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Concussion Prevention and Athletic Mouthguards

Do athletic mouthguards have a role in reducing the incidence and severity of cerebral concussion in sports?

This is a controversial question now being asked by the sporting world, especially for high-impact sports such as hockey and football. The apparent increase in concussion rates has led to claims by dentists and over-the-counter mouthguard suppliers regarding the use and effectiveness of athletic mouthguards in reducing concussions. Numerous minor hockey leagues have introduced mouthguard rules as a possible result of concussion, rather than dental concerns.

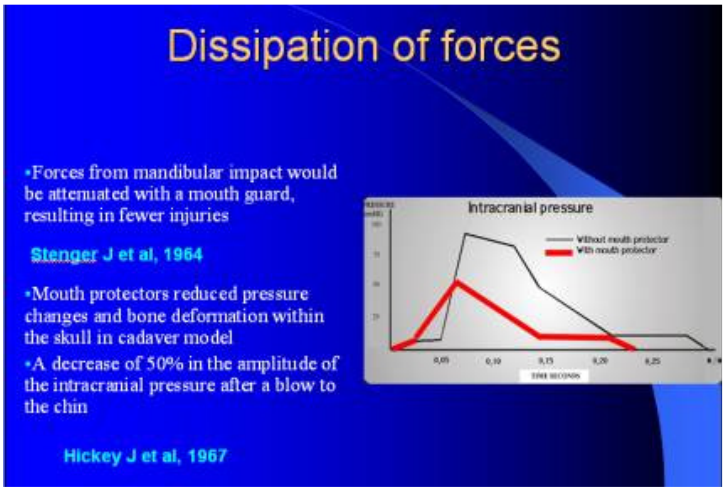
Though anecdotal, there are three possible theories on the potential benefits of properly-fitting athletic mouthguards and the reduction of the incidence or severity of concussions. It should be noted that these are theories, which in most cases are NOT PROVEN in the medical/dental literature.

1. Direct dissipation and/or absorption of force of an upward blow to the jaw.
2. Increased separation of the head of the condyle and glenoid fossa
3. Increased head stabilization by activating and strengthening neck muscles.

Dissipation of forces

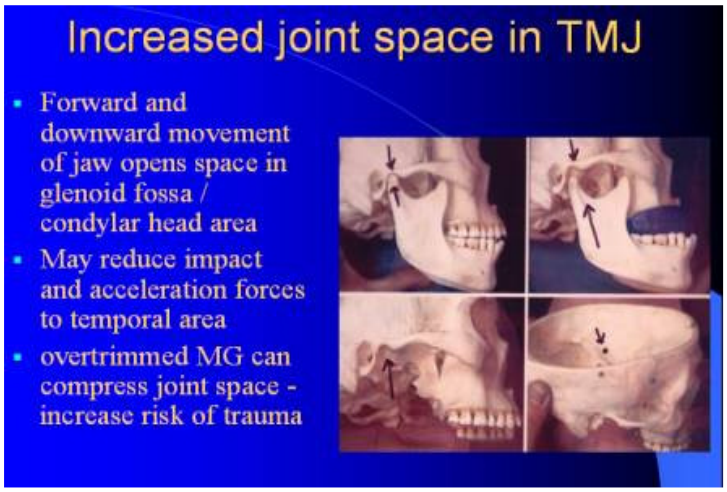
Mouthguard materials by nature must have shock absorption qualities. They must be resilient and yet soft enough to absorb impact energy and reduce transmitted forces. The thickness of mouthguard material is directly related to energy absorption and inversely related to transmitted forces when impacted. However, wearer comfort is also an important factor in their use. Thicker mouthguards are often not user-friendly. Transmitted forces through different thicknesses of the most commonly-used mouthguard material (ethylene vinyl acetate – EVA - Shore Hardness of 80) were compared when impacted with identical forces capable of damaging the oro-facial complex. The results showed that the optimal thickness for EVA mouthguard material with a Shore Hardness of 80 is around 4 mm. on the occlusal surface. All teeth must be properly covered and the bite balanced accordingly. Increased thickness, while improving performance marginally, may result in less wearer comfort and acceptance.

Stenger, in 1964, reported that forces from mandibular impact would be attenuated with a mouthguard, resulting in fewer injuries. Hickey discussed that mouth protectors reduced pressure changes and bone deformation within the skull in a cadaver model. He demonstrated a decrease of 50% in the amplitude of the intracranial pressure after a blow to the chin when wearing a mouthguard.



Increased Condylar Separation

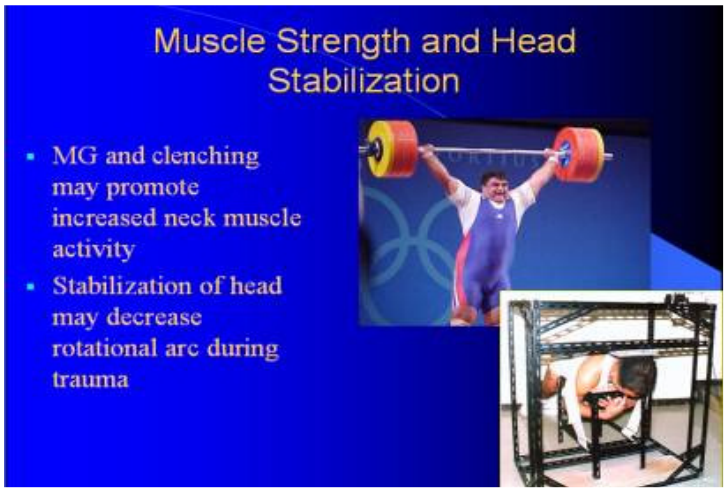
When a properly-fitted and balanced custom-made mouthguard is in place there is a forward/ downward movement of the jaw, thus opening the space between the glenoid fossa and the condylar head. This may reduce the opportunity for the condylar head to directly impact the glenoid fossa after an upward blow to the jaw, thus reducing the impact and acceleration forces to the entire temporal region. Again, while it might be advantageous to significantly open this space for protection, an excessive thickness of material on the biting surface might compromise both comfort and performance.



Increased head stabilization by activating and strengthening neck muscles

Dr. Karen Johnston, a prominent Canadian concussion researcher, noted that: “The force required to concuss a fixed head is almost twice that required to concuss a mobile head”. Further, there is some correlation between the degree of rotation that the head goes through on impact and the severity of the concussion that might result.

By activating additional head and neck muscles at the time of impact this arc of rotation might be decreased, leading to less harmful movement of the brain inside the skull. Some researchers have begun to show that by being able to clench down harder on a mouthguard the activation of the head and neck muscles might serve to stabilize the head. Some have suggested further that this effect might be in place whether or not the athlete sees the impact coming.



The Bottom Line

As Dr. Paul McCrory once stated about the connection between mouthguards and concussions “Absence of proof is not proof of absence”. We should always remember

that the primary role of mouthguards is the protection of the teeth and orofacial structures, and mouthguards should be primarily designed to accomplish this goal – with adequate protection in the areas most likely to be traumatized (maxillary incisor teeth).

However, there are some basic design elements that can and should be included in any mouthguard that might enhance the potential concussion-prevention aspects of mouthguards. All mouthguards should have an adequate thickness and should cover as much of the occlusal surface as the athlete can tolerate. Mouthguards must have proper retention built into them to ensure that they stay in place at the moment of impact. Mouthguards should not be over trimmed in the posterior, which might actually force the condyles into the glenoid fossae. All mouthguards should be balanced occlusally to ensure an even distribution of force across the entire surface.

NOTE: The authors would like to stress and emphasize that the above information is theory ONLY and has not yet been proven in the medical/dental literature. We DO NOT support the claims made by mouthguard manufacturers and other dentists that there is a definite relationship between mouthguards and cerebral concussion. Until it is proven in the medical literature, this stand will continue. Athletic mouthguards, until proven different, are primarily for the reduction of orofacial injury.

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