

# Sports-Related Dental Injuries and Sports Dentistry



**Course Author(s):** Connie M. Kracher, PhD, MSD; Rick Knowlton, DMD, MAGD

**CE Credits:** 2 hours

**Intended Audience:** Dentists, Dental Hygienists, Dental Assistants, Dental Students, Dental Hygiene Students, Dental Assistant Students

**Date Course Online:** 01/06/2003

**Last Revision Date:** 07/21/2020

**Course Expiration Date:** 07/20/2023

**Cost:** Free

**Method:** Self-instructional

**AGD Subject Code(s):** 154

**Online Course:** [www.dentalcare.com/en-us/professional-education/ce-courses/ce127](http://www.dentalcare.com/en-us/professional-education/ce-courses/ce127)

#### Disclaimers:

- P&G is providing these resource materials to dental professionals. We do not own this content nor are we responsible for any material herein.
- Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

#### Conflict of Interest Disclosure Statement

- The authors report no conflicts of interest associated with this course.

#### Introduction – Sports Dentistry

Whether for exercise, competition or the simple enjoyment of recreational activity, increasing numbers of health conscious Americans are involved in sporting activities. Over the past decade, 46 million U.S. children were involved in sports. It's estimated that 30 million of these children are participating in organized sports. Sports injury accounts for 10-39% of all dental injuries. Children most prone to sports-related oral injury are between 7-11 years old.<sup>29,43,45-47</sup>

## Course Contents

- Overview
- Learning Objectives
- Glossary
- Statistics
- Common Athletic Injuries
  - Soft Tissue Injuries
  - Fractures
  - TMJ Injuries
  - Tooth Intrusion
  - Tooth Extrusion
  - Crown and Root Fractures
  - Avulsion
- Emergency Treatment
- Mouthguards
  - Stock Mouthguards
  - Mouth Formed Protectors or “Boil-and-Bite”
  - Custom Made Mouthguards
- Dental Team’s Role
- Summary
- Course Test
- References / Additional Resources
- About the Authors

## Overview

Whether for exercise, competition or the simple enjoyment of recreational activity, increasing numbers of health-conscious Americans are involved in sporting activities. Over the past decade, 46 million U.S. children were involved in sports. It’s estimated that 30 million of these children are participating in organized sports. Sports injury accounts for 10-39% of all dental injuries. Children most prone to sports-related oral injury are between 7-11 years old.<sup>29,43,45-47</sup>

Approximately 15 million Americans suffer dental injuries and 5 million teeth are lost annually in sports-related injuries. During a single athletic season, athletes have a 1 in 10 chance of suffering a facial or dental injury. In fact, the lifetime risk of such an injury is estimated to be about 45% according to the National Youth Sports Foundation (NYSSF) reports athletes who don’t wear mouthguards are 60 times more likely to experience trauma to the oral cavity.<sup>41</sup> In a survey commissioned by the American Association of Orthodontists (AAO), 84% of children did not wear a mouthguard during organized sports because they were not required to wear them, even if they’re required to wear helmets and other safety gear.<sup>44</sup> In 2016 the

National Athletics Trainers’ Association (NATA) developed a position statement on preventing and managing sports-related dental and oral injuries. Their detailed clinical recommendations and suggested best practice guidelines were published in the Journal of Athletic Training providing current evidence for athletic trainers and other healthcare professionals.<sup>9</sup> In a 2017-18 National High School Sports-related Injury Surveillance Study conducted by the Center for Injury Research & Policy in the Colorado School of Public Health, the most common injury diagnoses during competition and practices was head/face concussion (n=255,923).<sup>53</sup> Dentistry plays a large role in treating oral and craniofacial injuries resulting from sporting activities.

Prior to the 1980s, little was available in the scientific literature in terms of sports-related injury assessment. Several injury surveillance systems have been established in an attempt to track sports-related accidents and injuries. While all injury surveillance systems provide valuable information on generalized sports injuries, very little information is available regarding dental or craniofacial injuries. In terms of data collection and analysis in the United States, the field continues to be open for dentistry to assume a major leadership role in assessing dental injuries resulting from sporting activities.<sup>3</sup> One reason for a lack of empirical studies in the United States is the absence of academic training in sports dentistry. A survey by Kumamoto and others was sent to 69 dental schools in the United States and Canada regarding course offerings, opinions about offering a course, construction of mouthguards, and provision of treatment for trauma. Of the 19 dental schools with sports dentistry courses, 17 taught the course in the undergraduate curriculum, 12 as a required course and the remaining five dental schools taught this subject as an elective. Two schools offered the course on a graduate level. Data from the study also concluded that more than half of the schools that teach sports dentistry do not treat any outside athletic group on a regular basis.<sup>4</sup>

This course is designed to explain the various sports-related dental injuries, discuss the three types of mouthguards utilized and the dental team’s role in sports-related injuries and sports dentistry.

## Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Discuss various statistics relating to sports dental-related injuries.
- Discuss soft tissue injuries, jaw fractures, TMJ injuries, tooth intrusion, crown and root fractures, and avulsion due to sports accidents.
- Explain emergency treatment with sports-related injuries.
- Differentiate various observed patterns of mouthguard wearing by males and females, cultural differences, and the influence of peer pressure.
- Identify and differentiate the three mouthguards available and identify the ideal mouthguard.

## Glossary

**ankylosis** – Abnormal fusion of the tooth with the bone (joining together).

**avulsed** – Entire tooth is knocked out.

**axially** – Referring to the long axis of the tooth.

**condyle** – The posterior bony process that extends up from the mandible.

**crazing** – To become covered with fine cracks.

**edema** – Swelling.

**extrusion** – Tooth is partially forced out due to injury or purposeful orthodontic treatment.

**intrusion** – Tooth is driven into the alveolar process.

**malocclusion** – The contact between the maxillary and mandibular arches, whereby the positioning of the teeth are not in accordance with the usual rules of anatomic form.

**mobility** – State of the tooth being mobile.

**necrotic** – Death of living tissue.

**pulpal necrosis** – Death of pulpal tissue.

**Sports dentistry** – Involves the prevention and treatment of orofacial athletic injuries and

related oral diseases, as well as the collection and dissemination of information on dental athletic injuries and the encouragement of research in the prevention of such injuries.

## Statistics

More than 5 million teeth are avulsed each year; many during sports activities, resulting in nearly \$500 million spent on replacing these teeth each year.<sup>1</sup> In an issue of the Journal of the American Dental Association (JADA), it was reported that 13-39% of all dental injuries are sports-related, with 2-18% of the injuries related to the maxillofacial. Males are traumatized twice as often as females, with the maxillary central incisor being the most commonly injured tooth. Studies of orofacial injuries published over the last forty years reflects various injury rates dependent on the sample size, the age of participants, and the specific sports.<sup>30-31</sup> Even in football, a sport requiring protective gear, only about two-thirds of athletes are in compliance. In soccer, where rules are not uniform on wearing mouthguards, only 7% of the participants wear them.<sup>1</sup> In baseball and softball, again only 7% wear mouthguards. Recent studies show basketball had the highest injury rate with both male and female students due to hand or elbow contact or by collision with other players. The close contact of basketball players, as well as the speed of the game increases the potential for possible orofacial trauma.<sup>37</sup> Currently, the *National Federation of State High School Associations (NFHS)* mandates properly-fitted mouthguards for only five sports: football, ice hockey, lacrosse, field hockey, and wrestling. Wrestlers are mandated if they have fixed orthodontic appliances.<sup>32,55</sup> However, many high schools and colleges continue to support mandatory protective equipment relating to contact sports.<sup>29</sup> It is evident from past studies there is a need for more research on the topic of sports dentistry. There is also a need to educate communities of interest, including more regulations for mouthguard use in sports.

In 1962, high school and collegiate football players were required to wear faceguards and mouth protectors during practice sessions and in competition. Several studies confirm that since this requirement, the percentage of

orofacial injuries in football has dropped from approximately 50% to 0.5%, depending on the study cited.

The *American Academy of Pediatric Dentistry (AAPD)* recommends a mouthguard for all children and youth participating in any organized sports activities. The *American Dental Association (ADA)*<sup>51</sup> recommends wearing a properly-fitted mouthguard for all of the following sports:

acrobatics	handball	sky diving
basketball	ice hockey	soccer
bicycling	inline skating	softball
boxing	lacrosse	squash
equestrian events	martial arts	surfing
extreme sports	racquetball	volleyball
field events	rugby	water polo
field hockey	shotputting	weight lifting
football	skateboarding	wrestling
gymnastics	skiing	

A study conducted on high school varsity basketball teams in Florida assessed the benefit of mouthguard use in sports other than football. It was found that 31% of surveyed Florida varsity basketball players sustained orofacial injuries during the season. Fifty-three percent reported more than one injury during the season. Of the 1,020 players, fewer than half wore mouthguards and only 2 of these players sustained oral injuries not requiring professional attention during the season.<sup>5</sup> It was concluded by the authors that there is a high risk of orofacial injury competing in basketball without a mouthguard, which would increase a player's chance of orofacial

injury almost sevenfold.<sup>6</sup> Soporowski and others found that of all the injuries presented to dental offices, 62% occurred while the patient was participating in an unorganized sport. Children between the ages of 7-10 years have the highest number of injuries (59.6%). Baseball had the most injury sites, 72 of 159 injuries, biking followed with 59 injuries, and hockey and basketball were third and fourth respectively.<sup>7</sup> Another study was conducted with 3,411 athletes. The highest incidence of orofacial injury for the male athletes was noted in wrestling and basketball. For females, it was basketball and field hockey. None of the athletes who sustained an injury was wearing a mouthguard. None of the athletes who sustained an injury was wearing a mouthguard.<sup>4</sup>

A study conducted on high school athletes, in which researchers interviewed 2,470 junior and senior high school football players, showed 9% of all athletes sustained some form of orofacial injury, with 3% reporting loss of consciousness. Fifty-six percent of all traumatic brain injuries (concussions) and 75% of all orofacial injuries occurred when the athlete refrained from using mouthguard protection.<sup>4</sup> In Alabama, a study on 754 football players revealed that 52% of all orofacial injuries occurred in sports other than organized football. Basketball and baseball had the highest incidence of sports-related dental injuries with children 7-17 years old. Baseball also had the highest incidence of trauma with 7-12 year old children, with basketball injuries occurring more frequently with children 13-17 years old.<sup>4,47</sup> With non-organized sports, bicycles are the most common consumer sports product that contributes to dental injuries of children.<sup>47</sup> Other recreational sports include skateboarding and roller or inline skating.<sup>47</sup> Other recreational sports include skateboarding and roller or inline skating.<sup>29,47-50</sup> Morrow and Kuebker conducted surveys in selected Texas high schools to determine the incidence of orofacial injuries with approximately 122,000 male and female athletes. They learned that soccer and basketball players had higher dental injury rates than football players. They also found that male athletes reported lip and tongue lacerations as the most frequent injuries. In addition, fourteen jaw fractures were reported with as many fractures in baseball and soccer as there were in football.<sup>8</sup>

## Common Athletic Injuries

### Soft Tissue Injuries

The face is often the most exposed part of the body in athletic competition and injuries to the soft tissues of the face are frequent. Abrasions, contusions, and lacerations are common and should be evaluated to rule out fracture or other significant underlying injury.<sup>10</sup> These usually occur over a bony prominence of the facial skeleton such as the brow, cheek, and chin. Lip lacerations are also common.<sup>11</sup>

### Fractures

Fractures of the facial bones present an even more complex problem. The most frequent site of bony injury is the zygoma (cheekbone). Fractures of the zygoma account for approximately 10% of the maxillofacial fractures seen in sports injuries, occurring as a result of direct blunt trauma from a fall, elbow, or fist.<sup>12</sup> In a study by Linn and others, of the 319 patients treated for sports-related injuries, males proved to be more prone to zygomatic fractures than females because of the powerful physical contacts during sports.<sup>13</sup> Like the zygoma, the prominent shape and projection of the mandible cause it to frequently be traumatized. Approximately 10% of maxillofacial fractures from sporting activities occur in the mandible when the athlete strikes a hard surface, another player, or equipment. In a mandibular fracture,

airway management is the most important aspect of immediate care.<sup>14</sup> In both children and adults, the condyle is the most vulnerable part of the mandible. Fractures in this region have the potential for long-term facial deformity. Recent data suggest that condylar fractures in children can alter growth of the lower face.<sup>11</sup>

### TMJ Injuries

Most blows to the mandible do not result in fractures, yet significant force can be transmitted to the temporomandibular disc and supporting structures that may result in permanent injury. In both mild and severe trauma, the condyle can be forced posteriorly to the extent that the retrodiscal tissues are compressed. Inflammation and edema can result forcing the mandibular condyle forward and down in acute malocclusion. Occasionally this trauma will cause intracapsular bleeding, which could lead to ankylosis of the joint.

### Tooth Intrusion

Tooth intrusion occurs when the tooth has been driven into the alveolar process due to an axially directed impact. This is the most severe form of displacement injury. Pulpal necrosis occurs in 96% of intrusive displacements and is more likely to occur in teeth with fully formed roots. Immature root development will usually mean spontaneous re-eruption. Mature root

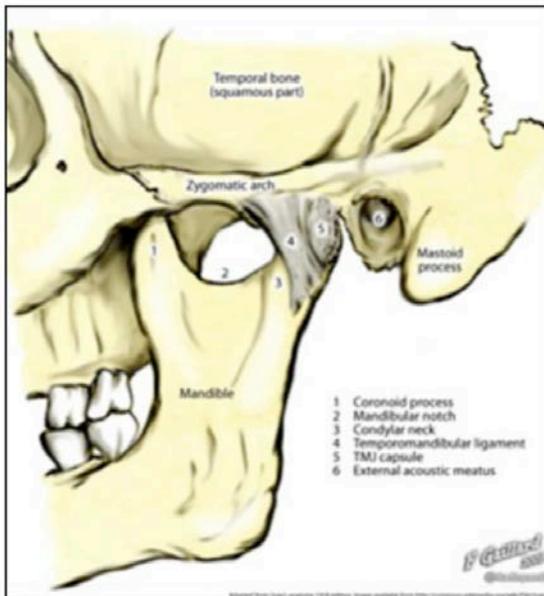


Figure 1. TMJ Landmarks.

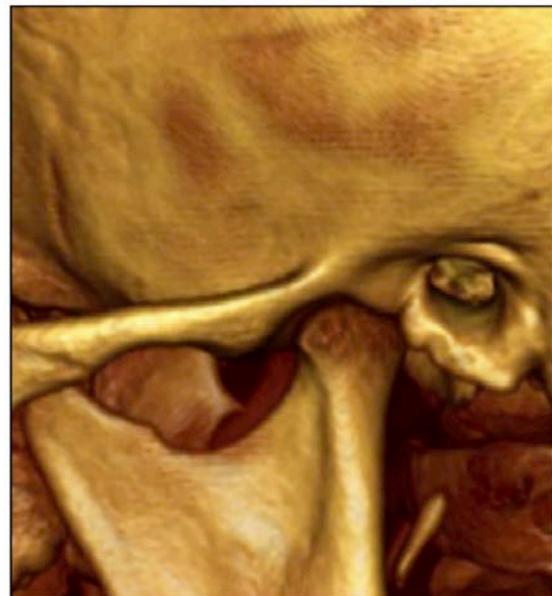


Figure 2. Dimensional Image of TMJ.



**Figure 3.** Images of Intrusion.



**Figure 4.** Images of Extrusion.

development will require repositioning, surgery, and splinting or orthodontic extrusion. Treat relatively quickly since the pulp usually becomes necrotic – this can be treated with temporary filling of calcium hydroxide paste followed by root canal therapy.

### **Tooth Extrusion**

The tooth is displaced partially out of the socket by the trauma. It is usually displaced palatally. Radiographically the tooth appears dislocated and empty at the end of the socket. Treatment is to try to reposition gently – local anesthetic is usually not needed. Check the occlusion to be sure there is no pressure on the tooth and use a non-rigid splint for two weeks. The dentist should periodically monitor the vitality of the pulp and perform root canal therapy if needed.

### **Crown and Root Fractures**

Crown fractures are the most common injury to the permanent dentition and may present in several different ways. The simplest form is crown infraction. This is a crazing of enamel without loss of tooth structure. It requires no treatment except adequate testing of pulpal vitality.<sup>14</sup> Fractures extending into the dentin



**Figure 5.** Tooth Fracture.

are usually very sensitive to temperature and other stimuli. The most severe crown fracture results in the pulp being fully exposed and contaminated in a closed apex tooth or a horizontal impact may result in a root fracture. The chief clinical sign of root fracture is mobility. Radiographic evaluation and examination of adjacent teeth must be performed to determine the location and severity of the fracture as well as the possibility of associated alveolar fracture.<sup>12</sup> Treatment is determined by the level of injury.

## Avulsion

Certainly one of the most dramatic sports-related dental injuries is the complete avulsion of a tooth. Two to sixteen percent of all injuries involving the mouth result in an avulsed tooth. A tooth that is completely displaced from the socket may be replaced with varying degrees of success depending largely on the length of time the tooth is outside the socket. If the periodontal fibers attached to the root surface have not been damaged by rough handling, an avulsed tooth may have a good chance of recovering full function. After one hour, the chance for success is greatly diminished. Statistics show that the patient can have a 90% success rate if the tooth is placed back in the socket within twenty minutes. Success decreases 10% for each additional 5 minutes that the tooth is out of the socket.<sup>42</sup> The fibers become necrotic and the replaced tooth will undergo resorption and ultimately be lost.<sup>11</sup>

## Emergency Treatment

Due to the high incidence of sports-related dental injuries, it is vital that primary healthcare providers such as school nurses, athletic trainers, team physicians, and emergency



**Figure 6.** Images of Avulsion.

personnel are trained in the assessment and management of dental injuries. Dental team members can assist these providers by offering to speak to their schools, since they will be providing immediate treatment at sporting events. The ADA has urged its members to work together with schools, colleges, athletic trainers, and coaches to develop mouthguard programs and guidelines to prevent sports injuries.

The main method for preventing orofacial injuries in sports is wearing mouthguards and headgear, consisting of a helmet and face protector. Yet, a study by the *National Institute of Dental and Craniofacial Research (NIDCR)* reported that children do not consistently wear mouthguards and headgear during organized sports. Even in football, a sport that requires the use of mouthguards, as earlier noted, only about 75% of students are in compliance.<sup>15</sup>

Parental perceptions of children's risks to injury, expenses associated with protective gear, and peer pressure may influence use of mouthguards. Interestingly one study found that lower socioeconomic parents were reported to be more aware of orofacial injuries than affluent parents.<sup>16</sup> The observed patterns of mouthguard wearing by males and females can represent cultural differences, peer pressure, and/or nature of sports played, including the following:

1. Perceptions that female athletes are less aggressive and thus, a reduced risk of injury may exist,
2. Perceptions regarding the absence of long-term commitment to a sport may result in a differential willingness to devote resources to female athletes,
3. Aesthetic appeal may influence protective orofacial gear usage,
4. Female athletes may play in non-league-based sports with fewer or less stringent rules or may play less combative sports than male players.<sup>15</sup>

The literature indicates the use of mouthguards by athletes is most influenced by their coaches.<sup>17</sup> However, several studies indicate mouthguard compliance by athletes is usually not mandated by their coaches or referees.<sup>35</sup>

One study found that coaches reported they did not have sufficient knowledge of mouthguards. Coaches also reported that most information about mouthguards comes from sales representatives (72%), educational materials (33%), and dentists (11%).<sup>18</sup>

In 1995, the ADA House of Delegates revised their policy recognizing “the preventive value of orofacial protectors” and endorsed their use “in sports activities with a significant risk of injury at all levels of competition.”<sup>19</sup>

## Mouthguards

When athletes are surveyed as to why they don’t wear mouthguards, results indicate participants believe their mouthguards will affect their breathing. However, Rapisura, et al. tested two types of mouthguards with female athletes and found there was no effect on aerobic performance with their subjects with either the custom or prefabricated mouthguards they tested.<sup>34</sup>

When considering recommendations, an ideal mouthguard should follow the following recommendations outlined by the *Academy for Sports Dentistry (ASD)*:

The fitting of a mouthguard is best accomplished under the supervision or direction of a dentist. The athletes and caregivers should be educated on the special design of a “properly fitted mouthguard” with following properties and considerations:

- It should be fabricated to adequately cover and protect all teeth in the arch, including the surrounding tissues.
- It should be fabricated from a custom impression of the athlete’s arch.
- Adequate thickness in all areas is important to provide for the reduction of impact forces. In particular, a minimum of 3 mm thickness in the occlusal/labial area.
- It should have a seated equilibrated occlusion that is balanced for even occlusal contact. This provides for a balanced absorption of impact energy.
- A fitted mouthguard that is retentive and not dislodged on impact.
- Speech considerations.
- A material that meets FDA approval.<sup>38</sup>

The properly fitted mouthguard should be routinely and professionally examined for fit and function. Frequency of routine inspection is dependent on factors such as the athlete’s age and the willingness for the athlete to properly care for the appliance. The frequency of the inspection should be determined by the dental professional for each individual situation and athlete.

Mouthguards typically are made of thermoplastic copolymer and designed to fit over occlusal and facial surfaces of the maxillary teeth and gingival tissues.<sup>36</sup> The *American Society for Testing and Materials (ASTM)* and the manufacturers of mouthguards have classified the mouthguards into three types:

- Stock Mouthguards
- Mouth-formed Protectors or Boil-and-Bite Mouthguards
- Custom-made Mouthguards

## Stock Mouthguards

Stock mouthguards may be purchased from a sporting goods store, pharmacy, or other retail stores. Made of rubber, polyvinyl chloride or a polyvinyl acetate copolymer,<sup>21</sup> their advantage is that this type of mouthguard is relatively inexpensive, but the many disadvantages far outweigh the advantages. Stock mouthguards are available only in limited sizes, do not fit very well, inhibit speech and breathing, and require the jaws to be closed to hold the mouthguard in place.<sup>22</sup> Because stock mouthguards do not fit well, the player may not wear this type of mouthguard due to discomfort and irritation. Orthodontists may recommend this type because they allow



**Figure 7.** Stock Mouthguard.

for protection of soft tissues while allowing tooth movement. In doing so, the ASD stated this type of mouthguard does not allow for adequate protection of the teeth and consider the stock mouthguard as unacceptable as an orofacial protective device.<sup>23</sup>

### Mouth-Formed Protectors or “Boil-and-Bite”

There are two types of mouth-formed protectors: the shell-liner and the thermoplastic mouthguard. The shell-liner type is made of a preformed shell with a liner of plastic acrylic or silicone rubber. The lining material is placed in the player’s mouth and molds to the teeth and then is allowed to set. The preformed, thermoplastic type also has a lining that is immersed in boiling water for 10-45 seconds, transferred to cold water and then adapted to the teeth (also known as “boil-and-bite” guard). This mouthguard seems to be the most popular of the three types and is used by more than 90% of the athletic population.<sup>24</sup> In 2015, the ADA gave its first Seal of Acceptance for a sports mouthguard. The mouthguard was created by a New Jersey dentist/pharmacist and an associate professor of chemistry at Rutgers University.<sup>52</sup> Currently the ADA has listed only one mouthguard on the ADA Seal Products website — the Game On Mouthguard by *Dental Choice Holdings, LLC*. The ADA states that it received acceptance due to meeting the safety and efficacy requirements. They indicate when use as directed, it can help protect teeth from impact trauma.

### Custom Made Mouthguards

This is the superior of the three types and the most expensive to the athlete. Families can spend quite a bit of money on athletic clothing and shoes but might not think about protecting their child’s teeth. We need to educate our patients and their families about the importance of mouthguards when they come in for preventive and other appointments. The custom mouthguard is made of thermoplastic polymer and fabricated over a model of the athlete’s dentition.<sup>21</sup> The mouthguard is made by the dentist and fits exactly to the athlete’s mouth. The advantages include fit, ease of speech, comfort and retention.<sup>20</sup> By wearing a protective mouthguard, the incidence of a concussion by a blow to the jaw is significantly



Figure 8. Boil-and-Bite Mouthguards.

reduced because the condyle is separated from the base of the skull by placing the mandible in a forward position.<sup>25</sup>

There are two types of custom mouthguards. The most common is a custom vacuum formed mouthguard. This is the most widely made mouthguard by the dental profession. It offers good protection with the least interference to speaking and breathing. They are fabricated from a single sheet of EVA polyvinyl acetate-polyethylene copolymer. The EVA sheet is heated, placed over the stone model, and suctioned by vacuum to fit to the shape of the mouth and teeth.

Vacuum formed mouthguards have been found to decrease in thickness occlusally by 25%, while the buccal and lingual surfaces can be by more than 50%.<sup>40</sup> They have been found to retain their shape for only a few weeks after

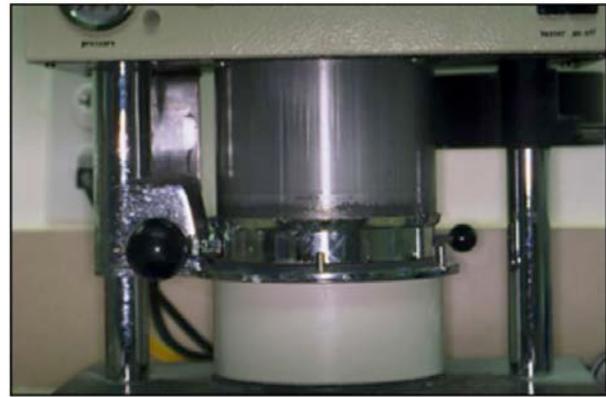


**Figure 9.** Vacuum Formed Mouthguards.

wearing. They will not provide protection for long periods of time and should be closely monitored.

The other type of custom mouthguards are pressure-laminated mouthguards. They are considered to be a better mouthguard compared to boil and bites. They are made of multiple sheets of laminating EVA materials that are heated, placed over a stone model, and pressed onto the model or previous laminate with a maximum pressure of 6 atmospheres.

Multiple layers can be fused together to form an adequately thick and protective mouthguard allowing for precise adaptation due to increased pressure. This allows them to remain in place better during sport activity. They allow for a more balanced occlusion and shows negligible deformation when worn for prolonged periods of time. There is little to no elastic memory when high heat is combined



**Figure 10.** Pressure Laminating Machine.



**Figure 11.** Mouthguard Comparison.

with high pressure during fabrication. These mouthguards are typically made by dentists or dental laboratories.

Custom pressure-laminated mouthguards allow for effective communication. Interference with breathing is minimized and they show less wear in chewing and biting. They are more comfortable to wear so they are worn more regularly by participants. The laminating machines have 10x the pressure of vacuum systems. Since pressure is even throughout, it allows for a uniform thickness of guard material. Pressure-laminated mouthguards are substantially superior to all other types. According to sports dentistry experts in our dental profession, they are the only type that can be counted on to offer the best protection for our children's teeth during all types of sporting activities.<sup>39</sup> The ASTM recommends the mouthguard cover all teeth in at least

once arch to reach maximum protection, cushioning, and retention. Typically, the maxillary arch is the most common arch for mouthguards. However, it's recommended Class III malocclusion patients receive a mandibular mouthguard. One research study conducted with high school football players showed significantly less dental injury with players who used a properly fitted pressure-laminated custom mouthguard.<sup>53</sup> Research studies continue to reinforce the importance of custom mouthguards.

**Dental Team’s Role**

Dentists and their staff need to educate patients on the need and benefits of protective devices. *The American Dental Association* ([www.ada.org](http://www.ada.org)) publishes brochures, which explain the different types of

mouthguards and their advantages. The ASD has resources available on their website [academyforsportsdentistry.org](http://academyforsportsdentistry.org). Emergency Treatment of Athletic Dental Injuries cards in English and other languages that provide detailed lay instructions regarding avulsion, luxation, and tooth fractures. Field emergency kits are a simple and inexpensive item for dentists attending a sporting event. See some recommended items from an emergency kit.<sup>12</sup> More items can be found on the American Academy for Sports Dentistry (AASD) website.

Another activity for dentists and their staff is making mouthguards for sport teams. “Fitting mouthguards is a perfect activity for a dental society,” says Robert Morrow, D.D.S., Professor of Prosthodontics, University of Texas-San Antonio Dental School. “You simply

Dental Emergency Kit for Sporting Events	
PPE: gloves, masks, safety glasses, disposable gown	Consumables: paper towels (both dry and wet), sealable baggies, tongue depressors
Zinc oxide eugenol (i.e., IRM)	Mixing pad and spatula
Flashlight or penlight	2x2 and 4x4 sterile gauze
Tongue depressor	Sterile instruments: mouth mirror, explorer, small wire cutters (for removal of broken orthodontic wires), hemostats, crown and bridge scissors
Soft wax (rope or utility wax)	Spare commercial mouthguard
Soft wax (rope or utility wax)	If the avulsed tooth cannot be reimplanted. Emergency tooth-preserving solution i.e., <i>Save-a-Tooth™</i> or Hanks Balanced Saline Solution™ for the avulsed tooth
Canned air	Biohazard bag
Informed consent form	

get a group of dentists together at the school and begin making impressions. It spreads out the costs and cuts down on the time. And it's worthwhile."<sup>22</sup> "It's a great practice builder," says Robert Donnelly, D.D.S., a general practitioner in San Marcos, Texas, and dentist for the Southwest Texas State University football team. "I don't charge for my time or the materials to make a mouthguard. I do it for free. As a result, we get a lot of referrals."<sup>22</sup>

Due to the increasing participation in sporting events by children of all ages, a need for mouthguard implementation is of extreme importance. Dental professionals need to develop effective ways of conducting research to determine the prevalence of sports-related injuries in their communities. By combining research with preventive efforts, legislation can be changed in your area. Mouthguard requirements would help to reduce the number of orofacial sporting injuries and protect athletes. Dentists and allied dental professionals can provide education to athletes and their families on the types of injuries, treatment procedures, and mouthguard prevention.

The role as dental professionals should include:

- Good impression techniques and knowledge of mouthguard materials/manipulations in mouthguard creation.
- Communication with children and their families. Dental charting should include questions about involvement in sports and

the use of mouthguards. If patients are unwilling or unable to pay for an office-made mouthguard, the dental providers could educate patients about affordable boil and bite-type guards for minimal protection.

- Basic instructions on emergency treatments of dental emergencies such as avulsions, fractures, extrusions and intrusions that an adult can perform immediately until dental treatment can be attained.<sup>33</sup>

Sports dentistry can encompass much more than mouthguard fabrication and the treatment of fractured teeth. As dental professionals, we need to educate our community regarding the issues related to sports dentistry and specifically to the prevention of sports-related oral and maxillofacial trauma. Dental and facial injuries can be reduced significantly by requiring protective equipment such as mouthguards and face shields.

### Summary

With the many sports that children play, such as soccer, basketball, football, baseball, and all kinds of skating, it is recommended that dentists fabricate mouthguards for all patients – especially children who participate in organized and unorganized sports. Dentistry should be working diligently to require mandatory use of mouthguards in all sports, which starts at the local and state levels.

## Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: [www.dentalcare.com/en-us/professional-education/ce-courses/ce127/test](http://www.dentalcare.com/en-us/professional-education/ce-courses/ce127/test)

- 1. In sports, males are traumatized twice as often as females. The maxillary canine is the most commonly injured tooth.**
  - A. Both statements are true.
  - B. The first statement is true and the second statement is false.
  - C. The first statement is false and the second statement is true.
  - D. Both statements are false.
- 2. The teeth most susceptible to trauma are \_\_\_\_\_.**
  - A. mandibular molars
  - B. maxillary canines
  - C. mandibular lateral incisors
  - D. maxillary central incisors
- 3. The National Federation of State High School Associations mandates mouthguard use for \_\_\_\_\_.**
  - A. football
  - B. basketball
  - C. soccer
  - D. field/ice hockey
  - E. A and D
- 4. The American Academy of Pediatric Dentistry recommends a mouthguard for all children and youth participating in sports. The Academy for Sports Dentistry has stated that the stock mouthguard is unacceptable as an orofacial protective device.**
  - A. Both statements are true.
  - B. The first statement is true and the second statement is false.
  - C. The first statement is false and the second statement is true.
  - D. Both statements are false.
- 5. The most common facial bone to be fractured during sports is the \_\_\_\_\_.**
  - A. condyle
  - B. coronoid of the mandible
  - C. mandible
  - D. zygoma
- 6. As stated, males are more prone to \_\_\_\_\_ than females in all types of sports.**
  - A. lip lacerations
  - B. zygoma fractures
  - C. crown fractures
  - D. tooth avulsions
- 7. The most frequent site of bony injury is the zygoma. In TMJ injuries inflammation and edema can result forcing the condyle down and forward.**
  - A. Both statements are true.
  - B. The first statement is true and the second statement is false.
  - C. The first statement is false and the second statement is true.
  - D. Both statements are false.

8. **In a mandibular fracture, \_\_\_\_\_ is the most important aspect of immediate care.**  
A. airway management  
B. tooth reimplantation  
C. sutures  
D. spinal stabilization
9. **The most severe form of displacement injury in regard to oral injuries of teeth is \_\_\_\_\_.**  
A. intrusion  
B. extrusion
10. **The most common injury to the permanent dentition during sports is \_\_\_\_\_.**  
A. avulsion  
B. crown fractures  
C. tooth intrusion  
D. tooth extrusion
11. **If the \_\_\_\_\_ attached to the root surface has/have not been damaged by rough handling, an avulsed tooth may have a good chance of recovering to full function.**  
A. periodontal ligament  
B. cementum  
C. periodontal fibers
12. **After \_\_\_\_\_, an avulsed tooth's chance for success diminishes greatly.**  
A. 1 hour  
B. 20 minutes  
C. 4 hours  
D. 5 minutes
13. **One study indicated lower socioeconomic parents are \_\_\_\_\_ aware of orofacial trauma than affluent parents.**  
A. more  
B. less  
C. equally
14. **Athletes are most influenced to wear a mouthguard by their \_\_\_\_\_.**  
A. coach  
B. parents  
C. teachers  
D. dentists
15. **Coaches receive most information about mouthguards from \_\_\_\_\_.**  
A. dentists  
B. sales representatives  
C. educational materials
16. **A properly fitted mouthguard remains secure and does not dislodge during impact. A properly fitted mouthguard adequately covers and protects the teeth and surrounding tissues.**  
A. Both statements are true.  
B. The first statement is true and the second statement is false.  
C. The first statement is false and the second statement is true.  
D. Both statements are false.

17. **Of the three available mouthguards, the \_\_\_\_\_ is recommended by dentists.**  
A. stock mouthguard  
B. mouth-formed protector/mouthguard (boil and bite)  
C. custom mouthguard
18. **The mouthguard that requires a dentist to fabricate a mouthguard from an impression is the \_\_\_\_\_.**  
A. stock mouthguard  
B. mouth-formed protector/mouthguard (boil and bite)  
C. custom mouthguard
19. **The mouthguard that is immersed in boiling water, transferred to cold water then adapted to the teeth is called the \_\_\_\_\_.**  
A. stock mouthguard  
B. mouth-formed protector/mouthguard (boil and bite)  
C. custom mouthguard
20. **Due to decreasing participation of youth in sporting events, there is no need for mouthguard implementation. Dental professionals have a responsibility to remain educated regarding the issues related to sports-related dental trauma treatments.**  
A. Both statements are true.  
B. The first statement is true and the second statement is false.  
C. The first sentence is false and the second statement is true.  
D. Both statements are false.

## References

1. Olin WH. Dentistry and sport. Meeting the needs of our patients. *J Am Dent Assoc.* 1996 Jun;127(6):809-18.
2. Smith C. The Sporting Life. *AGD Impact*, 1989:4-8.
3. Elliott MA. Professional responsibility in sports dentistry. *Dent Clin North Am.* 1991 Oct;35(4):831-40.
4. Kumamoto DP. Sports dentistry at the state level. *J Am Dent Assoc.* 1996 Jun;127(6):816. Accessed July 21, 2020.
5. Koch T, Moavenian N, Parker J, et al. The Use of Mouthguards in High School Contact Sports. U of M School of Dentistry, Class of 1996. Medline Site.
6. Flanders RA, Bhat M. The incidence of orofacial injuries in sports: a pilot study in Illinois. *J Am Dent Assoc.* 1995 Apr;126(4):491-6.
7. Soporowski NJ, Tesini DA, Weiss AI. Survey of orofacial sports-related injuries. *J Mass Dent Soc.* 1994 Fall;43(4):16-20.
8. Morrow RM, Kuebker WA. Sports dentistry: a new role. *Dent Sch Q.* 1986;2(2):11-3.
9. Glassman M. The first line of defense. *N Y State Dent J.* 1995 Aug-Sep;61(7):48-50.
10. Crow RW. Diagnosis and management of sports-related injuries to the face. *Dent Clin North Am.* 1991 Oct;35(4):719-32.
11. Guyette RF. Facial injuries in basketball players. *Clin Sports Med.* 1993 Apr;12(2):247-64.
12. Padilla R, Balikov S. Sports dentistry: coming of age in the '90s. *J Calif Dent Assoc.* 1993 Apr;21(4):27-34, 36-7.
13. Linn EW, Vrijhoef MM, de Wijn JR, et al. Facial injuries sustained during sports and games. *J Maxillofac Surg.* 1986 Apr;14(2):83-8.
14. Camp JH. Diagnosis and management of sports-related injuries to the teeth. *Dent Clin North Am.* 1991 Oct;35(4):733-56.
15. Nowjack-Raymer RE, Gift HC. Use of mouthguards and headgear in organized sports by school-aged children. *Public Health Rep.* 1996 Jan-Feb;111(1):82-6.
16. Glik D, Kronenfeld J, Jackson K. Predictors of risk perceptions of childhood injury among parents of preschoolers. *Health Educ Q.* 1991 Fall;18(3):285-301.
17. Ranalli DN, Lancaster DM. Attitudes of college football officials regarding NCAA mouthguard regulations and player compliance. *J Public Health Dent.* 1993 Spring;53(2):96-100.
18. DeYoung A, Godwin W, Robinson E. Comparison of comfort and wearability factors of boil-and-bite and custom mouthguards. Abstract 1390. *J Dent Res*, 1993;72:277.
19. Winters JE. Sports dentistry, the profession's role in athletics. *J Dent Am Assoc.* 1996 Jun;127(6):810-11. Accessed July 21, 2020.
20. Kopp BP. All mouthguards are not created equal. *Laboratory Digest*, Fall, 1996:1.
21. Powers JM, Godwin WC, Heintz WD. Mouth protectors and sports team dentists. Bureau of Health Education and Audiovisual Services, Council on Dental Materials, Instruments, and Equipment. *J Am Dent Assoc.* 1984 Jul;109(1):84-7.
22. Kerr IL. Mouth guards for the prevention of injuries in contact sports. *Sports Med.* 1986 Nov-Dec;3(6):415-27.
23. Flanders RA. Mouthguards and sports injuries. *Ill Dent J.* 1993 Jan-Feb;62(1):13-6.
24. McCarthy MF. Sports and mouth protection. *Gen Dent.* 1990 Sep-Oct;38(5):343-6.
25. Padilla RR. Sports in daily practice. *J Dent Am Assoc.* 1996 Jun;127(6):815-17. Accessed July 21, 2020.
26. For the dental patient. The importance of using mouthguards. Tips for keeping your smile safe. *J Am Dent Assoc.* 2004 Jul;135(7):1061.
27. American Dental Association. Oral Health Topics: Mouthguards, updated March 27, 2019. Accessed July 21, 2020.
28. American Academy of Pediatric Dentistry Clinical Affairs Committee, American Academy of Pediatric Dentistry Council on Clinical Affairs. Policy on prevention of sports-related orofacial injuries. *Pediatr Dent.* 2005-2006;27(7 Suppl):45.

29. Tesini DA, Soporowski NJ. Epidemiology of orofacial sports-related injuries. *Dent Clin North Am.* 2000 Jan;44(1):1-18, v.
30. Kumamoto D, Maeda Y. Global trends and epidemiology of sports injuries. *J Pediatr Dent Care.* 2005;11:15-25.
31. Kumamoto DP, Maeda Y. A literature review of sports-related orofacial trauma. *Gen Dent.* 2004 May-Jun;52(3):270-80; quiz 281.
32. Mills S. Can we mandate prevention? *J Pediatr Dent Care* 2005;11(2):7-8.
33. Academy for Sports Dentistry. Emergency treatment of athletic dental injuries - Treatment cards. Accessed April 19, 2017.
34. Rapisura KP, Coburn JW, Brown LE, et al. Physiological variables and mouthguard use in women during exercise. *J Strength Cond Res.* 2010 May;24(5):1263-8. doi: 10.1519/JSC.0b013e3181d1572d.
35. Ranalli DN. Dental injuries in sports. *Curr Sports Med Rep.* 2005 Feb;4(1):12-7.
36. ADA Council on Access, Prevention and Interprofessional Relations; ADA Council on Scientific Affairs. Using mouthguards to reduce the incidence and severity of sports-related oral injuries. *J Am Dent Assoc.* 2006 Dec;137(12):1712-20; quiz 1731.
37. Cohenca N, Roges RA, Roges R. The incidence and severity of dental trauma in intercollegiate athletes. *J Am Dent Assoc.* 2007 Aug;138(8):1121-6.
38. Academy for Sports Dentistry. Position statements - A properly fitted mouthguard. Accessed July 21, 2020.
39. Padilla R. Twenty-fifth Annual Symposium of the Academy for Sports Dentistry, 2006.
40. Park et al, Methods of improved mouthguards. First. International Symposium on Biomaterials, Taejon, Korea. August 1993.
41. Powers JM, Godwin WC, Heintz WD. Mouth protectors and sports team dentists. Bureau of Health Education and Audiovisual Services, Council on Dental Materials, Instruments, and Equipment. *J Am Dent Assoc.* 1984 Jul;109(1):84-7.
42. Andreasen JO, Andreasen FM, Andersson L. Textbook and color atlas of traumatic injuries to the teeth, 4th ed. Hoboken, NJ. Wiley.2013:444-488.
43. Play it Safe: Prevent Facial Injuries with Simple Sports Safety Precautions. American Dental Association (ADA). April 2013. Accessed July 21, 2020.
44. American Association of Orthodontists. Protective Sports Gear Survey. Reported by the American Dental Association. April 2013. Accessed July 21, 2020.
45. Rodd HD, Chesham DJ. Sports-related oral injury and mouthguard use among Sheffield school children. *Community Dent Health.* 1997 Mar;14(1):25-30.
46. ADA Council on Access, Prevention and Interprofessional Relations; ADA Council on Scientific Affairs. Using mouthguards to reduce the incidence and severity of sports-related oral injuries. *J Am Dent Assoc.* 2006 Dec;137(12):1712-20; quiz 1731.
47. Stewart GB, Shields BJ, Fields S, et al. Consumer products and activities associated with dental injuries to children treated in United States emergency departments, 1990-2003. *Dent Traumatol.* 2009 Aug;25(4):399-405. doi: 10.1111/j.1600-9657.2009.00800.x.
48. Ranalli DN. Prevention of sports-related traumatic dental injuries. *Dent Clin North Am.* 2000 Jan;44(1):35-51, v-vi.
49. Finoff JT, Laskowski ER, Altman KC, et al. Barriers to bicycle helmet use. *Pediatrics.* 2001 Jul;108(1):E4.
50. Fasciglione D, Persic R, Pohl Y, et al. Dental injuries in inline skating - level of information and prevention. *Dent Traumatol.* 2007 Jun;23(3):143-8.
51. American Dental Association. ADA approves first Seal of Acceptance for sports mouthguard. Nov 2, 2015. Accessed July 21, 2020.
52. American Dental Association. ADA approves first seal of acceptance for sports mouthguard. Nov 2, 2015. Accessed July 21, 2020.
53. Collins CL, McKenzie LB, Ferketich AK, et al. Dental injuries sustained by high school athletes in the United States, from 2008/2009 through 2013/2014 academic years. *Dent Traumatol.* 2016 Apr;32(2):121-7. doi: 10.1111/edt.12228. Epub 2015 Sep 26.

54. Comstock RD, Pierpoint LA, Arakkal A, Bihl JH. 2017-18 National High School Sports-related Injury Surveillance Study. October 2018. Accessed July 21, 2020.

### Additional Resources

- See the [Academy for Sports Dentistry](#) website for [specific emergency treatment instructions](#).
- The website of the International Association of Dental Traumatology, has a [Dental Trauma Guide](#).
- Organizations such as the [Academy for Sports Dentistry](#), founded in 1983, contribute to overall efforts to eliminate dental injuries in sporting activities. The ASD conducts educational programs, publishes a biannual newsletter, offers an annual symposium for dentists and other health professionals interested in trauma and preventive therapy, and promotes legislative efforts and encourages research in all dentally-related sports issues.<sup>3</sup>
- The American Dental Association's sports safety brochure, co-produced with the Academy of Sports Dentistry is available through the [ADA Catalog](#). The brochure includes the importance of custom mouthguards, lists sports and active games when a mouthguard should be used, and tips as to what patients should do during a dental emergency.
- The American Dental Association's [Oral Health Topics](#) website includes key points on mouthguards. American Academy of Pediatric Dentistry (AAPD). [Decision Trees for Management of an Avulsed Permanent Tooth](#) that can be found on the AAPD website in the Policies and Guidelines link. There are two current policy and guidelines publications: [2013 Policy on Prevention of Sports-related Orofacial Injuries](#) and [2015 Guideline on Adolescent Oral Health Care](#).

### About the Authors

#### Connie M. Kracher, PhD, MSD



Dr. Kracher is an Associate Professor of Biology and Director of University Research and Innovation at Purdue University Fort Wayne. Dr. Kracher is a national Key Opinion Leader (KOL) for several R&Ds, consultant for national dental organizations, and has presented for the American Dental Association, American Dental Education Association, and the World Dental Federation. Dr. Kracher is a member of several professional organizations, including the American Association of Dental Research.

Email: [kracher@ipfw.edu](mailto:kracher@ipfw.edu)

#### Rick Knowlton, DMD, MAGD



Rick Knowlton, DMD, MAGD, was the 2013-2014 President of the Academy for Sports Dentistry. He practices general and esthetic dentistry in Elizabethtown, PA and is the team dentist for numerous local sports teams and lectures on Sports Dentistry and related topics. He can be contacted at: [Knowlton Dental Associates](#).

Email: [RdKnowlton@aol.com](mailto:RdKnowlton@aol.com)