et al. (1998)    | 54.7 percent of boys, 56.3 percent of girls reported orofacial injury  |
| Berg et al. (1998)       | 85.4 percent of boys' coaches, 78.4 percent of girls' coaches          |
| Kumamoto et al. (1998)   | 33 cases of tooth avulsion                                             |
| Kumamoto et al. (1998)   | 24.1 percent of dentists injured playing sports                        |
| Diab and Mourino (1997)  | 19 percent reported by parents                                         |
| Gomez et al. (1996)      | 14 percent of injuries reported                                        |
| Akimoto et al. (1995)    | 11 percent oral injury rate in basketball                              |
| Kujala et al. (1995)     | 5.2 percent of reported total injuries                                 |
| Teo et al. (1995)        | 19 percent Singapore schoolboys                                        |
| Flanders and Bhat (1995) | 18.3/100,000 of Illinois sample                                        |
| Soporowski et al. (1994) | 12.1 percent of schoolchildren                                         |
| Lee-Knight et al. (1992) | 0.8 percent of male players; 1.3 percent of female players             |
| Morrow et al. (1991)     | 10.0 percent of male collegiate players                                |
| Morrow et al. (1989)     | 7.5 percent of female collegiate players                               |
| Maestrello-deMoya (1989) | 31 percent of high school players                                      |
| McNutt et al. (1989)     | 40 percent of injuries in baseball and basketball                      |
| Sane et al. (1988)       | 5.8 percent of sample                                                  |
| Bhat and Li (1987)       | 3.38 percent hospital emergency room treatment                         |
| Garon et al. (1986)      | 11.8 percent of sample <sup>25,54,56,64</sup>                          |

basketball players had an injury rate of 2.3 percent.<sup>43</sup>

Studies that focused on groups of athletes rather than the general population, showed higher injury rates for basketball participants. Both Ferrari et al. and Akimoto et al. sampled groups of injured athletes. As a result, the injury rates were greater (36.4 percent and 11 percent, respectively) than in studies involving the general population.<sup>19,44</sup> A 1989 study by McNutt et al. reported that 40 percent of basketball and baseball players experienced oral trauma.<sup>38</sup> That same year, Maestrello-deMoya and Primosch reported an injury rate of 31 percent among high school basketball players.<sup>37</sup> A 1995 study of Singapore schoolboys by Teo et al. reported an injury rate of 19 percent.<sup>51</sup>

A retrospective study investigated 33 reports of children who were attempting to "slam dunk," a basketball through a rim and net.<sup>45</sup> Avulsed teeth were reported as a result of the children getting their teeth entangled in basketball nets. The average player injured was a white, male, and 12.3 years of age. Eighty-five percent of the accidents occurred at home. There was no adult supervision in 93 percent of the cases reported.

Different surveys indicated coaches and parents reported that basketball participants experienced dental trauma in high percentages. Berg's 1998 study noted injury rates reported by basketball coaches and parents of 85.4 percent for boys and 78.4 percent for girls, while Kvittem et al. reported injury rates of 54.7 percent for boys and 56.3 percent for girls who participated in basketball.<sup>8,33</sup> In a 1995 study by Diab and Mourino, 19 percent of parents reported that one of their children experienced a dental injury while playing basketball.<sup>36</sup> Although these percentages appear extremely high, these numbers reflect the number of coaches and parents who reported injuries and not a true count of the number of dental injuries sustained.

**Table 3**

### Orofacial Injury Studies

| Author                     | Percentage of injuries                                   |
|----------------------------|----------------------------------------------------------|
| Gabris et al. (2001)       | 85.87 percent maxillary central incisors                 |
| Lombardi et al. (1998)     | 87 percent maxillary permanent incisors                  |
| Borssen and Holm (1997)    | 75 percent maxillary incisors                            |
| Petti and Tarsitani (1996) | 62 percent maxillary central incisors                    |
| Petti et al. (1996)        | 74.6 percent maxillary central incisors                  |
| Teo et al. (1995)          | 64.8 percent maxillary incisors damaged                  |
| Nysether (1987)            | 45 percent of injuries affected maxillary anterior teeth |
| Nicholas (1980)            | 72.4 percent maxillary central incisors                  |

Female basketball players also have been shown to be at risk for dental trauma. A 1996 study by Gomez et al. found that orofacial injuries accounted for 14 percent of sports injuries from a sample group.<sup>32</sup> Morrow et al. reported that female collegiate players had a 7.5 percent injury rate while a 1992 study noted that elite players of Olympic caliber during limited competition produced a low injury rate of 1.3 percent.<sup>34,46</sup>

Older athletes tended to have fewer dental injuries than younger players.<sup>35,46,47</sup> A 1991 study by Morrow et al. stated that male collegiate players had an injury rate of 10 percent, while a subsequent study by Lee-Knight et al. reported a very low oral injury rate (0.8 percent) among elite male basketball players during a short tournament period.<sup>39,46</sup> Maestrello-deMoya (31 percent), Diab and Mourino (19 percent), Teo, et al (19 percent), and McNutt, et al (40 percent) all reported high dental injury rates for grade and high school age basketball players.

Labella et al. reported a significant difference in the injury rates of collegiate basketball players who wore mouthguards compared with players who did not.<sup>47</sup> This prospective study collected data from college athletic trainers utilizing a survey form located in a website on the Internet. This system

eliminated the paper questionnaire and made follow up by the investigators much more efficient. It was determined that players who wore mouthguards had significantly lower dental injury rates than those who wore no protection; however, soft tissue injuries and concussions occurred at similar rates, whether or not mouth protection was worn.<sup>47</sup>

These reports show a clear pattern of orofacial injury for basketball competitors. Injury frequencies are higher for male and female basketball players than for their football counterparts. Although football players are required to wear helmets with face shields and mouthguards at the amateur level to minimize the risk of dental injury, basketball players have no such mouthguard rule. The authors believe the dental community should make a strong recommendation for basketball players to use mouthguards to reduce the incidence of dental trauma.

### Orofacial Injury Site Studies

Individuals participating in sports activities may be at risk for dentofacial trauma. The literature indicates that the maxillary central incisors are injured more frequently than any other teeth<sup>20,23-25,49,51,53</sup> (Table 3). Other non-sporting events, such as falls, automobile accidents, fighting, and work

injuries, also can result in trauma to the maxillary front teeth.

The site of injury is relatively similar regardless of the sport involved or the geographic region. The countries listed in **Table 3** include Norway, Finland, Hungary, Italy, New Zealand, Singapore, Sweden, and the United States. The sports involved include soccer, football, bandy, ice hockey, wrestling, and basketball.

The use of a mouthguard may protect the maxillary front teeth from injury. Football has demonstrated a dramatic decrease in dental injuries with the use of mouthguards and helmets with facemasks. The use of mouthguards in all sports would reduce the chance of dental injury for an athlete.

As of 2003, football, boxing, ice hockey, field hockey, and lacrosse are the only sports in the United States that require players to use a mouthguard. For sports where a dental injury might occur, such as basketball, athletes should use mouth protection.

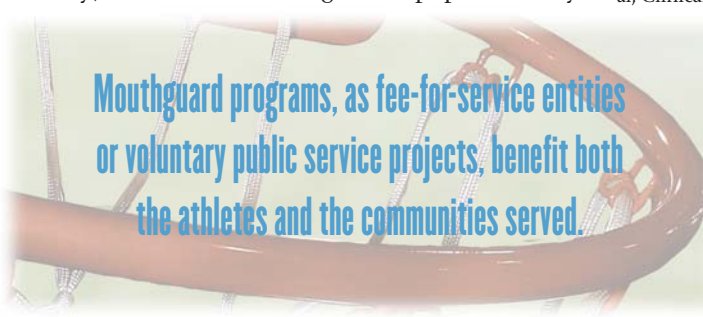
## Summary

Comparing injury statistics can be difficult as there is no uniform system for reporting the number of injuries.<sup>47,55-64,67,68</sup> The small size of the target populations may yield higher than average injury rates that are inaccurate. Conversely, these statistics may be lower than expected because the athletes affected may not report all of their injuries. A universal reporting system utilizing the Internet could aid in the collection and interpretation of orofacial/dental injury statistics.

Studies show that basketball accidents are the cause of many dental injuries and that trauma rates vary for many reasons. In some cases, injury rates have increased as more individuals participate in basketball. Over time, injury

rates have decreased in some sports such as football and ice hockey due to the requirement and improvement of protective equipment, such as facemasks and mouthguards. However, the studies reviewed indicate that there is a need for mouthguard usage in basketball.

The importance of orofacial protection during sports activities should be stressed to the general population by



Mouthguard programs, as fee-for-service entities or voluntary public service projects, benefit both the athletes and the communities served.

members of the dental profession. Mouthguards have been shown to reduce the number of dental injuries for sports participants. Mouthguard programs, as fee-for-service entities or voluntary public service projects, benefit both the athletes and the communities served. These programs also promote dentistry and enhance the image of the profession.

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# Sports Dentistry and the Olympic Games

Paul M. Piccininni, BSc, DDS, and René Fasel, DMD

## Abstract

This paper will provide a review of dental services from previous Olympic Games, and will outline components of an ideal dental program for future event organizers.

**T**he Olympic Games bring the finest amateur and professional athletes in the world together for competitions every four years. The games are awarded by the International Olympic Committee to a host city, which in turn creates an Organizing Committee responsible for all aspects of the games, including the development of an appropriate medical service. Under the direction of the IOC Medical Commission, and in accordance with the stipulations of the Olympic Charter, this comprehensive service includes medical facilities for athletes at both training and competition sites; a medical service for spectators, media and officials at the various Olympic facilities and hotels; coordination of ambulances, and hospital and diagnostic services. This can be a tremendous logistical exercise. In Tokyo in 1964, there were approximately 9,100 health care personnel providing medical services.

The center of Olympic medical care for the athletes is the polyclinic. Situated in the main Olympic Village, it offers a comprehensive range of services at no charge, including emergency services supported by ambulance transport; sport and general medicine; medical imaging; pharmacy; physiotherapy and massage therapy. Dental services are also provided at this location.

## Dental Services at the Olympic Games

There has been considerable latitude in the level of dental service offered at previous Olympic Games, primarily due to the lack of firm direction within the Olympic contract. In fact, in the IOC Medical Commission guidelines, the requirements for dental service are listed simply as follows:

- Dental care

Dental care shall be available on an emergency basis only. Services to be provided shall include:

- Treatment of broken or injured teeth;

- Fillings;

- Replacement of caps; and

- Limited oral surgery.

There is a fundamental difference in the manner by which medical and dental care is sought by athletes. Aside from regular physical assessments,



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team physicals or elective massage, there are relatively few situations where a noninjured or healthy athlete seeks medical attention. While orofacial injuries are an unfortunate part of high-level competition, their treatment usually makes up only a small percentage of the overall dental service during any games. Similarly, as true dental emergencies (swelling, abscess etc.) can severely limit an athlete's ability to train or compete, part of the mandate of the Olympic dental service is to deal with these when they arise.

However, there are countless other situations where athletes may choose to seek dental care of a nonurgent or elective nature. Athletes may wish to have a simple check-up or cleaning. They may have a cavity or lost restoration that is not causing any pain or discomfort, but for which they would like treatment. They may have a nonpainful but necrotic tooth that requires endodontic treatment. They may have a large restoration that would benefit from a crown. Or, they may wish to obtain a custom-made mouthguard.

These situations arise because of the nature in which dental care is delivered in many countries. Typically, an athlete in training has access to medical and therapy care through their National Olympic Committee at little or no cost, which is important as many athletes are training with limited financial resources. Unfortunately, very few NOCs have programs to deliver dental care to their athletes. There are some exceptions such as South Africa, which offer a program to screen athletes in advance of the Olympic Games, and have arrangements made to complete any necessary treatment.<sup>1</sup>

However, unless socialized dentistry is available in their country, or the athlete has access to dental or other third-

party insurance coverage, the costs will come out of their own pockets. Many athletes thus neglect their dental health while in training, but seek elective care during the Olympics because these services are provided free of charge.

The challenge to the organizing committee is to determine what services should be available and to what extent. The dental service has fulfilled its primary mandate when it can deliver



The dental service has fulfilled its primary mandate when it can deliver “urgent and necessary care” to athletes with injuries, pain, or significant dental disease.

“urgent and necessary care” to athletes with injuries, pain, or significant dental disease. It is in the determination of the additional or elective services that significant variation has occurred from games to games.

## The Dental Health of Olympic Athletes

Forrest gave one of the first in-depth indications of the generally poor health of athletes.<sup>2</sup> He conducted a basic examination of 35 members of the British Olympic team (about 14 percent of the team) prior to their departure for the Mexico City Olympics in 1968. He performed emergency treatment on two eventual gold medal winners who had caries encroaching the pulp, and also found a high use of glucose drinks or other sweets. His overall assessment of the dental state of his team was “very poor.” He then made arrangements to assess the dental health of other participating countries during the games and, after examining more than 400 athletes from 30 countries, found many with both extensive caries and gingivitis.

Forrest documented two anecdotes that showed the ability of dental dis-

ease to adversely affect the quality of competition. A world-record holder presented to the clinic with severe pericoronitis and an apparent systemic infection. Although she received treatment, she was forced to drop out of her competition after having completed less than half the distance. Two other athletes refused treatment for apparent pulpitis and took part in their events while using large amounts of analgesic medication. Both were eliminated in the preliminary rounds. Forrest commented, “A dentally unfit mouth is a risk in that a crisis might occur at any time, and will then jeopardize the contestant’s chances. It is impossible to know which unfit mouth will break down and become an emergency at the wrong time. There is a strong case for careful dental screening of all contestants.”<sup>2</sup>

The article also made reference to comments from medical officers of other nations about the dental health of their own athletes. A Yugoslav medical officer referred to the dental condition of his team as “very bad ... with many emergencies.” A United States medical officer was very concerned about the “... poor dental state” of many members of his team, and noted that of 47 athletes participating in a pre-Olympic camp, there were seven dental emergencies.

The article concluded with a number of key recommendations that, although more than 30 years-old, are still worth considering today. The need for pre-Olympic assessments and education on the importance of good dental health was emphasized, and the completion of necessary dental treatment prior to the games was encouraged. Pericoronitis and other related third molar problems were mentioned as being of particular importance in this population. Oral hygiene education and materials should be available within the

village, possibly with the assistance of corporate sponsors.

In a similar vein, Callaghan noted that in a study of elite British cyclists, 21 percent (102 of 467) required further dental treatment following their routine screening exam, but many did not complete treatment due to dental phobia or other training issues.<sup>3</sup> He observed that "... the authors have experience at Olympic and Commonwealth Games of elite cyclists presenting with acute dental problems that could have been prevented by proactive dental care."

An article on the role that dentistry plays in the United States Olympic Committee pointed out that "... every pre-competition screening turns up several athletes with severely decayed or abscessed teeth."<sup>4</sup> The author also stated that one reason elite athletes may be more susceptible to dental emergencies is that many are between the ages of 18 and 23, when wisdom teeth are likely to cause dental distress. He suggested that "... dental neglect ... could mean that all the years of sweat and sacrifice leading to international competition can be compromised unnecessarily at the moment of truth by a tooth abscess or other dental emergency."

Similarly, Dr. Kenneth Clarke of the USOC made the somewhat controversial recommendation that "Dental fitness requirements should be insisted upon for the contestants from all countries participating in the Olympic Games."<sup>2</sup>

A 1994 examination of the U.S. biathlon team's 31 athletes revealed that:

- Eleven had not seen a dentist in more than two years;
- Twelve required wisdom tooth extraction;
- Six others might require wisdom tooth extraction;

■ Two suffered from periodontal disease requiring treatment;

■ Seven athletes had a total of 21 carious lesions; and

■ Two needed treatment for TMJ disorder.

The author also noted that five years prior to instituting oral exams, four biathletes developed serious dental complications, and one was forced to return home for dental care. One ath-



A conservative estimate at that time  
was that 40 percent of the screened athletes  
required dental care.

lete fractured a tooth and required immediate care on the eve of the 1994 Winter Olympic Games.<sup>5</sup>

Drs. Ray Padilla and Emilio Canal examined 35 players during routine screenings of the USA Men's World Cup pool of soccer players in January 1998. Thirty-three of them had suffered a previous soft tissue injury, and 20 had incurred a hard tissue injury, including six who had teeth avulsed. Future treatment was required by 25 (71 percent), of the athletes and immediate care needed by six (17 percent).<sup>6</sup>

Kerr discussed the steps that had been taken to prepare American athletes prior to the L.A. Games in 1984. Dental assessments and treatments were made available at a number of pre-Olympic competitions. Athletes attending the 1983 Pan-Am and World University Games were screened and received treatment as required through the use of a mobile dental van with portable X-ray. A conservative estimate at that time was that 40 percent of the screened athletes required dental care. The USOC also took a lead role in using the Olympic Games to help promote

the use of mouth protectors in both Olympic and other sports.<sup>7</sup>

In any competition involving contact sports, injuries may play a significant role and many authors have discussed the injury potential of athletes competing in Olympic sports. Kvittem showed the high incidence of dental injuries in the Olympic sports of soccer, wrestling, and basketball.<sup>8</sup> Linn's review of facial injuries in the Netherlands confirmed, in addition to dental injuries, a high incidence of facial fractures, and any Olympic program should also be prepared to deal with this serious injury.<sup>9</sup>

Mouthguards have been shown to be effective tools in the battle against dental trauma. Garon proposed mouthguards for many sports, including the Olympic sports of baseball and basketball.<sup>10</sup> In Dreyer's article, Dr. Jim Gallman was quoted as stating "If every piece of protective equipment was as effective as the oral mouth protector, there would be no sports-related injuries at all."<sup>11</sup> McNutt recorded 69 oral injuries in baseball and basketball, 67 of which occurred in athletes not wearing mouthguards.<sup>12</sup> Duda and others have shown the effectiveness of introducing regulations requiring compulsory mouthguard use. In American football, the compulsory use of mouthguards reduced the incidence of orofacial injuries from 50 percent of all injuries to less than 1 percent.<sup>13</sup>

Concussions are another consequence of high-level competition. Barth presented specific information on concussion incidence in the Olympic sports of boxing, soccer and equestrian, and proposed a mathematical model to quantify the role that mouthguards may play in reducing concussion incidence or severity.<sup>14</sup> Biasca, concentrating his report on the Olympic sport of ice hockey, showed a very high incidence of

both head and orofacial injuries, and felt that the potential benefits of mouthguards from both an orofacial and neurological standpoint justified their use. He also pointed out that the International Ice Hockey Federation introduced a regulation regarding compulsory mouthguard use.<sup>17</sup> McNutt also agreed with the neurological benefits of mouthguards, stating with regard to football that "... mouth protectors are very effective at reducing concussions."<sup>12</sup> McCrory however, while acknowledging the benefits of mouthguards in reducing dental injuries, pointed out that inadequate research exists to develop a science-based argument for any relationship between these devices and a reduction in concussions.<sup>15,16</sup>

Despite the high incidence of dental injuries, there is still resistance from athletes to use mouth protection. Chapman, reviewing Australian data, noted that approximately one-third of all dental trauma resulted from sporting injuries, but in only 1 in 20 occurrences was a mouthguard worn.<sup>18</sup> Bolhuis showed that while 1 in 5 field hockey players sustained at least one serious dental injury during their careers, only 20 percent of international players chose to wear a mouthguard. The main deterrent was education about the potential benefits.<sup>19</sup>

## Physical Set-up of the Olympic Dental Service

The first significant recorded data from the Olympic Games dental service was from Los Angeles in 1932. Commendations should go to the medical director who felt that "... great emphasis should be placed on the importance of dental hygiene in the care of the athletes," which was accomplished by using a donated "traveling

health mobile" in the Olympic Village, along with a staff of 27 dentists. The official report notes that "... probably for the first time in Olympic history, toothaches, decayed teeth, exposed nerves and other dental troubles which might impair the efficiency of the athlete on the eve of a contest received immediate attention."<sup>21</sup>

At the following Olympic Games in Berlin in 1936, only three dentists were used at a clinic in the Olympic Village.<sup>22</sup> Similar data was recorded from Tokyo

Despite the high incidence of dental injuries, there is still resistance from athletes to use mouth protection.

in 1964, where three dentists and three nurses used three dental chairs in the Olympic Village to provide treatment. This was a relatively small program, considering that more than 9,100 health care professionals were involved in these games.<sup>23</sup>

In 1968, at the Winter Olympics in Grenoble, the dental service was turned over to private clinics in the region, a decision that meant athletes had long distances and long waits for treatment. At the Summer Games that same year in Mexico City, two full-time dentists used a clinic in the Olympic Village to provide the dental service.<sup>24</sup>

In Sapporo in 1972, a small medical clinic, including a dental clinic, was established in the Olympic Village and provided treatment daily between 9 a.m. and 5 p.m.<sup>25</sup> A more extensive program was developed for the Munich Olympics later that year, with four chairs in two locations and 21 dentists providing treatment from 6 a.m. to 10 p.m. during the games.<sup>26</sup>

This standard model was again used

in Montreal in 1976, where 32 dentists provided extensive care, available 24 hours a day, either on-site at the polyclinic or on-call. These games were the first to have provided venue coverage for the athletes — dentists equipped with appropriate instruments and IOC-approved medications — either in attendance at competition sites or available within 30 minutes to render emergency treatment.<sup>27</sup>

At Lake Placid in 1980, emergency dental treatment was defined as "... the treatment of dental anomalies and buccal pathologies which could prevent an athlete from performing to the best of his/her ability during the Games." The treatment policy was outlined as "... treatment is to be of an emergency or temporary nature, except when in judgment of

the dentist on duty a more permanent treatment is indicated. However, the clinic is not to be responsible for any treatment or repair of a nature that would require extensive time." Eighteen dentists provided treatment through the polyclinic between 6 a.m. and 11 p.m. usually with one on-site and one on-call dentist.<sup>28</sup>

One of the more extensive and well-documented dental services was developed for the 1984 Olympic Games in Los Angeles. There were a number of innovations at these games. The importance of pre-Olympic screening was recognized and a portable van with X-ray equipment traveled to various pre-games competitions to examine athletes and arrange treatment.

On-site dentists were used selectively at soccer, water polo, and basketball. As an indication of the usefulness of this program, during a pre-Olympic water polo tournament in 1982 a player lost four teeth due to contact with the goalpost. He received both immediate and follow-up care, along with a

mouthguard, and was able to return for the next game.<sup>27</sup> These were also the first Olympic Games with a mouth-guard program for athletes. Three dental clinics were established (one at each village) with a total of five operatories. Volunteer dentists committed to 30 days during the games, along with their involvement in pre-Olympic competitions.<sup>29</sup>

In 1988, Calgary used a 2,000-square-foot mobile clinic that was sent to northern Alberta after the games. The clinic was outfitted with state-of-the-art equipment, and was open from 1 p.m. to 7 p.m. daily, with an on-call service for emergencies. Treatment was provided by three dentists and three assistants. Some private offices were also used to treat emergencies at outlying venues.<sup>30</sup>

A different model was used in Albertville in 1992, where budget constraints caused the proposed Olympic Village dental clinic to be scrapped in favor of private clinics in Brides Les Bains, Val-d'Isère, and La Plagne. One chair was also set up in Les Saisies for use of a private dentist for emergency treatment.<sup>31</sup>

Following the Los Angeles model, Dr. Esteban Brau and his staff used nine dentists and a two-chair clinic during the Barcelona Games of 1992. The clinic became a social medicine clinic and is still in use today.<sup>32</sup>

At the 1994 Winter Games, dental services were offered by 13 dentists in four locations: the main public clinic in Lillehammer (10 operatories); a clinic in the Olympic Village, (one operatory); a field unit with two operatories; and the regional hospital in Lillehammer (for advanced oral surgery). The large number of clinics resulted from the organizers commitment to provide treatment for 3,500 Olympic family members; 13,000 volunteers and functionaries, and approximately 100,000 spectators daily.<sup>33</sup> A more standard model, consisting of a one-room, two-chair operatory,

was used during the following 1998 Winter Olympics in Nagano.

The importance of oral hygiene was emphasized during the Atlanta Olympics in 1996. In addition to a three-chair dental clinic in the polyclinic, there was also an athlete health education center located within the village. Three different sections allowed athletes to learn about various aspects of vision, hearing, and oral health. Upon providing evidence of participation in all three components, athletes were given a complimentary electric toothbrush.<sup>34</sup>

With the support and guidance of the IOC medical committee, a comprehensive dental program was developed for the Sydney Olympics in 2000. Dental care was provided in a four-chair dental clinic with an on-site laboratory. Patient records were computerized, and digital radiography, including a digital orthopantomogram, was available. The clinic was open daily from 8 a.m. to 11 p.m.

One initiative was the provision of pressure-laminated mouthguards for athletes in contact sports including basketball, field hockey, water polo, and soccer. An oral health program was also designed to promote the importance of overall good dental health to the athlete. A key component of this program was the distribution of the IOC-sponsored brochure "Sports Dentistry and the Olympic Athlete." This educational document was produced in English, French, and Spanish, and was distributed in the dental clinic and to each of the 199 NOCs in attendance at these games.

### **Treatment Statistics from the Dental Service**

It is a statistical challenge to directly compare dental treatment statistics from different games as there has never been a standardization of the Olympic data-collection system. In some cases, the number of visits was tracked while

in others, the number of procedures was noted. Athlete visits were not always separated from visits by delegation members, volunteers, or staff. An athlete reporting for an examination, two radiographs and a three-surface restoration would be recorded in some cases as having had four procedures, while in other cases, would simply be one visit to the clinic. Occasionally, treatment was sorted by age, sex, sport, or country.

Some trends and tendencies do become apparent, and though the pool of data is too extensive for complete analysis within this paper, the key points will be noted and a chart summarizing the findings (Table 1) can be found at the conclusion of this section.

The earliest data comes from Berlin in 1936, where 147 athletes received a total of 473 treatments, including 33 radiographs. Two athletes were treated for jaw fractures.<sup>22</sup> No other reliable data is available until Tokyo in 1964, where 202 dental cases were treated, including 60 cases of Class I and II caries, and 16 dental fractures. A large number of the patients came from athletics (53) and basketball (19), which may be reflective of the overall participation numbers.<sup>23</sup>

In Mexico City in 1968, there were more than 1,000 emergency visits with more than 400 sedative or permanent dressing placed to treat caries. Additionally, 370 teeth were extracted; more than 40 patients received endodontic treatment; and third molar pericoronitis was particularly noted as one of the persistent problems in the clinic, with more than 40 cases.

Staggering data also came from the Munich Games of 1972, with the staff of 24 dentists treating close to 2,300 patients and performing close to 1,400 surgical procedures. There were 3,359 restorative and endodontic procedures. It is believed these statistics include treatment performed outside of the Olympic family, on both volunteers

| Table 1                                                     |              | Los Angeles | Calgary | Seoul | Albertville | Barcelona | Lillehammer | Atlanta | Nagano | Salt Lake City | Athens |
|-------------------------------------------------------------|--------------|-------------|---------|-------|-------------|-----------|-------------|---------|--------|----------------|--------|
| Summary of Recent Olympic Games Dental Treatment Statistics |              | 84          | 88      | 88    | 92          | 92        | 94          | 96      | 98     | 02             | 04     |
| Total number of athletes                                    |              | 6829        | 1423    | 8391  | 1807        | 9356      | 1737        | 10318   | 2176   |                |        |
| Visits                                                      | Athletes     | 359         | 36      | 280   | 36          | 356       | 112         | 578     | 134    |                | 278    |
|                                                             | Others       | 185         | 6       | 548   | 20          | 327       | 413         | 388     | 126    |                | 287    |
|                                                             | Total        | 544         | 42      | 828   | 56          | 683       | 525         | 906     | 260    | 311            | 565    |
| Procedures                                                  | Restorations | 174         | 10      |       | 42          | 222       | 353         | 473     | 164    | 224            | 356    |
|                                                             | Endodontic   | 63          | 13      |       | 15          | 81        | 80          | 72      | 35     | 48             | 144    |
|                                                             | Periodontal  | 74          | 3       |       | 2           | 11        | 29          | 44      | 18     | 56             | 167    |
|                                                             | Prosthetic   | 50          | 3       |       | 5           | 35        | 16          | 16      | 15     | 0              | 22     |
|                                                             | Extractions  | 49          | 4       |       | 5           | 60        | 57          | 88      | 7      | 11             | 49     |
|                                                             | Mouthguards  | 25          | 0       |       | 0           | 1         | 0           | 6       | 0      | 11             | 56     |

and spectators, but they are still impressive.<sup>26</sup> In comparison, approximately 300 athletes and another 130 staff were treated during the subsequent 1976 Olympic Games in Montreal.<sup>27</sup>

At Lake Placid in 1980, 68 patients sought treatment, 30 of them athletes. Nineteen cases of caries, 12 of pulpitis, and 11 fractures represented a majority of the diagnosis, while treatment included 40 permanent or temporary dressings, five extractions, and three endodontic procedures.<sup>28</sup>

Approximately 20 athletes sought treatment at the next Winter Games in Sarajevo in 1984, with the remainder of the 137 patients being staff, officials or others.<sup>35</sup>

During the 1984 Los Angeles Games, more than 500 patients received treatment, with close to 70 percent of them being athletes. Pulpitis and caries were the cause of more than 200 visits, and pericoronitis was again prominent with 50 cases. There were also more than 40 fractures or trauma cases. Treatment included close to 174 permanent or temporary restorations, 49 extractions,

and 63 endodontic procedures, and in an apparent Olympic first, 25 mouthguards were fabricated.<sup>29</sup>

Data from the subsequent two Olympic Winter Games, Calgary in 1988 and Albertville in 1992, were quite comparable. Forty-two patients were treated in Calgary, 36 athletes, and six support staff. Treatment included 20 restorations, four extractions and 13 endodontic procedures.<sup>30</sup> In Albertville, a total of 56 patients, 36 who were athletes, received 42 restorations, 14 endodontic procedures and five extractions. Close to one-third of the patients were from Russia.<sup>31</sup>

There is little data from the 1988 Summer Games in Seoul, although we do know that 828 individuals, including 280 athletes, were treated, making dentistry the third most utilized service within the Village Medical Center. Interestingly, the next most popular service was acupuncture, with 724 patients.<sup>36</sup> There is, however, excellent data from the following games in Barcelona in 1992. During the 32 days the clinic was open, 681 patients received treatment, including 356 ath-

letes. The age range of athletes was 15 to over 60, and the average age was 34. The sports of athletics and boxing provided the largest numbers of patients, and citizens of the former Soviet Bloc, including Belarus, Moldavia, Ukraine and Kazakhstan, made up more than 100 of the patients.

One particular case deserves mention. An athlete who was one of the top five marathon runners in the world developed an abscess and required an extraction the day before her race. Not surprisingly this athlete, after four years of training, had a very poor result the next day.

Close to 200 patients presented in Barcelona with either lost restorations, including crowns and bridges, or fractured teeth. Almost 100 suffered from acute apical abscess and 31 were diagnosed with pericoronitis. Treatment included more than 200 restorations, 81 endodontic procedures and 60 extractions.<sup>32</sup>

The data collected in Lillehammer in 1994 showed more than 400 patients were treated, including 112 athletes.

Their service also offered care to a large number of functionaries and spectators, and many of the patients were from Russia, Ukraine, and Kazakhstan. Treatment included more than 350 restorations, 80 endodontic procedures and 57 extractions.<sup>33</sup>

In 1996, the Atlanta Olympic Games dental service provided treatment for 906 patients, 518 of whom were athletes. There were 473 restorations placed, and 72 endodontic procedures were performed. Unfortunately, 88 teeth were also extracted. Again, 19 percent of the patients came from the former Soviet Bloc, primarily Ukraine, Russia, and Belarus.<sup>34</sup>

During the 1998 Winter Olympics in Nagano, dentistry was the fourth most-requested service at the polyclinic, making up nearly 20 percent of all visits. A total of 260 dental patients received 164 restorations, 35 endodontic procedures and seven extractions. Seventeen percent of the patients came from each of Russia and Ukraine, and another 9 percent were from Kazakhstan.<sup>37</sup>

No official treatment data was ever made available by the organizers of the Sydney Olympic Games of 2000.

### **Dental Service at Recent Olympic Games**

While the previous historical overview was designed to illustrate the development of some trends and tendencies, the current state of both athlete dental health and the Olympic dental service can be best seen by a detailed look in detail at the two most recent events, the 2002 Olympic Winter Games in Salt Lake City and the 2004 Summer Olympic Games in Athens.

#### *Salt Lake City, 2002*

Under the direction of Lynn Powell, DDS, of the University of Utah, a two-chair dental clinic was established within the polyclinic. Both panoramic and intraoral radiographs were available. The

clinic was open daily from 8 a.m. to 8 p.m., and there was a dentist on-call after normal clinic hours. The university hospital dental clinic was also available for after-hours emergencies.

There were 14 dentists and 12 dental assistants, with one dentist/assistant team scheduled per shift. Four dental specialists were on-call, but only the endodontist was used extensively.

A total of 311 patients visited the clinic. There were 224 restorations placed and 48 endodontic procedures performed. Eleven teeth were extracted, and 11 custom mouthguards were fabricated. With dental cleaning being available, 56 patients took advantage of this treatment, and approximately 500 radiographs were taken.

There was also a team of dentists who provided venue treatment at the men's ice hockey games. Injury statistics provided by the IIHF's Injury Reporting System predicted between seven and 11 orofacial injuries during the Olympic competition, and in fact, seven dental injuries were reported and treated. Of those injured, six returned to play within a few minutes, and one was forced to retire from competition.<sup>38,39</sup>

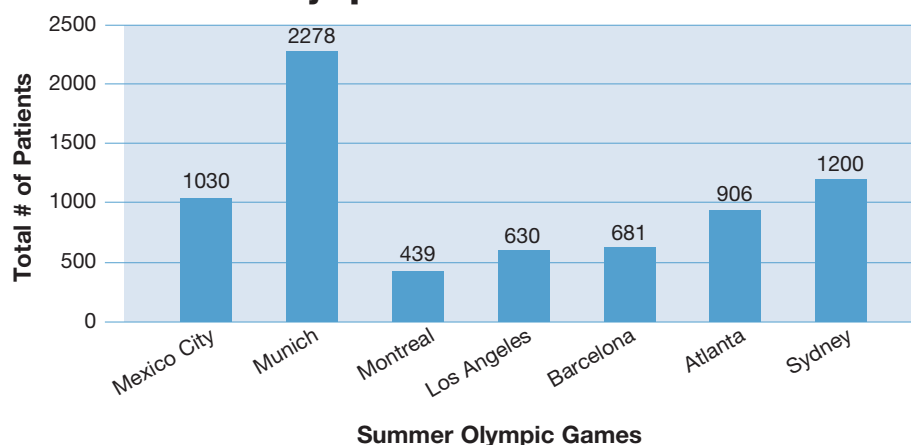
## Athens, 2004

Dr. George Vougiouklakis and the staff of the University of Athens dental school created an excellent dental service for both the Olympic and Paralympic Games. The primary treatment venue was a five-room clinic within the polyclinic. One large room held three dental chairs while a single chair, for either surgery or confidential consultation, was in a second room. There was also a small laboratory, a business office and a staff room. A digital panorex unit was in the final room, and digital X-ray units were available at all chairs. A computer system was networked not only to the entire dental suite, but also to the other imaging units within the polyclinic, allowing immediate access to CT, MRI, or ultrasound images if needed.

There were approximately 28 dentists and/or specialists (virtually all staff members from the university) and the same number of support staff. Many of the auxiliaries were senior dental students. The clinic was equipped to perform all dental procedures, and was open for approximately 15 hours each

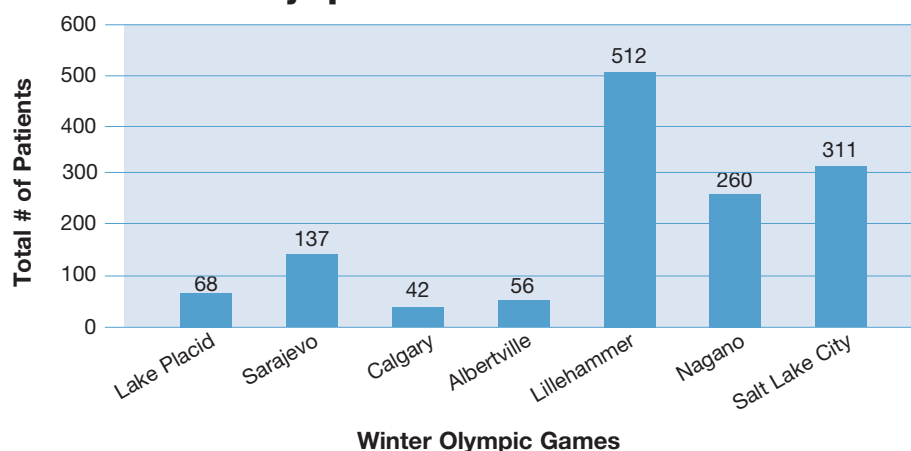
**Table 2**

## Summer Olympic Games — Dental Patients



**Table 3**

## Winter Olympic Games — Dental Patients



day. The clinic began operation 10 days before the start of the games and, except for a short break, continued to offer treatment through the end of the Paralympic Games which followed the Olympics. Translation services were readily available within the polyclinic, as were immediate consultations with other health care professionals.

The clinic also offered custom-made pressure laminated mouthguards and many of the athletes, especially boxers, took advantage of this opportunity. Five traumatic injuries (lateral luxations of five teeth in two athletes; one avulsion; one orbital bone fracture; and one cusp

fracture) occurred during the boxing competition. Other injuries were documented in sailing (enamel fracture), taekwondo (crown-root fractures of two teeth) and wrestling (lateral luxations of two teeth). Vials with Hank's balanced solution, along with written protocols, were distributed to venue physicians serving at events with a high potential for traumatic injury.<sup>40</sup>

## Discussion

While it is not scientifically appropriate to directly compare the data from different games due to the differences in nomenclature and collection

**Table 4****Extractions vs. Endodontics at Various Games**

| Event               | Extractions | Endodontics |
|---------------------|-------------|-------------|
| Mexico City (68)    | 370         | 43          |
| Los Angeles (84)    | 49          | 63          |
| Barcelona (92)      | 60          | 81          |
| Lillehammer (94)    | 57          | 80          |
| Atlanta (96)        | 88          | 72          |
| Nagano (98)         | 7           | 35          |
| Salt Lake City (02) | 11          | 48          |
| Athens (04)         | 49          | 144         |

methods, one can find certain trends, tendencies, changes, and other concepts within this data.

The utilization of the dental service by athletes and officials over the last 30 years is clearly increasing. At the Summer Games (**Table 2**), the number of dental patients has increased steadily since Montreal, and the same can be said for the Winter Games (**Table 3**) from Calgary to Salt Lake City. (The 512 patients seen in Lillehammer reflects the large number of volunteers treated.)

Some of this gain can be explained by the overall increase in the number of athletes participating at the Olympic Games and the number of sports that are now included. We should expect the demand on this service to continue to increase, as the dental needs of both athletes and officials are not being properly dealt with at home.

One visible trend is a greater attempt to save teeth as opposed to extracting them (**Table 4**). In Mexico City, for example, it is estimated that 370 extractions were done and only 43 endodontic procedures. This can be compared with the Atlanta in 1996 (88/72); Nagano in 1998 (7/35); and Salt Lake City in 2002 (11/48). Part of this trend may be the result of better oral hygiene by the athletes or improved

access to treatment in their home country. Another reason may be that the Olympic dental service has expanded from an emergency-only clinic where little but extractions was offered. Regardless of the reason, this trend toward keeping instead of extracting teeth is one that should be promoted, planned for, and encouraged by future games organizers.

There is also a greater tendency to provide permanent instead of temporary restorations. As **Table 5** confirms, a majority of restorations placed at the more recent Olympic Games have been permanent, while this was not the case, for example, in Lake Placid in 1980. Part of the movement to permanent restorations may be a technical one, in that "near" pulp exposures can now have solid and stable liners placed and be immediately restored. It is more likely that this trend reflects the establishment of clinics with sufficient volunteers with permanent restorative materials at their disposal.

A common theme is the regular appearance of pericoronitis as a problem during the games. The number of reported cases is in some instances staggering, with more than 40 from Mexico City in 1968; seven from Lake Placid in 1980; 53 from Los Angeles in 1984; 31

from Barcelona in 1992; and 39 from Lillehammer in 1994. This should be no surprise considering the age range of the competitors, but as pericoronitis can be a debilitating condition, significantly inhibiting performance, this problem must be identified and treated well in advance of the games.

The Olympic dental service must primarily take care of the athletes. In most cases where this type of data was kept, more than 50 percent of all treatment was provided for athletes (**Table 6**). This is an objective that organizing committees must maintain, and at recent games, after dealing with true emergencies from any member of the Olympic family, elective or nonurgent treatment has been limited to the athletes only.

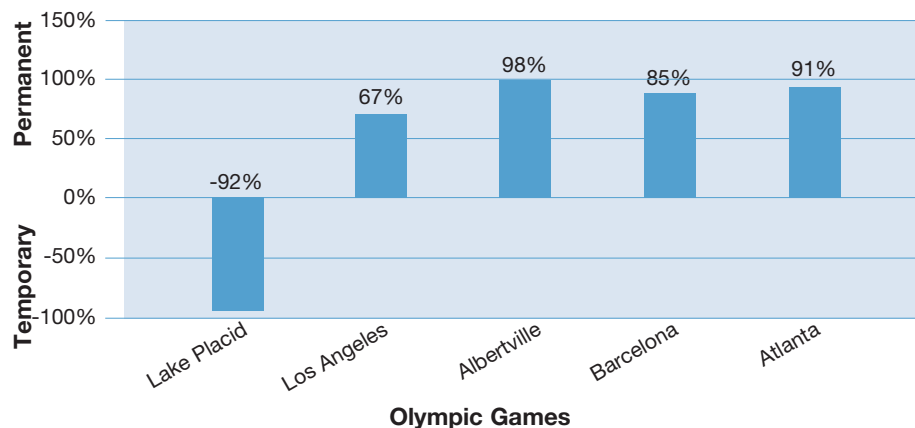
Recognition of the importance of the dental service has resulted in an increase in the number of dental volunteers and staff. While only two dentists managed the needs of the athletes in Mexico City and three in Calgary, there were a reported 50 dentists in Sydney and 14 in Salt Lake City. Since in most cases the dentists were volunteers, and there was little ancillary cost aside from food and outfitting, organizers should be encouraged to ensure there is an adequate dental staff to best treat the needs of the athletes. With additional staff, chairs and time, more teeth can be saved and fewer extracted.

Trauma is an ongoing problem, with reported cases of fractured jaws, avulsed and loosened teeth, and dental fractures during competition and training. This data confirms the importance of having trauma-trained dentists both on-site at certain venues, and within the clinic, to deal with these injuries promptly and allow the athletes to return to competition.

Whenever dental cleanings have been made available this service has been well-utilized, as evidenced by 74 treatments in Los Angeles, 44 in Atlanta and

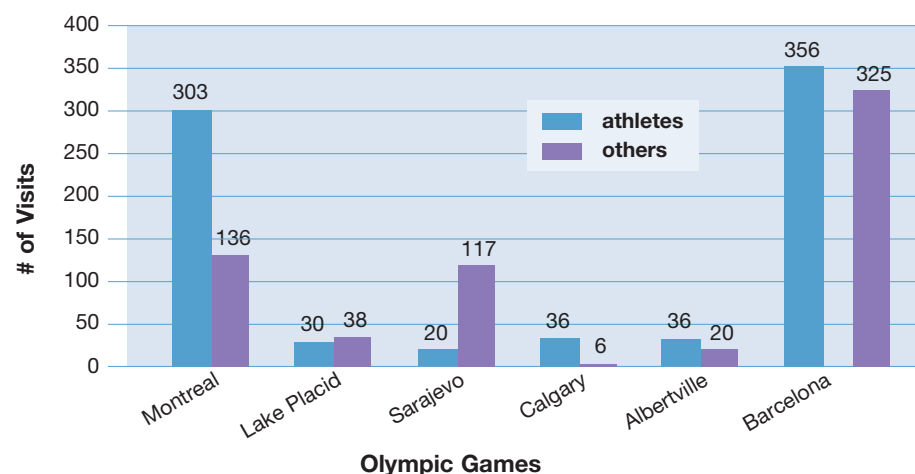
**Table 5**

## Ratio of Temporary to Permanent Restorations



**Table 6**

## Dental Visits



56 in Salt Lake City. If dental hygienists are available, they should be utilized as a part of the dental services team.

Another fairly consistent tendency is the geographic distribution of patients. While this data was not kept from all games, athletes from the Eastern Bloc, or former Soviet Union, made up a significant number of the patients in Barcelona, Lillehammer, Atlanta, and Nagano. Personal communication also indicated this to be the case in Salt Lake City and Athens. In some cases, there has been a significant patient base from Africa or Cuba. These national trends must be fur-

ther investigated so that both the IOC and NOC's can try to identify and treat these athletes before and between, not during, the Olympic Games.

### Recommendations for an Ideal Model

This paper has outlined the significant variation in the level of dental care provided at the Olympic Games over the last decades. While in all cases the need to effectively treat emergencies has been met, there have been major differences in the type of clinic established, the equipment available, the level of staffing, the services provided, the

materials used and the inclusion of auxiliaries and specialists.

The dental services at the Olympic Games should reflect that the best athletes in the world are present and are entitled to an elite level of care. Further, just as the Olympic Games are a showcase for technology in such areas as communication, security and transportation, so too should the dental clinic use the best technology available. A number of recommendations for establishing an ideal dental service are outlined below.

### Mode of Dental Treatment Delivery

Of the many reported methods of delivery (contract out to private dentists – Grenoble (1968); Albertville (1992); create a clinic from a trailer or other module – Nagano (1998); use a self-contained mobile dental clinic - Los Angeles (1932); Calgary (1988)), the most effective and efficient delivery system is the establishment of a proper dental clinic within the Village Polyclinic. This ensures convenience and security, and allows the use of shared services such as reception and translation. Joint consultation with other health care colleagues on difficult cases is readily available. The clinic can have the appearance of a regular dental office, making it appear both more professional to the athletes and more familiar to the dentists and staff providing treatment. In some cases, the clinic can be retained for public or private use following the games.

### Physical Set-Up of the Dental Clinic

The ideal dental clinic should accommodate a reception area, an appropriate number of operatories, an instrument cleaning and sterilization area, a storage area, and a small laboratory area. In many cases the reception area can be shared with the rest of the polyclinic.

An analysis of the requirements for athlete care indicates that between six and eight chairs would be ideal for a Summer Olympic Games of approxi-

mately 12,000 athletes, while four chairs would be required for an Olympic Winter Games of approximately 3,000 athletes. Operatories must be of reasonable size as there are often extra people brought into the treatment area with the patient such as coach, team doctor or therapist, or interpreter. A modular cabinet system might be considered, as it provides not only the space for supplies and equipment but can also serve as a room divider, reducing some need to erect walls.

The most up-to-date equipment and supplies, digital periapical and panoramic X-ray, air abrasion, laser technology, electronic apex location, and other state-of-the-art devices should be available along with all available modern restorative materials, bonding techniques and cements.

### *Services Provided*

The most common services were examinations, radiographs (both periapical and panoramic), restorations (permanent and temporary); root canal treatment (complete or partial); hygiene or periodontal treatments, and extractions. The clinic must also be prepared to deal with all potential traumas, including the replantation of avulsed teeth and fixation of luxated teeth. Severe trauma or alveolar fractures may be referred to an outside clinic or hospital once stabilized.

The hygiene or periodontal needs of the athletes are reasonably high, and since any time hygiene services have been available they have been well-utilized, there should be an attempt to provide and expand these services.

### *Mouthguard Program*

With the significant advances in mouthguard technology and evidence

of their effectiveness, many organizations have now officially endorsed or mandated the use of these protective devices. At the Summer Olympic Games, a mouthguard program should be available to athletes competing in basketball, field hockey, boxing, martial arts, volleyball, cycling, water polo, and soccer. At the Olympic Winter Games, athletes competing in ice hockey, slalom skiing, aerials, and skeleton should have access to pressure-laminated guards.



### *Venue Coverage*

A dental clinic some distance from the competition venue will not facilitate the quick return to competition for an athlete with a serious laceration, tooth avulsion, dental fracture or jaw dislocation, especially in light of current trauma protocols calling for replantation within five minutes for the best chance of success. These dental emergencies should be treated at the field-of-play by experienced and properly equipped sport dentists.

Of the Olympic sports, consideration should be made for having a venue dentist at ice hockey, boxing and some of the martial arts sports, such as tae kwon do. On-call or on-site dentists may also be useful in basketball, field hockey and soccer, especially in the medal round matches. As the National Basketball Association, Major League Soccer, and National Hockey League in North America usually have a dentist on-site for all

games, this standard should be considered for Olympic athletes as well.

### *Staffing*

Clinic staff should include general dentists, hygienists, dental assistants and specialists in both endodontics and oral surgery. Other specialty and laboratory services should be available on a referral basis. One or two full-time staff should be present while other staff should be able to provide a maximum number of shifts. The more field-experienced of the general staff might be assigned to venue coverage. The clinic hours and staff should reflect the population of the Olympic Village, which increases as the opening day approaches. Hours during the Olympic Games should be 8 a.m. to 10 p.m., with a 24-hour on-call service available.

Dentistry must also be fully represented on the organizing committee, as the dental service is one of the most heavily utilized. A well-run dental clinic at the Olympics will impact with such areas as volunteer and athlete services, venue management, transportation, accreditation, and food services. There will also be significant liaison required with local and international dental societies, various government agencies, local universities and other teaching institutions, dental suppliers and manufacturers, and groups representing auxiliaries. Design, construction and equipment and supply procurement will need to be closely supervised and a staff selection process developed along with schedules and protocols.

Thus, a director of dental services should be appointed as early as possible, and should be a part of the core medical commission for the Olympic Games. He or she should head a dental subcommission with appropriate personnel assigned to deal with the entire dental service.

## Other Recommendations

Many authors, including the British Dental Association, have reported on the potentially harmful effects of sport beverages on the athlete's dentition.<sup>41</sup> This damage can be reduced or eliminated if water is also made available to the athletes. Chilled sport beverages are also less erosive to the enamel, and acidic beverages, if used during competition, should be avoided during the remainder of the day to give the enamel an opportunity to remineralize. Bottled water should be available at all sporting venues as an alternative to sport beverages and energy drinks. Athletes should be educated on the potential harmful effects of these beverages and techniques for minimizing this damage.

Both the IOC and World Anti-Doping Agency publish a list of banned or restricted drugs and procedures. A number of items on these lists might be used by a dentist in the regular course of practice. These agents may include, but are not limited to, analgesics, corticosteroids, local anaesthetics, decongestants, and stimulants. Any dentist working with athletes before or during the Olympic Games must be aware of the current doping regulations to prevent an inadvertent positive test.

Education initiatives should be undertaken in multiple languages to provide athletes with information on the relation of oral health to performance; the dangers of smokeless tobacco; the benefits of proper mouth protection and other key topics.

Data collection and survey completion must be done in an accurate and responsible manner during the games, as this data will be part of a continuing stream that will make the set-up and running of the dental service at future games more effective and productive.

## Summary and Conclusions

The dental health of athletes is often poorer than that of the general population, and may result in acute or chronic problems that can compromise an athlete's performance. The possibility of an athlete losing four hard years of training due to an avoidable dental illness or injury is unacceptable, and steps must be taken to prevent these occurrences.

Access to adequate dental care is compromised in certain parts of the world, and a disproportionate amount of treatment has been sought at the

The dental health of athletes is often poorer than that of the general population, and may result in acute or chronic problems that can compromise an athlete's performance.

Olympic Games by athletes from Eastern Europe and, in some cases, African nations. Further assessment of this problem must take place, and a system to help educate and deliver a better level of care to these athletes, through their NOCs, must be developed. A partnership with global bodies, such as the International Society for Dentistry and Sport, might help with this initiative.

Games organizers must establish dental programs that best meet the needs of the athletes, using the recommendations included in this report which are based on trends in the dental service that have been identified over the last 30 years. These include:

- Providing both emergency and elective dental treatment;
- Performing more permanent and less temporary restorations;
- Retaining more teeth and extracting fewer;
- Having hygiene services available;

■ Providing screenings and necessary radiographs;

■ Opening the clinic during hours that work best for the athlete; and

■ Ensuring that elective dental treatment is prioritized for the athletes.

Ideally, if all parties were able to work together to assess and treat athletes at home prior to their departure for the Olympic Games, the Olympic dental service might return to being solely for emergencies and trauma. This should be the ultimate goal for everyone involved. Until that happens, however, addressing the needs of the athletes by providing an enhanced dental service during the Olympic Games must continue. With the tremendous support of both volunteer dentists and corporate partners, and the encouragement of the IOC and the games organizers, it is expected that an appropriate dental service, as outlined in this paper, will be available in Torino in 2006, Beijing in 2008, Vancouver in 2010, and beyond. Hopefully, this paper will have provided the cornerstone for the development and implementation of that service for these and future games.

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# The Raid on Heteropterans

They could probably  
take over the  
whole works right  
now if they wanted,  
but the world is in  
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according to the 11  
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wisely decided to  
bide their time.



hey outnumber us — 800,000 species to our one; two, if you count Michael Jackson. They're smarter than we are and they have unlimited patience. Entomologists agree that when the Big One hits, when Armageddon arrives, after the smoke clears from the Great Cataclysm, it's not the meek, but the insects that will have inherited the earth.

We spend countless millions every year to fight bugs. The bugs don't spend a dime and they are winning. What does that tell you? And what is even more exasperating, they win without giving us a second thought. The Geneva Convention never considered the possibility that a war could be won by ignoring the enemy and without bankrupting the winner. There is no evidence to suggest that bugs, individually or collectively, ponder the realities of coexistence with us on this planet. They could probably take over the

whole works right now if they wanted, but the world is in such a mess according to the 11 o'clock news, they've wisely decided to bide their time.

To a bug, we are less than nothing ... a minus ... nada. Whereas, we, or at least the entomologists, agonize over bugs all the time. If you should corner an entomologist, even at a party, and demand to know what he's thinking, he'll answer "bugs" if he's truthful. What kind of a life is this, devoting your whole existence to something that pointedly ignores you, even though many marriages operate more or less successfully under the same conditions?

Recently, I was reading at home in the library (sometimes referred to as the "bathroom"), when I noticed a small insect of the suborder heteroptera of the order Hemiptera crawling across the linoleum. Big mistake; crawling. The Johnson Wax Co., manufacturer of

*Continued on Page 509*



## There are no fat bugs or anorexic bugs, bugs with last year's hairdos or painted mandibles.

*Continued from Page 510*

Raid, states that 98 percent of all bug deaths are the result of moving violations. The first thing a bug should learn is to not move. A stationary bug can easily be mistaken for debris on the floor for maybe a month at our house, but a moving bug is asking for it. He's thinking, I got all these legs, I'm a born locomotor, I gotta move!

So this bug marches toward the baseboard; lefts, rights, lefts, rights, pauses for a few seconds, does a right flank maneuver, reverses himself and then climbs a couple inches up the wall. This would be the human equivalent of scaling a 30-story building without climbing accessories, safety ropes, or a net. If there were a ladybug watching, you might think he was just showing off or performing part of a mating ritual, but he's a loner.

I'm thinking, what's one bug doing in my bathroom? Is he the point man for a whole battalion of invaders lying doggo in the wainscoting, waiting to see if the coast is clear? Or is he lost, a doofus bug that can't distinguish the bathroom from the kitchen and has now concluded that there's nothing here to eat but soap, talcum powder and Neosporin? That's what happens sometimes when one achieves maturity by metamorphosis rather than by direct growth.

Yes, of course, the kitchen! Head for the kitchen, that's where they keep the good stuff, he decides, instinct triumphing over intelligence. And so he gets all his legs operating in the same plane in a proper bug rhythm and I, in my infinite compassion, decide to not squash him — yet.

He aborts his mission to climb to the ceiling, rappels down to floor level again and charges off to ... Whoa! His little

feet dig in as he slides to a halt on the linoleum. He has no idea where the kitchen is, that it's at least four light-years (bug time) from his present position. Makes you wonder, doesn't it, how they're going to survive and we won't? At least I know where the kitchen is, but I wouldn't take any bets that the bug won't find it sooner or later.

In fact, I saw him there subsequently, or one just like him, which opens another mystery. You take 50 sow bugs (which are technically not bugs at all, but animals), for example and every one of them will have perfect little bug bodies and little bug faces, all identical.

How come all bugs of the same species look exactly the same? There are no fat bugs or anorexic bugs, bugs with last year's hairdos or painted mandibles. If a bug looked in a mirror, how would it know it was him? How do bugs recognize their friends without name tags?

"Hi, Joe!"

"I'm not Joe, I'm Kevin."

"Sorry, you look just like Joe. Are you sure you're not Joe?"

"I dunno. I suppose I could be."

I think the reason the invertebrates will triumph over the vertebrates in the final analysis is that in their complex social structures they have no lawyers. Screw up in their society and you're off the team, out of the nest. You're an ex-bug. The ACLU couldn't get you a hearing. Everyone has a job and he or she does it without question. There's no litigation, no appeals, no arbitration.

"I don't wanna be a drone anymore."

"You don't wanna be a drone? It's always about you, innit? Get back in line."

If that's where we're heading and it's inevitable, fine! I don't want to think about it anymore. You can bet though,

when the time comes, they'll take Park Avenue and Boardwalk. Maybe if we're lucky, they'll leave us Baltic Avenue. If we're really lucky, they'll forget who sprayed the Raid.

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