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Why Judo Should Require Mouthguards

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ABSTRACT

Judo is a very dynamic and aggressive full-contact sport. This study shows the value and need for Judoka (Judo athletes) to wear mouthguards during competition. The goal was to study and establish the actual use of Mouthguards in Judo and to use published articles to predict the benefit of mouthguard use for Judoka. When observing the number of Judoka who wear mouthguards during competition, it is clear that the lack of use is a problem that should be addressed. Many sports require the use of mouthguards during practice and competition, but Judo does not. Even though mouthguards can reduce many kinds of injuries to athletes, Judoka have only recently been allowed to wear mouthguards during competition, however, it still is not encouraged. I hypothesized that the number of Judoka who wear mouthguards may be low and the severity of injuries would be reduced in Judoka who wear mouthguards. My results indicate that mouthguards are not frequently worn as I found that approximately 1.5% of Judoka wear mouthguards from studying tournaments that took place in 2022. Mouthguards are important, as they can protect the hard and soft tissues of the mouth, reduce the seriousness of neck injuries, and minimize the severity of concussions. The purpose of this study is to raise awareness of the lack of use of mouthguards in the sport of Judo and that wearing mouthguards in Judo will reduce the risk and severity of injuries while avoiding costly medical treatment.

INTRODUCTION

Judo is an Olympic sport that has thousands of competitors in the United States and millions throughout the world. The current culture in Judo is to not wear a mouthguard simply due to tradition; however, Judo is a full-contact sport. Like other aspects of Judo, mouthguards are not a traditional part of the sport. This study shows how Judo utilizes mouthguards currently and why Judo should change its approach to mouthguard use.

I have personally been practicing Judo for over a decade and I am a USJA (United States Judo Association) certified referee. I compete in tournaments as a competitor and I referee competitors as well, and I have seen very limited use of mouthguards in practice and in competition, even after the mouthguard ban was lifted in 2018. I find myself constantly forgetting to wear a mouthguard due to the fact that almost nobody seems to wear one. The International Judo Federation (IJF), the ruling organization of Judo worldwide, has shown its commitment to safety by prohibiting several throws that are “very likely to cause injury” (4). If the IJF is willing to change how the sport is played in order to make Judo safer, it should be willing to go a little further and do something as simple as require mouthguards during randori (practice fighting) and shiai (fighting competition). The rare use of mouthguards in Judo needs to change: every Judoka should wear a mouthguard, and mouthguards should be required to participate in Judo.

Mouthguards are protective equipment worn by athletes to help prevent injuries to the mouth. What is less commonly known is that, in addition to mouthguards reducing many kinds of injuries to the mouth, mouthguards can minimize the severity of concussions (1). Several sports require mouthguards, such as football, hockey, MMA, taekwondo, and lacrosse due to the dangers that these sports impose (2). Interestingly, some sports, such as Judo, pose a high risk of injury to the head and neck of athletes, yet they do not require the use of mouthguards. Judo is a close-contact sport and martial art that causes a fair number of mouth injuries (3). Despite this, mouthguards were

officially *illegal* to wear during Judo competition until 2018 (3). The recent approval of mouthguard use in tournaments is a positive step forward but is still insufficient. Mouthguard use by Judoka should be mandatory.

Mouthguards can prevent and reduce the effects of many types of injuries. Mouthguards help protect an athlete's hard tissues (teeth and bone) and soft tissues (muscle, brain, tongue, cheeks, lips, gums, etc.) during both practice and competition. Mouthguards help to absorb force by providing a cushion between the mandible (lower jaw) and maxilla (upper jaw) when they slam together. Mouthguards absorb the brunt of the force, preventing damage to the teeth, reducing neck trauma, and possibly preventing jaw fractures (5). Mouthguards also serve as barriers between the teeth and the rest of the mouth, making it less likely for the teeth to damage the soft tissues of the mouth (5). Mouthguards further distribute the force of impact from one tooth to all teeth, lessening the force of impact on any particular tooth, which helps prevent tooth chipping/breaking, and absorb forces that would otherwise be applied to the teeth (5). Mouthguards, especially custom-made mouthguards, may also help prevent concussions, as they absorb some of the shock and stabilize the head and neck (1,6).

My hypothesis is that because the number of Judoka who wear mouthguards may be low, this will lead to unnecessary injuries. My research indicates that mouthguards are rarely worn in Judo. Furthermore, the lack of mouthguard use leads to the risk of injuries associated with full-contact sports. The results show that the lack of use of mouthguards in full-contact sports is inherently dangerous and that Judo is not utilizing this simple protective gear.

MATERIALS AND METHODS

Scientific Review Committee and Institutional Review Board research approval guidelines listed on the Journal of Emerging Investigators website reads, "All studies involving human subjects (including interviews and surveys) must be approved by an SRC or IRB before the project begins, with the following exceptions: Projects use data from a pre-existing dataset that is published and/or publicly available, and do not involve any interaction with humans or the collection of any new data from human participants." Therefore, my research methods are approved, as they fit within the guidelines. IJF and USA Judo (organization that represents amateur and Olympic U.S. Judo athletes) photos and videos of Judo athletes during competition in national and international tournaments were used as the reference for this study. Care was used to pull small samples from many different tournaments. Smaller samples from several tournaments seem likely to provide a more accurate picture overall than focusing on one tournament, as there could have been a single outlier club that would have caused inaccurate results. Only competitions occurring in 2022 were used to observe 266 unique Judoka. Participants of this study were Judo competitors of all different ages, heights, weights, sexes, ethnicities and athletic abilities.

To conduct this study, photos and videos of Judo matches (usually less than 5-minute competitions between two athletes) were observed. Matches were observed in both national and international tournaments. I recorded data, which consisted of noting whenever an athlete was observed either wearing or not wearing a mouthguard during competition. In this study, only competition matches in which a competitor's face and mouth could easily be observed were used. If there was any ambiguity as to whether or not an athlete could be observed wearing a mouthguard, the photo or video was not used. Medical journals and interviews with multiple doctors of dental surgery were used to gather information regarding the benefits of mouthguard use in Judo.

RESULTS

Less than 1.5% of Judoka were observed to be wearing a mouthguard during several competitions that included 266 Judoka from across the U.S. and around the world. It was observed that only four athletes wore mouthguards during full-contact Judo matches (individual competitions (**Figure 1**)).

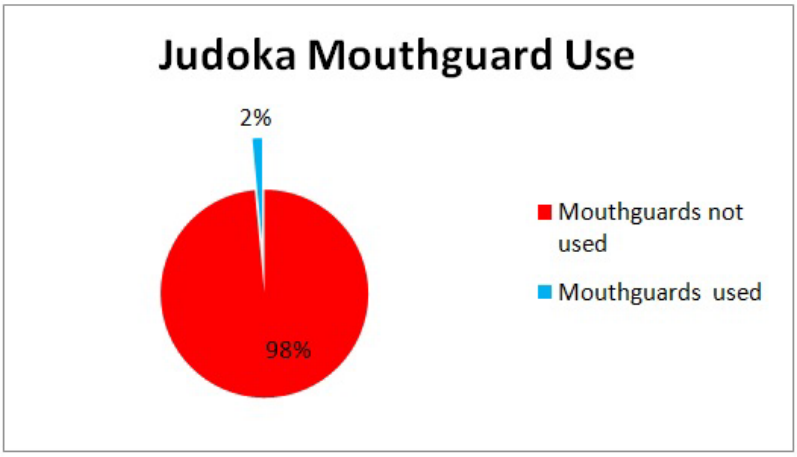

Figure 1: The number of Judoka (Judo athletes) observed who competed with and without wearing a mouthguard in national and international competitions in 2022. Red signifies a mouthguard was not worn (not used) by Judo athlete. Blue signifies a mouthguard was worn (used) by Judo athlete.

The actual use of mouthguards in Judo is uncommon, and many people may be surprised at how little mouthguards are utilized.

Judoka should be required to wear mouthguards—especially custom fit mouthguards—during randori and competition because of the protection they offer. The research conducted on the benefits of mouthguards shows the necessity for full-contact sports like Judo to require such simple and affordable protective gear **(Figure 2)**.

Figure 2

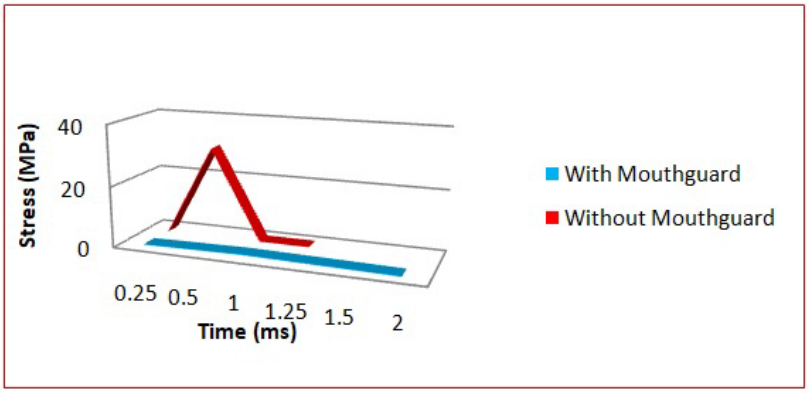

Figure Adapted from: Firmiano, et. al. Dental Traumatology. 2022. https://doi.org/10.1111/edt.12746

Figure 2: The stress on jaw bones (upper and lower jaw) with mouthguard use and without mouthguard use. Line graphs show stress applied over time. The blue color line is an average of five different mouthguard brands. Red line signifies no mouthguard.

The research demonstrates clearly that wearing any brand of mouthguard is better than not wearing one at all.

DISCUSSION

Contact sport participants who do not wear a mouthguard during practice or competition are more than twice as likely to receive orofacial injuries, which may include the complete loss of a tooth or teeth (7), which can lead to per-

manent damage and high costs to repair injuries. A tooth that has been avulsed (knocked out of the tooth socket) must be treated as soon as possible; if the tooth has been out of the mouth for over an hour, the chances of it being successfully re-implanted decrease significantly, and the salvageability of the tooth could be permanently lost (8). When a tooth is avulsed, the nerves and blood vessels in the tooth are damaged and are unable to be repaired, making root canal therapy necessary (8). Root canal therapy may cost anywhere from $600 to $1,400 depending on the tooth (9). Additionally, teeth that receive root canals should be crowned in order to maintain them long term, which can cost an additional $100 to $3,500 per tooth, depending on the material used (10,11). There are also many complications associated with reinserting an avulsed tooth, such as tissue inflammation, breakdown of tooth root structure, and pulp necrosis, which may necessitate the removal of the tooth (12). Root canal treatment will make a tooth weaker than it once was, increasing the risk of future infections (13). Crowns may chip, become loose, and may cause the gumline to recede (14). If a tooth cannot be saved, there are alternative treatments, but all treatments have downsides such as infection, adjacent muscle nerve damage, decreased longevity, and high risk of infection for implants; being unstable, requiring the loss of perfectly good tooth enamel, and damaging healthy teeth for dental bridges; and looking unnatural, being fragile, requiring daily cleaning, and needing replacement for dentures (15,16,17).

It is important to restate that athletes have been found to be more than twice as likely to suffer from orofacial injuries when not wearing a mouthguard, which includes soft tissue injuries (7). While most soft tissue injuries may not seem to pose any real harm other than discomfort, deep cuts in the mouth have a higher infection rate than that of overall traumatic injuries due to the mouth's dirty nature, being exposed to food and other foreign material, as well as being bathed in secretions full of bacteria (18). In addition, biting the tongue can lead to severe injury, which requires medical attention within eight hours to avoid permanent damage (19). Even if the injury is minor, soft tissue damage within the mouth can cause a lot of bleeding due to the fact that the mouth is an area that contains many blood vessels (20). Besides the danger to the athlete who is bleeding, another problem is that bleeding poses a safety hazard due to the potential to spread blood-borne pathogens. In addition, a Judo match must be stopped when a Judoka is bleeding while on the mat. Cleaning up blood and disinfecting an area takes time, and the process may take longer in the event a Judoka continues to bleed or multiple Judoka are bleeding. These unnecessary delays may easily be prevented with mouthguard use, and, practically speaking, since some tournaments can continue past midnight, it would be best to get through matches as fast as possible, especially for larger tournaments. Another problem for athletes is that bleeding Judoka may be medically disqualified from a tournament if it is determined that the bleeding cannot be controlled.

A 2005 laboratory study showed that a mouthguard reduces mandibular distortion by 55% when someone is hit in the mandibular undersurface, potentially preventing jaw fractures (21). A broken jaw is an injury that must be treated immediately, as more severe jaw fractures can cause breathing issues (22). A broken jaw is typically very painful, can cause bleeding from the mouth or nose, and can prevent the jaw from opening or closing all the way (22). Additionally, while the jaw heals, the injured person will need to eat a soft or liquid diet in order to avoid causing further damage to the jaw (22). Minor fractures typically cost less than $1,000 for X-ray, facility, and doctor fees, but can cost anywhere from $10,000 to $30,000 for fractures that require surgery (23). In addition to cost, surgery also comes with potential complications, including infection, malunion, malocclusion, and other side-effects (24).

Neck injuries are another potential complication in Judo that can be lessened by the use of mouthguards. Neck injuries may be as minor as a simple sprain, or as serious as a cervical spine injury (25). A five-year study of football player head and neck injuries showed that after the entire team started wearing mouthguards, the number of players who ended up requiring cervical collars (neck braces) due to neck injuries dropped to zero (26). Additionally, some players who only wore mouthguards on occasion discovered that old injuries reoccurred when they did not wear them, convincing these players to wear their mouthguards constantly (26). A neck sprain, which is a stretched muscle or tendon/ligament, can result from excessive movement of the neck (27). An example of this is whiplash. While neck sprains are usually not very serious injuries (28), they can become much worse through continuous use

of the neck, which can cause tendonitis, permanent muscle damage, or even fatal complications in the kidneys due to protein released by the damaged muscle (29). This poses a problem if a Judoka with a neck sprain wishes to continue practicing and especially if they have an upcoming competition. On the other extreme is a cervical spine injury which is usually severe, and can potentially cause permanent partial or full loss of sensory abilities, as well as many other complications, with cervical spine injuries higher in the neck often being fatal (30). It is very important to try to prevent neck injuries, as well as concussions, as a buildup of concussions can cause permanent damage (30).

A systematic review by the ADA showed that athletes who do not wear mouthguards have a 25% higher risk of receiving concussions than those who wear mouthguards (7). A study showed that wearing a mouthguard significantly decreases acceleration of the head when receiving a direct blow to the mandibular undersurface (21). Therefore, mouthguards likely reduce the severity of concussions, as concussions are associated with higher acceleration of the head (31). A concussion may result in post-concussive syndrome, which includes symptoms that last between weeks to months, and may include dizziness, memory problems, difficulty concentrating, changes in personality, mood swings, fatigue, headaches, and insomnia (32). After a concussion, athletes should avoid participating in sports or sport-like activities until they fully heal, especially due to the fact that concussions may cause coordination and balance issues that are necessary to keep the athlete safe (32). If someone receives a second concussion before a previous concussion has fully healed, they are at risk of symptoms lasting longer and brain damage, and may even die as a result of second impact syndrome (32). Not practicing for several weeks to months can be quite detrimental to the skill and ability of an athlete, during which time their opponents are training and improving. In addition, competitors may miss out on important competitions or events by waiting for a concussion to heal. Even if the brain recovers from a first concussion, the more traumas the brain experiences, the more likely long-term symptoms are to occur. Long-term effects include, but are not limited to, mood-related symptoms such as depression or anger, memory loss, trouble focusing, fatigue, headache, blurry vision, and sensitivity to light and noise (32). Multiple concussions may also cause autonomic nervous system dysfunction, which includes blood pressure changes, heart rate irregularities, temperature irregularities, and more (32,33).

A recent study showed the stress generated on jaw bones by an impact is significantly higher without a mouthguard than with a mouthguard, regardless of the brand of the mouthguard tested **(Figure 2)**. Wearing a mouthguard absorbs 80% or more of the shock on teeth and significantly reduces the stress and strain generated by an impact which could otherwise potentially chip and/or knock out teeth, cause severe soft tissue damage, or even cause a concussion (34).

In Judo, it is not uncommon for a Judoka to accidentally hit their jaw against the tatami (mat) or against their opponent, or get hit in the face by their opponent attempting to take a grip. A mouthguard can help absorb some of the shock and prevent these accidents from being more serious. Hitting the tatami is the predominant cause for receiving head trauma in Judo (35). When a Judoka hits his/her head directly on the tatami, a mouthguard can reduce the force transferred from the mandible to the maxilla when the jaws slam together; a mouthguard can lessen the severity of a concussion or hard or soft tissue damage, preventing later complications such as disease and permanent injury (1). Grip fighting is a key component to practicing and competing in Judo, so it is imperative that Judoka learn how to quickly grab and keep a grip on their opponent (4). When a Judoka quickly moves to grip an opponent by their gi (Judo uniform), it is easy to accidentally hit their opponent in the mouth. Judoka may also accidentally hit an opponent's head with their elbow, knee, etc. while trying to throw or grapple on the ground. This often causes the opponent's soft tissues to bleed when they are not wearing a mouthguard, and could even cause micro concussions in the right circumstances (1). If a mouthguard was always worn, these injuries could easily be prevented, or at least lessened, and time could be saved during competitions.

According to a 2019 systematic review, contact sport competitors are more than twice as likely to receive an orofacial injury when they do not wear a mouthguard (7). While orofacial injuries such as a chipped tooth may seem trivial, they can be significant because a chipped tooth may cause sharp pain if the damage exposes the dentin of the tooth, as the tooth's nerves may become exposed to the outside environment and become extremely sensitive to factors such as pressure and temperature with activities such as eating and drinking (36). A chipped tooth can

have a sharp edge, which can frequently cut the mouth's soft tissues, making common activities such as eating and talking quite painful and tedious (36,37). Chipping creates fractures or cracks, resulting in weaker teeth, which can cause further damage, and even breakage, much more likely to occur (37). A chipped tooth can become more susceptible to bacteria, which can lead to damage and infection, and could eventually require root canal therapy or extraction of the tooth (37). Severe tooth infections can even lead to sepsis, which is a life-threatening condition (38). While there are treatments for a chipped tooth, these treatments have many potential side effects, such as the risk of tooth and gum infections, higher risk of trauma, tooth decay, and uneven attrition (39,40). Along with possible side effects, tooth repair can be very expensive, costing anywhere from $90-$3,200 (41). The benefits of wearing a mouthguard in Judo are many.

The research in medical and dental journals shows that the use of mouthguards is not only a good idea but should be required in all full-contact sports. Mouthguards considered 'boil and bite' can be purchased for less than two dollars (at the time of this publication) in many local drug and grocery stores in the U.S. and offer valuable protection against many types of injuries. The research into the use of mouthguards in Judo shows the need for Judo to make a policy change.

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REFERENCES

1. McCarthy, Evan. "Athletic Mouthguards Reduce Dental and Head Trauma." Sporting Smiles (blog). January 11, 2022. https://www.sportingsmiles.com/blog/athletic-mouthguards-reduce-dental-head-trauma/.
2. McCarthy, Evan. "Which Sports Require Mouthguards?" Sporting Smiles (blog). January 18, 2022. https://www.sportingsmiles.com/blog/which-sports-require-mouthguards/.
3. Susanne Bruggesser et al, "The Prevalence of Orofacial Injuries in Judo: A Cross-Sectional Study," PubMed, February 13, 2020, https://pubmed.ncbi.nlm.nih.gov/31994310.
4. "Judo – Kinshi Waza," Black Belt Wiki, Accessed July 10, 2022, https://blackbeltwiki.com/kinshi-waza.
5. "Ask Your Denver and Englewood Dentist: 3 Ways Mouthguards Protect You When You Play Sports," Sierra Dental and Orthodontics, August 15, 2018, https://mysierradental.com/dental-care/ask-your-denver-and-englewood-dentist-3-ways-mouthguards-protect-you-when-you-play-sports/.
6. Custom-Made Mouthguards Reduce Athletes' Risk of Concussion, Study Shows," ScienceDaily, May 4, 2022, www.sciencedaily.com/releases/2014/05/140501101133.htm.
7. "Athletic Mouth Protectors (Mouthguards)," ADA, Last Updated October 19, 2021, https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/athletic-mouth-protectors-mouthguards.
8. "What Do I Do if My Tooth Is Knocked Out?," Westermeier Martin Dental Care, Accessed 10 July 2022, https://wmsmile.com/what-do-i-do-if-my-tooth-is-knocked-out/#:~:text=When%20a%20tooth%20has%20been,it's%20put%20back%20into%20place.
9. Joe Resendiz, "Average Cost of a Root Canal & How to Save," ValuePenguin, Last Modified December 7, 2021, https://www.valuepenguin.com/average-cost-root-canal.
10. Nicholas Leon-Guerrero, "Will I Need a Crown After My Root Canal?," Dominion Endodontics (Blog), Accessed July 10, 2022, https://www.dominionendodontics.com/blog/will-i-need-a-crown-after-my-root-canal.

11. Robert Milner, "Dental Crowns: Preserving Damaged Teeth," Consumer Guide to Dentistry, Accessed 10 July, 2022, https://www.yourdentistryguide.com/crowns/.
12. "Avulsed Tooth," Cleveland Clinic, Accessed July 10, 2022, https://my.clevelandclinic.org/health/diseases/21579-avulsed-tooth.
13. "What Are the Side Effects of Root Canal Treatment?," Smilepoint Dental, Accessed July 10, 2022, https://www.smilepointdental.com/what-are-the-side-effects-of-root-canal-treatment/.
14. Jared Harding, "Potential Complications With Dental Crowns," Dentistry of West Bend, August 1, 2021, https://www.dentistryofwestbend.com/potential-complications-with-dental-crowns/.
15. Karthik Kumar, "Disadvantages of Dental Implants," MedicineNet, Accessed July 10, 2022, https://www.medicinenet.com/disadvantages_of_dental_implants/article.htm.
16. "The Pros and Cons of Dental Bridges," Aurora Dental, April 27, 2020, https://www.myauroradentist.com/the-pros-and-cons-of-dental-bridges/.
17. Kate Ranta, "Dentures vs. Dental Implants: Pros & Cons of Each," Solstice (blog), December 4, 2020, https://blog.solsticebenefits.com/solstice-member-blog/dentures-vs.-dental-implants-pros-cons-of-each.
18. Suzanne Katsetos et al, "Antibiotic Prophylaxis for Oral Lacerations: Our Emergency Department's Experience," National Library of Medicine, September 13, 2016, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5020007/.
19. "Is Accidentally Biting Your Tongue Dangerous?," Oral & Facial Surgery of Utah, December 31, 2020, https://www.oralsurgeryofutah.com/2020/12/31/is-accidentally-biting-your-tongue-dangerous/#:~:text=The%20human%20jaw%20is%20very,injury%20to%20avoid%20permanent%20damage.
20. "How to Properly Care for Oral Cuts and Scrapes," healthline, Reviewed November 18, 2019, https://www.healthline.com/health/cut-in-mouth#summary.
21. Tomotaka Takeda et al, "Can Mouthguards Prevent Mandibular Bone Fractures and Concussions? A Laboratory Study With an Artificial Skull Model," National Library of Medicine, June 21, 2005, https://pubmed.ncbi.nlm.nih.gov/15876323/.
22. "Broken or Dislocated Jaw," Cleveland Clinic, Last Reviewed November 1, 2021, Accessed July 3, 2022, https://my.clevelandclinic.org/health/diseases/22014-broken-dislocated-jaw.
23. "Broken Jaw Cost," CostHelper, Accessed July 3, 2022, https://health.costhelper.com/broken-jaw.html#:~:text=Without%20health%20insurance%2C%20diagnosis%20and,severe%20jaw%20fracture%20that%20requires.
24. Daniel Perez and Edward Ellis, "Complications of Mandibular Fracture Repair and Secondary Reconstruction," National Library of Medicine, December 4, 2020, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7759430/.
25. "Common Neck Injuries and Conditions," Dignity Health, Accessed June 19, 2022, https://www.dignityhealth.org/conditions-and-treatments/orthopedics/common-neck-injuries-and-conditions/.
26. John Stenger et al, "Mouthguards: Protection Against Shock to the Head, Neck and Teeth," Accessed July 3, 2022, http://www.mosessport.com/Mouthguards_-_Protection_Against_Shock_to_Head__Neck_and_Teeth.pdf.
27. "Neck Sprain," OrthoInfo, Accessed June 19, 2022, https://orthoinfo.aaos.org/en/diseases--conditions/neck-sprain/.
28. "Neck Sprains and Strains," Bon Secours, Accessed June 20, 2022, https://www.bonsecours.com/health-care-services/spine-care/conditions/neck-sprains-and-strains#:~:text=Most%20neck%20strain%20or%20sprains,an%20appointment%20with%20your%20doctor.
29. "What Can Happen When You Ignore a Muscle Injury?," Integrated Rehabilitation Services (blog), January 1, 2020, https://integrehab.com/blog/injuries/ignore-muscle-injury/.
30. "Cervical Spinal Cord Injury: Symptoms and Prognosis," Shepherd Center, Accessed June 22, 2022, https://www.shepherd.org/patient-programs/spinal-cord-injury/levels-and-types/Cervical-Spinal-Cord-Injury#:~:text=Cervical%20spinal%20cord%20injuries%20often,cord%20injury%20often%20being%20fatal.

31. Melanie Bussey, "History of Concussion Is Associated With Higher Head Acceleration and Reduced Cervical Muscle Activity During Simulated Rugby Tackle: An Exploratory Study," ResearchGate, Accessed July 11, 2022, https://www.researchgate.net/publication/332031907_History_of_concussion_is_associated_with_higher_head_acceleration_and_reduced_cervical_muscle_activity_during_simulated_rugby_tackle_An_exploratory_study.
32. Mark Allen, "Multiple Concussions: Long-Term Effects and Treatment Options," Cognitive fx (blog), May 31, 2022, https://www.cognitivefxusa.com/blog/multiple-concussions-effects-and-treatment.
33. Jaycie Loewen, "The Patient's Guide to Post-Concussion Autonomic Dysfunction (Dysautonomia)," Cognitive fx (blog), May 23, 2022, https://www.cognitivefxusa.com/blog/post-concussion-autonomic-dysfunction-dysautonomia#ans-dysfunction.
34. Tainah Costa Firmiano et al, "Influence of Different Ethylene-Vinyl Acetate Brands Used for Custom-Fitted Mouthguard Fabrication on the Stress and Strain During an Impact," Wiley Online Library, March 12, 2022, https://onlinelibrary.wiley.com/doi/10.1111/edt.12746.
35. Haruo Murayama et al, "Simple Strategy to Prevent Severe Head Trauma in Judo —Biomechanical Analysis—," National Library of Medicine, September 25, 2013, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4508688/#:~:text=In%20judo%2C%20as%20the%20participants,predominant%20cause%20of%20head%20injury.
36. "Will a Chipped Tooth Grow Back?," Providence Family Dentistry (blog), Accessed June 5, 2022, https://www.providencefamilydentistry.com/blog/will-a-chipped-tooth-grow-back/.
37. Nabil Achache, "The Consequences of Ignoring a Chipped Tooth," Highbury Park Dental, March 10, 2020, https://highburyparkdental.ca/the-consequences-of-ignoring-a-chipped-tooth/.
38. Phil Jevon, Ahmed Abdelrahman, and Nick Pigadas, "Management of Odontogenic Infections and Sepsis: An Update," National Library of Medicine, September 25, 2020, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7517749/.
39. "7 Possible Side Effects of a Tooth Filling," Same Day Dental (blog), Accessed July 6, 2022, https://www.samedaydental.com/blogs/7-possible-side-effects-of-a-tooth-filling#:~:text=There%20are%20two%20main%20risks,break%20or%20fall%20out%20completely.
40. "Do Dental Veneers Have Any Side Effects?," American Dental Group (blog), June 12, 2018, https://www.mywestcovinadentist.com/blog/do-dental-veneers-have-any-side-effects/.
41. "You Chipped a Tooth - How Much Will Repairs Cost?," Spirit Dental & Vision (blog), August 29, 2019, https://spiritdental.com/blog/categories/dental-health/you-chipped-a-tooth-how-much-will-repairs-cost#:~:text=Generally%2C%20you%20might%20expect%20to,anywhere%20from%20%2490%20to%20%24500.