



# Are Mouthguards Necessary for Basketball?

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## 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 than 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**

<b>Orofacial Injury Studies</b>	
<b>Author</b>	<b>Percentage of injury</b>
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
Marcenes 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; 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**

<b>Orofacial Injury Studies</b>	
<b>Author</b>	<b>Percentage of injuries</b>
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

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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