HOW TO AVOID CONCUSSIONS IN CONTACT SPORTS

Introduction

Harry Carson, Hall of Fame linebacker of the New York Giants estimated he sustained between 15-18 concussions during 21 years of high school, college and professional football. In fact, it's thought that about 75% of college football players do not report symptoms associated with concussions, and Carson stated, "I never really acknowledged I sustained concussions with the trainer, I just wanted to play". This hidden mini-epidemic needs to be addressed, as mitigation of concussion might be feasible using oral appliances.

Concussions: What are they?

Concussion or mild traumatic brain injury (MTBI) may be caused by a direct blow to the head, jaw, face or neck, or elsewhere on the body with an 'impulsive' force transmitted to the head. Typically, this trauma results in the rapid onset of short-lived impairment of neurological function that is manifested by alteration of awareness, "ding", dizziness, wooziness, or fogginess etc. that resolve spontaneously. Other signs and symptoms include loss of consciousness, temporary blindness, amnesia, loss of breathing, and permanent brain damage. In professional boxers, long-term effects from repeated blows can include depression, 'punch drunk syndrome' and possibly precursor symptoms of Parkinson's and Alzheimer's disease. The signs and symptoms commonly associated with 'post concussion syndrome' include, headache, vertigo, light-headedness, loss of balance, unsteadiness, syncope, cognitive dysfunction, memory disturbance, hearing loss, tinnitus, blurred vision, diplopia, personality change, drowsiness and an inability to perform usual daily activities. In view of these potentially serious consequences, dental professionals should counsel athletes involved at all levels of participation in contact sports, such as football, ice-hockey, boxing, martial arts, lacrosse etc., to identify risks, and provide oral appliances that may help to avoid concussions/MTBI.

Sports Mouthguards vs. Oral Orthotics

While it is accepted that sports mouthguards decrease the incidence of dental injuries in sports athletes, the use of oral orthotics (intra-occlusal splints) may be beneficial in decreasing the incidence and/or severity of concussion/ MTBI in contact sports. In the late 1960s, it was found that concussions were dramatically reduced when oral appliances were worn by the Notre Dame football team, and more recent reports suggest that properly fabricated custom oral appliances can reduce the rate of concussions. Previous studies also suggest that helmet design may prevent concussion in sports athletes, but recent reports indicate that sports mouthguards do not have this utility. Maher notes that in professional football, while a helmet with a chinstrap is worn, oral appliances are not. This approach puts the mandible in the most vulnerable position for injury of concussion i.e. positioned upwards and backwards in the glenoid fossa, which is the part of the cranial base of the skull closest to the temporal lobe of brain. Put simply, sports mouthguards protect against dental trauma but oral appliances, such as an oral orthotic (intra-occlusal splint) may be beneficial in avoiding concussions and/or MTBI.

Mechanism of concussion via the mandible

Blows to the mobile lower jaw during contact sports, such as boxing, football, ice-hockey etc. drive the jaw upwards and backwards, creating a transfer of energy from the mandible to the temporo-mandibular joint and the base of the skull. Some neurosurgeons recognize that in boxing the prime target for punches has always been the chin, the proverbial 'glass jaw'. Thus, sports athletes wearing face shields and helmets are at risk of concussion/MTBI from lower jaw impacts mediated via the TMJ.

Maher Mouthguard system

The Maher mouthguard system has three differently designed appliances i.e. ***B-Protect Orthotic***, Maher Intact Mouthguard (Level 2) and Maher Mouthguard (Level 1). Here we only discuss the ***B-Protect Orthotic*** appliance, and the Maher Intact Mouthguard (Level 2) and Maher Mouthguard (Level 1) will be discussed in other Practice Building Bulletins.

B-Protect Orthotic

The ***B-Protect Orthotic*** (Fig. 1?) has been specifically designed to aid in the prevention of concussion/MTBI. It works by repositioning the jaw into a more favorable relationship of the TMJ. Specifically, one common TMJ disorder is internal derangement, where the articular disc no longer localizes to its proper position in the joint. Typically, the disc becomes displaced anteriorly, limiting its functional benefit in relation to the movement of the mandibular condyle. Moreover, in this position it can also no longer serve as an intermediary of force absorption if a blow is directed through the mandible. The absence of this cushioning component would make it more likely that a force to the mandible would transfer more of its energy directly through the glenoid fossae to the temporal bone of the cranial base, and to the temporal lobe of the brain, with a concomitant risk of inducing concussion/MTBI.

Figure 1

On the other hand, the design of the custom-fitted ***B-Protect Orthotic*** is such that when it is worn during occlusion, it causes a repositioning of the mandible so that the condylar elements are moved from resting directly against the articular disc (or in the case of patients with internal derangements, the glenoid fossae) and onto the articular eminence instead. This re-positioning changes the contact area and, therefore, limits the direct transmission of force through the TMJ to the temporal bone and temporal lobe of the brain, by dissipating the forces through the thickest part of the articular eminence, which likely acts as a buttress.

The other advantage of the custom-fitted ***B-Protect Orthotic*** is that spans the molar area of the mandibular arch, which allows the appliance to remain in place without any occlusal pressure. In addition, the design of the ***B-Protect Orthotic*** does not restrict speech/communications or inhalation/exhalation, and it does not interfere with the oral intake of fluids. These features may improve the compliance for wearing the ***B-Protect Orthotic*** during sports. As most people naturally clench their teeth when they are about to be involved in a collision (e.g. in a sports activity), the occlusal pressure exerted allows the ***B-Protect Orthotic*** to influence the positioning of the mandibular condyles. This simple maneuver may prevent the onset of MTBI/concussive injury and its consequences. Steve Trapilo wore the ***B-Protect Orthotic*** since he was a freshman at high school. Trapilo became an All American at Boston College, and played for the New Orleans Saints for 7 years. During that time, he broke 26 steel facemasks while playing (Fig. 2?) but never sustained a concussion and had no damage from head injuries.

Figure 2

Diagnostics

It is important to screen your patients who are involved in contact sports for predisposition to concussions. Check for a history of contact sports and concussions for every new patient that attends your office. Note that there may be a relationship between a history of concussion and the patient's craniofacial anatomy. For example, it's important to check for neck strength in patients who are sports athletes. It is known that young people and females have a lower neck strength compared to adult males. Thus, high school athletes and females are less resistant to concussions. Some preliminary data suggests that the use of custom-fitted oral orthotics may actually increase muscle strength, although research is still on going in this area. Nevertheless, some professional athletes are described as being 'Burners'. These athletes experience numbness, tingling or paraesthesia of the forearm, likely mediated by entrapment of the brachial plexus of nerves in the neck.

It is also critical to examine the anatomy of the patient's TMJ, and diagnose an anteriorly displaced disc, if present. This condition may be associated with reciprocal disc clicking, other joint noises and/or dislocations. Remember to examine for other TMJ pathology, such as arthritis. Prior to starting any appliance therapy, it is important to take a history of dental treatment, including crowns and extractions, which may have yielded a mid-line discrepancy, possibly associated with TMJ derangements. Clinical experience suggests that a poor bite with a loss of teeth may predispose an athlete to sports concussion. Other dental factors such as retained deciduous teeth or absence of third molars may similarly predispose an athlete to an increased risk of sports concussion. Thus, it's important to question the patient about any orthodontic treatments in the past, and to classify the occlusion as Class I, Class II or Class III. Interestingly, clinical experience suggests that athletes with a Class III occlusion may be more resistant to sports concussions, by virtue of the fact that the maxilla helps dissipate forces applied to the mandible, which lies anterior to it in the Class III case.

Summary

Here we discussed the basic principles of concussions/MTBI and the role of the **B-Protect Orthotic** appliance. The Maher Intact Mouthguard (Level 2) and Maher Mouthguard (Level 1) will be discussed in other Practice Building Bulletins.

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Written by:

G. Dave Singh DDSc PhD BDS

Gerald J. Maher DMD FAHNP

Appliance Therapy Group Headquarters:
Space Maintainers Laboratory
9129 Lurline Ave. Chatsworth CA 91311
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We encourage participant feedback pertaining to all courses. Please be sure to complete the survey included within the answer sheet.

1. Concussion or mild traumatic brain injury (MTBI) may be caused by:

a. A direct blow to the jaw/face
b. An 'impulsive' force transmitted to the head
c. Significant deceleration of the neck (whiplash)
d. None of the above
e. All of the above

2. Typically, concussion or mild traumatic brain injury (MTBI) may cause:

a. Short-lived impairment of neurological function
b. Dizziness that does not resolves spontaneously
c. Long terms alteration of awareness
d. Slow onset of "ding", wooziness, or fogginess
e. None of the above

3. Currently, it is thought that severe signs and symptoms of concussion/MTBI include:

a. Permanent blindness
b. No amnesia
c. Loss of consciousness
d. No respiratory effects
e. None of the above

4. Which of the following conditions are associated with 'post concussion syndrome'?

a. Memory disturbance
b. Personality change
c. Inability to perform usual daily activities
d. All of the above
e. None of the above

5. Which of the following statements is NOT true?

a. Mouthguards decrease the incidence of dental injuries in sports athletes
b. Mouthguards decrease the incidence of concussion in sports athletes
c. Helmets decrease the incidence of concussion in sports athletes
d. Oral orthotics decrease the incidence of concussion in sports athletes
e. None of the above

6. The mechanisms of the B-Protect Orthotic do NOT include:

a. Preventing energy transfer from the jaw to the TMJ and the cranial base
b. Repositioning the jaw into a more favorable relationship to the TMJ
c. Repositioning of the jaw so that the condyles are resting directly against the articular disc
d. Dissipating the forces through the thickest part of the articular eminence
e. All of the above

7. Advantages of the custom-fitted B-Protect Orthotic include:

a. Remaining in place without any occlusal pressure
b. No restriction of speech/swallowing
c. No restriction of oral respiration
d. All of the above
e. Only a and c

8. Regarding the neck in patients who are sports athletes:

a. Adult females have a lower neck strength compared to adult males
b. Children have a lower neck strength compared to adult males
c. Custom-fitted oral orthotics may increase neck muscle strength
d. Athletes can experience numbness in the forearm due to entrapment of nerves in the neck
e. All of the above

9. Which of the following features is NOT associated with predisposition to concussions?

a. Reduction in the number of teeth present
b. Retained deciduous teeth
c. Extraction/absence of third molars
d. Class III malocclusion
e. None of the above

10. In the examination of a patient's TMJ, it is critical to:

a. Diagnose an anteriorly displaced disc, if present
b. Check for reciprocal disc clicking and other joint noises
c. Identify mid-line discrepancies associated with TMJ derangements
d. All of the above
e. None of the above