

An Osteopathic Physician's Approach to the Esports Athlete

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Esports is gaining acceptance in the world of professional, collegiate, and high school athletics. However, there is a lack of information for osteopathic physicians about the health concerns and appropriate treatment of esports athletes. Because of the sedentary nature of the sport and accompanying poor posture, esports athletes are likely to have musculoskeletal injuries of the neck, back, and upper extremities. Additionally, these athletes may have metabolic disturbances resulting from light-emitting diode computer monitors as well as mental health concerns regarding gaming addiction and social behavior disorders. The authors explore the osteopathic physician's role in promoting health and reducing injury in this new gaming phenomenon.

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Although controversial in its characterization as a sport,¹ esports is gaining acceptance in the world of athletics. In 2017, the International Olympic Committee accepted esports as a sporting activity, and in 2018, esports made its debut at the Asian Games.² Professional esports competitions attract more than 250 million viewers globally and sell out venues such as Madison Square Garden in New York City and the Staples Center in Los Angeles.³ Corporations including the National Basketball Association, which launched its 2K League in 2018,⁴ and Amazon, which purchased the esports streaming website Twitch.com for about 1 billion dollars in 2014,⁵ are committing to esports. In the world of intercollegiate athletics, Robert Morris University started the first esports team in 2014, and there are now more than 80 collegiate esports varsity teams in the United States, with 22 offering scholarships.⁶ Esports has also permeated high school athletics; the first competitive United States varsity season took place in fall 2018.⁷

Esports is similar to traditional sports because there are uniforms, practices, and coaches; however, there are key distinctions. Esports require manual dexterity and quick reaction times to achieve victory.⁸ Athletes at a professional level can perform up to 500 action moves per minute (APM) compared with 10 APM for a novice. Practice for collegiate esports can be 3 to 5 hours of gameplay per day, and many athletes continue to play at home.⁹ Esports athletes are seated throughout gameplay; therefore, the injury profiles and health concerns are more likely to resemble a desk worker than a soccer player.

With the emergence of esports and its unique characteristics, physicians need specific guidance. Therefore, in this article we discuss the current evidence on esports-related health concerns, such as ophthalmologic, musculoskeletal, metabolic, and mental health

conditions. We also present research-supported interventions that may improve the health and quality of life of esports athletes.

Computer Vision Syndrome

The most commonly reported complaint of esports athletes is eye fatigue. Greater than 25% of collegiate esports athletes report practicing more than 5 hours per day. During practice, athletes fix their eyes on a computer screen for long periods of time. Additionally, the typical duration of play before a standing break is more than 2 hours in greater than 50% of respondents.¹⁰ Therefore, many esports athletes have computer vision syndrome, which is characterized by symptoms including blurry vision, low back pain, and tension headache. The condition is found in 90% of individuals using a computer for more than 3 hours per day.¹¹ The lack of contrast and definition in pixel-generated computer images increases strain on the eye. Consequently, saccadic movements, accommodation, and convergence increases while blink rate decreases, which fatigues the oculomotor system.^{11,12}

Several interventions can minimize symptoms associated with computer vision syndrome. An athlete's gaming station should be organized so the center of the monitor is 5 to 6 inches below the straight vision line at a distance of 20 to 28 inches away. The lights in the room should be modified to limit glare.¹¹ Athletes may be advised to seek correction of refractive errors, accommodation/convergence disorders, and astigmatism.^{11,12} Esports athletes may also be instructed on exercises that reduce eye fatigue while they are gaming. These exercises include near-far focusing, palming, and the "20-20-20 rule" that instructs athletes to look 20 feet away for 20 seconds every 20 minutes.^{11,13,14}

Neck and Back Dysfunction

Approximately 35% of collegiate esports athletes report neck or back pain while gaming.¹⁵ Research examining

posture while gaming revealed that within 30 minutes of play, there was forward displacement of the head compared with the spine.¹⁶ Remaining in a forward head position for prolonged periods of time stresses the cervicothoracic junction and paraspinal muscles, which causes regional imbalances in muscle tension.^{16,17} Every inch of forward head displacement is associated with a 10-pound increase of force torque in the cervical extensors.¹⁶ The increase in force perpetuates a cycle of further forward head displacement and muscle strain. Therefore, in addition to cervical strain, esports athletes are at an increased risk of cervicogenic and tension headaches.¹⁶ In the lower back, slumping posture increases forces on the intervertebral discs and can result in herniations.¹⁸ Furthermore, seats with backrests, which are common in gaming chairs, promote flattened lumbar lordosis and posterior pelvic tilt causing increased muscle tension in the paraspinal muscles and weakness of the transversus abdominus.¹⁸

Appropriate interventions for esports athletes with neck pain include stretches, strengthening exercises, and osteopathic manipulative medicine (OMM). When prescribing exercise to this population, stretches and strengthening should focus on muscles associated with postural control, such as the back, abdomen, and neck. Strengthening exercises and stretches can decrease pain¹⁹ and improve range of motion.²⁰ Cervical postural manipulation was found to increase lordosis and cervical extension range of motion and decrease forward head posture in the cervical spine.²¹ High-velocity, low-amplitude (HVLA) and muscle energy techniques were found to decrease neck pain.²²⁻²⁴ In patients with chronic low back pain, soft-tissue mobilization, muscle energy techniques, and mobilization for lumbar segment techniques twice per week reduced pain intensity and improved physical function and mental health.²⁵

Upper Extremity Dysfunction

Playing video games longer than 3 hours is associated with shoulder pain and is likely a result of poor

posture while gaming.²⁶ Sitting for 5 minutes in the forward head posture position caused a significant decrease in shoulder external rotator strength.²⁷ Additionally, more than 30% of collegiate esports athletes report pain in the hand or wrist.¹⁰ Playing video games requires quick, repetitive movements involving the fingers, hands, and wrists. These repetitive movements result in hypertrophy of the flexor tendons in the carpal tunnel and increased cross-sectional area and swelling ratio in the median nerve.²⁸ The increase in pressure begins within 30 to 60 minutes of keyboard use and is exacerbated by an accompanying ulnar deviation of the wrist.²⁸ Video games that involve a joystick can result in de Quervain tenosynovitis.^{29,30} Wrist exercises can help alleviate wrist and hand pain.

To help prevent upper extremity injuries and decrease strain and stress when playing, it is paramount to counsel esports athletes on proper posture. Several OMM techniques can effectively address shoulder somatic dysfunctions associated with prolonged gaming. The fascial distortion model was found to increase shoulder range of motion and HVLA thrust manipulations, and high-amplitude, low-velocity thrust mobilizations were found to improve shoulder recovery after injury.^{31,32} In addition to OMM, rest, immobilization, and nonsteroidal anti-inflammatory drugs are recommended for hand and wrist injuries.³³ For carpal tunnel syndrome, balanced membranous tension of the interosseous membrane; high-amplitude, low-velocity springing of the carpal bones with direct release and extension; and release of the transverse carpal ligament using the opponens pollicis roll maneuver have demonstrated symptom improvement when administered weekly for 6 weeks.³⁴ Myofascial release has also shown efficacy in increasing carpal tunnel dimensions and reducing symptoms.^{35,36}

Metabolic Dysregulation

Esports athletes indicate practicing between 3 to 10 hours a day to master their sport.¹⁰ A negative effect on peripheral and central vascular health was found when

individuals remained in a seated position for greater than 3 hours.³⁷ In 2012, a professional esports athlete had a deep vein thrombosis, and treatment was delayed because he was unaware that leg pain could indicate a life-threatening condition. Survey data have also demonstrated that more than 40% of esports athletes do not participate in any kind of physical activity,¹⁰ which signals a high prevalence of exercise deficit disorder in this population. Exercise deficit disorder has been described as a condition in youth who engage in less than 60 minutes of physical activity per day.³⁹

Furthermore, with the rapid rise of esports, a market for energy drinks and supplements claiming to enhance focus, mental speed, and memory has started to increase.⁴⁰ As an example, GFuel (Gamma Labs) markets itself as the “official” drink of esports athletes.⁴¹ These drinks are not only laden with sugar but also contain unrestricted amounts of caffeine.⁴² Physicians should inquire about the nutrition habits of these patients.

Physicians must find a balance of educating esports athletes about the adverse effects of prolonged sitting and a sedentary lifestyle while understanding the demands of mastering their sport. Specifically, athletes need to recognize the signs and symptoms of deep vein thrombosis to prevent unnecessary complications. Physical activity can be addressed both for everyday movement and cardiovascular exercise. The Centers for Disease Control and Prevention suggests anywhere between 7000 to 10,000 daily steps and 150 minutes of moderate-intensity aerobic activity per week.⁴³ Activity trackers or phone applications can be effective tools to help patients attain these goals.

Circadian Rhythm

Computer monitors most commonly use light-emitting diodes, and although the light produced is perceived as white, it is actually in the blue spectrum (400–490 nm).⁴⁴ Blue light increases alertness and thought processing⁴⁴ but negatively affects sleep latency and duration, especially when encountered before bedtime.^{11,45} Blue light stimulates intrinsically photosensitive retinal

Table.
Esports Athletes' Health Concerns, Causes, and Physician Considerations

Health Concern	Cause	Intervention
Computer vision syndrome	• Decreased blink rate • Pixelated images • Increased saccades, accommodation, and convergence	• Gaming station organization • Limit glare • 20-20-20 rule
Neck and back dysfunction	• Forward head displacement • Stress of cervicothoracic junction and intervertebral discs • Back rest-induced flattened lumbar lordosis	• Stretching • Strengthening exercises for postural control • Osteopathic cranial manipulative medicine • HVLA (cervical) • Muscle energy • Soft-tissue mobilization (lumbar) • Mobilization for lumbar segment
Upper extremity dysfunction	• Forward head displacement • Quick repetitive movements • Hypertrophy of flexor tendons (wrist)	• Fascial distortion model (shoulder) • HVLA and LVHA (shoulder) • Balanced membranous tension (interosseous membrane) • LVHA (carpal bones) • Opponens pollicis roll maneuver • Myofascial (carpal tunnel)
Metabolic dysregulation	• Game play duration • Peripheral vascular stasis • Exercise deficit disorder • Energy drinks	• Dietary counseling • 10,000 steps/d • 150 min moderate-intensity exercise/wk
Circadian rhythm	• LED screens (blue light) • Timing of gameplay	• Pittsburg Sleep Quality Index • Sleep hygiene counseling • Blue light–blocking lenses
Mental health	• Internet gaming disorder • Anxiety • Depression • Alexithymia	• The Ten-Item Internet Gaming Disorder Test • Toronto Alexithymia Scale • Patient Health Questionnaire 2 and 9 • Clinically Useful Anxiety Outcome Scale (adults) • Screen for Child Anxiety Related Disorders

Abbreviations: HVLA, high velocity, low amplitude; LED, light-emitting diode; LVHA, low velocity, high amplitude

ganglion cells in the eye, which through the suprachiasmatic nucleus cause suppression of melatonin secretion from the pineal gland.⁴⁴ Specifically, the melatonin suppression peaks at 460 nm.⁴⁴ Altered sleep patterns and insomnia may result in fatigue, mood disorders, substance abuse, and weight gain.⁴⁵

Athletes should therefore be counseled on proper sleep hygiene, such as limiting blue light exposure before bedtime. Validated sleep questionnaires, such

as the Pittsburgh Sleep Quality Index,⁴⁶ can be used. Blue light–blocking lenses have been studied as a potential solution, with mixed results.^{47,48}

Mental Health

Internet gaming disorder (IGD) is estimated to affect approximately 5 million people in the United States.⁴⁹ According to the American Psychological Association,

IGD requires distress in 5 or more of the following criteria for at least 1 year: continued excessive use despite psychosocial problems, deception, escape, functional impairment, loss of interests, preoccupation tolerance, unsuccessful attempts to control, and withdrawal.⁵⁰ However, there is significant controversy regarding the validity and operational definition of this diagnosis in the psychological community.⁴⁹

Gender and game type are important factors in the mental health of esports athletes. Adolescent boys with IGD have been shown to have higher rates of anxiety, depression, and alexithymia. In adolescent girls with IGD, depression is manifested at higher rates compared with anxiety and alexithymia. Multiplayer online battle areas have been shown to regulate emotions, whereas massively multiplayer online role-playing games appear to be associated with disturbances in mood and behavior.⁵¹

A comparative study⁵² of professional and non-professional esports athletes with IGD revealed differences in brain structure and function. Han et al⁵² observed increased gray matter volumes in the anterior cingulate gyrus, which is responsible for regulating addictive behaviors, in professional esports athletes compared with people with IGD. Furthermore, people with IGD had increased gray matter volume in the thalamus, which is responsible for conditioned responses and is associated with the stimulus-reward pathway.⁵²

Esports athletes should be screened for gaming addiction and, if applicable, should be referred to mental health professionals for further assessment and treatment. Assessments can include the 10-Item Internet Gaming Disorder Test,⁵³ the 20-item Toronto Alexithymia Scale,⁵⁴ Patient Health Questionnaire 2 and 9 for depression,⁵⁵ the Clinically Useful Anxiety Outcome Scale for adults, and the Screen for Child Anxiety Related Disorders in children.⁵⁵

Conclusion

Applying the tenets of osteopathic medicine, physicians can provide comprehensive care to address the unique

concerns of the esports athlete (Table). Because of the sedentary nature of esports and the hundreds of APMs during gameplay, athletes are likely to have musculoskeletal injury, including dysfunctions of the cervical and lumbar spine and the upper extremity. Metabolic dysregulation characterized by dietary and exercise habits that are uncharacteristic of a traditional athlete may serve to exacerbate these issues. Furthermore, digital eye strain and circadian rhythm disturbances are relatively common because of light-emitting diode monitors, prolonged gameplay, and the demand for multiple object tracking. Finally, mental health disorders such as IGD, depression, anxiety, and alexithymia may be present at higher levels depending on gender and game type. Proactively exploring and addressing these concerns will promote health, prevent further injury, and likely improve performance.

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