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AFK!

Injury prevention and performance interventions for esports players

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ABSTRACT

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The world of esports has rapidly gained popularity in recent years, with an increasing number of players competing professionally. However, the sedentary nature of esports and constant repetitive movements have led to several health issues among players.

The objective of this thesis is to explore the common health issues experienced by esports players and identify effective methods for preventing gaming-related injuries while optimizing gaming performance.

Research shows that the most common musculoskeletal injuries of gamers appear in the hand, wrist, neck, and back. Other possible health problems include digital eye strain, insomnia or poor sleep quality, and venous thromboembolism.

To mitigate these issues, this thesis suggests incorporating various strengthening, stretching, and mobility exercises into the routine to positively impact the musculoskeletal system, leading to injury prevention, reduced pain, and improved performance. Taking active breaks during gaming sessions may enhance focus and decision-making and reduce strain caused by static posture. Moreover, implementing an ergonomic setup will help prevent musculoskeletal pain and injuries resulting from poor posture by keeping the body in a neutral sitting posture and providing adequate support to the neck, back, upper and lower limbs. Finally, adequate sleep hygiene will provide optimal recovery and improve cognition.

The proposed solutions are compiled in the form of a guidebook, with the goal of improving the health and well-being of esports players, enabling them to perform better and achieve greater success in their careers.

Keywords: esports, gaming, gamer, exercise, ergonomics, health promotion, physiotherapy, injury prevention, computer gaming, overuse injury

CONTENTS

LIST OF SYMBOLS AND TERMS

AFK – away from keyboard. A phrase used to let others know about being away from the computer.

Gaming – playing video games.

Gamer – a person playing video games.

FPS – first-person shooter, a game that involves shooting from a first-person perspective.

MMORPG - massively multiplayer online role-playing game.

MOBA – multiplayer online battle arena

PvE - a game, in which a player competes against the computer.

PvP - a game, in which a player competes against other players.

ROM - range of motion.

MET - metabolic equivalent task. The ratio of the work metabolic rate to the resting metabolic rate. 1 MET = 1 kcal/kg/hour. (Kisner et al., 2022, p. 249)

1 INTRODUCTION

Gaming has become a widely popular hobby over the years, and it has evolved to become a competitive field as well. The increasing popularity of competitive gaming has led to the creation of a new sport known as esports. (Hamari & Sjöblom, 2017)

The field of esports has garnered much attention in recent years, with ongoing debates about whether it should be classified as a sport. However, it is widely accepted that esports players possess a unique set of skills that require training and practice, much like traditional athletes. As with any sport, injuries and health problems can occur, which can have a significant impact on an esports player's career. (Kane & Spradley, 2017)

The importance of providing proper care for e-sports players cannot be overstated. Unfortunately, due to a lack of knowledge, resources, and interest, many esports players are not receiving the care they need. (Franks et al., 2022)

Esports is a predominantly sedentary activity, which brings many health risks. Adequate physical activity, optimal ergonomics, and sleep hygiene are effective methods of injury prevention and improved quality of life. (Wattanapisit et al., 2020)

Focusing on injury prevention and promoting the overall well-being of players is crucial not only for the health benefits but also for optimal performance (De Las Heras et al., 2020). This thesis underscores the need for esports players to prioritize their health and well-being in order to achieve long-term success both on and off the virtual battlefield.

2 AIMS AND OBJECTIVES

This thesis aims to provide an in-depth understanding of ergonomics, physical exercise, and sleeping habits for esports players, focusing primarily on PC gamers. The ultimate goal is to prevent physical and mental strain that can result from prolonged gaming sessions. The thesis will explore the impact of physical activity on esports players, analyze the physiological effects of gaming, and investigate common health problems and injuries associated with gaming.

Drawing upon relevant theoretical frameworks, the objective is to develop a comprehensive guidebook that provides guidance on exercise, ergonomics, and healthy habits tailored to the unique needs of esports players. The guidebook will further incorporate a list of recommended exercises, complete with accompanying visuals and descriptions.

3 ESPORTS

Hamari & Sjöblom (2017) define esports as “a form of sports where the primary aspects of the sport are facilitated by electronic systems; the input of players and teams as well as the output of the eSports system are mediated by human-computer interfaces.”

Esports is a phenomenon that has gained enormous popularity in recent years. The history of esports reaches back to arcade games in the 1980s and over the four decades it has evolved into a multi-million-dollar business with millions of followers. The worldwide revenue in the esports industry is projected to be 1.63 billion USD in 2023 (ESports - Worldwide | Statista Market Forecast, n.d.). Esports has also gained popularity among spectators, who watch tournaments through various streaming platforms or in specially designed arenas for live viewing. The global audience reached 532 million in 2022 and is projected to grow to 640.8 million by 2025 (Global ESports Audience

2020 | Statista, n.d.). Due to its increasing popularity, competitive gaming has experienced a drastic rise in interest. This has led to the emergence of new esports teams worldwide, competing against each other. As the sport has become highly professional and profitable, it has also found its way into the realm of traditional sports. For example, sports programs and scholarships are now being offered by collegiate varsity teams in the US (Difrancisco-Donoghue et al., 2019). The world of esports has also attracted professional sports teams, such as French PSG, German FC Schalke 04, and Turkish Besiktas Istanbul. In fact, there is even a virtual version of the national football league Bundesliga in Germany. (Scholz et al., 2021) The International Olympic Committee has also jumped on board, launching The Olympic Esports Series in 2023, a global competition, with the first ever Olympic Esports week taking place in Singapore (Olympic Esports | Series and Week 2023, Stories, Performance & Wellbeing, n.d.).

The topic of whether competitive gaming should be labelled as a sport has been widely discussed. Several common characteristics define a sport, including being a competitive individual or team activity, being organized, requiring physical effort and skill, and having specific rules. (Cambridge Dictionary, n.d.; Britannica Dictionary, n.d.) Esports can be played individually or in teams. There are amateur and professional teams worldwide that participate in various competitions with a large audience and sponsorship. The competition is highly organized, and players achieve ranks according to their success. Just as any traditional athlete, esports players train regularly and prepare for competitions. (Jenny et al., 2016) Achieving success in high-level computer gaming requires continuous training in both cognitive and motor skills, as these play significant roles in defeating opponents. While different game genres demand distinct abilities, specific fundamental skills are crucial for excelling in esports. These cognitive and motor skills include good hand-eye coordination, hand dexterity, spatial perception, working memory, and cognitive speed and accuracy. (Difrancisco-Donoghue et al., 2021; Nagorsky & Wiemeyer, 2020; Toth et al., 2021) The primary argument against considering esports as a "real" sport is the physical aspect. Although gaming is often viewed as a very sedentary activity, various studies have shown this is not the case. (Carrani et al., 2022)

4 ESPORTS AND PHYSICAL ACTIVITY

Multiple studies have been conducted on the physical activity levels of esports players, but the findings are inconsistent. It is widely believed that gamers are sedentary, resulting in low physical activity and a higher risk of obesity due to increased BMI. For example, according to Trotter et al.'s (2020) survey, over 80% of players still need to meet the WHO recommendations. Similarly, Puolitaival et al. (2020) surveyed Finnish adolescent gamers, indicating lower levels of physical activity and higher BMI among gamers than recommended. Additionally, DiFrancisco-Donoghue et al. (2022) compared collegiate esports players with a control group of similar age. They reported esports players being less active and having a higher fat percentage than the control group, with Goulart et al. (2023) reaching similar results. Rudolf et al. (2020) examined German esports players and reported that about one-third lacked physical activity, and only half had BMI within healthy limits. However, multiple studies demonstrated that esports players are physically active; some even exceeded the WHO recommendations. (Harding & Noorbhai, 2021; Kari et al., 2018; Kari & Karhulahti, 2022; Paramitha et al., 2021; A. M. Pereira et al., 2021) A study by Roncone et al. (2020), shows that up to 80% of varsity esports players exercise for five or more days a week, with 50% exercising seven times a week, while Kari & Karhulahti (2022) reported that elite esports players engaged in physical activity three times the WHO recommendation. Similarly, a study conducted by Giakoni-Ramírez et al. (2022) revealed that over 90% of esports players practiced moderate to high physical activity levels.

According to Kari et al. (2018), the primary motivation for exercising is to enhance or maintain physical health, followed by improving one's physical appearance. Furthermore, more than half of the participants believed exercise positively impacts gaming performance. This finding is consistent with Nagorsky & Wiemeyer's (2020) research, which showed that over 50% of players believe a positive relationship exists between exercising and gaming performance. Elite players have been reported to exert significantly more than amateur or semi-professional esports athletes (Kari & Karhulahti, 2022; Trotter et al., 2020). Kari & Karhulahti (2022) have observed that professional

athletes have a greater understanding and appreciation of the positive impacts of physical exercise on health. This is likely due to the increased access to the coaching staff and available resources. Individual approaches to physical activity are common among players, with most choosing to exercise independently and only a small number receiving guidance from their team and coaches.

4.1 Benefits of physical activity

The benefits of physical exercise are beyond doubt. Consistent physical activity lowers the risk of chronic disease and premature mortality. It also positively impacts the cardiovascular system, reducing the risk of hypertension, heart attack, and dyslipidemia. Regular exercise decreases the likelihood of obesity, some cancers, stroke, and type 2 diabetes. It also enhances bone density, thus reducing the risk of osteoporosis. Musculoskeletal fitness improves well-being by promoting bone health, body composition, and glucose homeostasis. (Warburton & Bredin, 2016) Besides the physiological advantages, physical activity positively affects mental health. It enhances overall mood and may prevent depression or anxiety or alleviate symptoms. (Schuch & Vancampfort, 2021)

The recommended amount of physical activity for adults, according to the World Health Organization (WHO), is at least 150-300 minutes of moderate-intensity physical activity or 70-150 minutes of vigorous physical exercise per week, including both aerobic and anaerobic training (WHO Guidelines on Physical Activity and Sedentary Behaviour, n.d.).

4.2 Sedentary behavior of esports payers

Sedentary behavior is defined as “any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents (METs), while in a sitting, reclining or lying

posture.” (Tremblay et al., 2017) Excessive sedentary behavior is associated with numerous adverse health effects, such as cardiovascular diseases, obesity, musculoskeletal problems, cancer, and an overall higher mortality risk (Friedenreich et al., 2021; Lavie et al., 2019; Silveira et al., 2022). In addition, sedentary behavior may have a negative impact on mental health, increasing the risk of depression and anxiety (Hallgren et al., 2020; Wang et al., 2019).

Even though most esports players are reportedly physically active, it does not change the fact that esports is a predominantly sedentary activity. Therefore, some esports players can be called “active couch potatoes”. This term describes people, who are sedentary for a large portion of the day, but exercise daily. (Lepp et al., 2023) Kari et al. (2018) reported that elite esports players spend, on average, 5.28 hours per day (approximately 37 hours per week) training. This is a slightly higher figure than the 4 hours/day revealed by Pluss et al. (2020). Respondents in Andre et al.'s (2020) study practice on average 19 hours per week, with one reaching up to 50 hours a week. Forman & Holmes (2023) reported that professional computer gamers spend on average 33.1 hours/week training, while competitive gamers train for 31.5 hours/week. Meanwhile, Difrancisco-Donoghue et al.'s (2019) study revealed that collegiate esports players practice up to 10 hours daily.

4.3 Physical activity and its effect on performance

Not much research has been conducted on the influence of physical activity on gaming performance, but a few studies have delved into this subject. De Las Heras et al. (2020) investigated the impact of high-intensity interval training (HIIT) on League of Legends players. The study discovered that 15-minute HIIT sessions carried out 20 minutes before the game session improved the players’ performance, with accuracy increasing by 75%, improved target elimination by 9%, and improved overall by 17%. In a study of Norwegian esports students by Baumann et al. (2022), the participants considered physical exercise as beneficial due to its positive effect on mental health and self-confidence, with Kari et al. (2018) reaching similar results. According to a study by

Stamatis et al. (2019), which involved 23 recreational esports players, physical exercise has a positive correlation with esports performance. The study also suggested that higher exercise frequency may lead to better gaming results. Trotter et al. (2020) reported that the highest-ranked players were significantly more involved in physical activity as compared to the low-ranked players. Further studies by Stamatis et al. (2019) and Roncone et al. (2020) have reported that physical exercise is associated with improved mental toughness, which has a positive impact on esports players' performance. While research in esports settings is limited, studies suggest that physical activity may benefit performance (Ketelhut et al., 2021; McNulty et al., 2023; Toth et al., 2020).

5 THE PHYSIOLOGICAL IMPACT OF GAMING

As a relatively new sport, esports has yet to become a subject of studies focusing on the health and physiological impact of the sport and injury prevention. There is a need for research to evaluate the biomechanics, injury risks, and overall health effects of gaming on the players, in order to provide optimal health care and guidelines for gamers. (Franks et al., 2022)

5.1.1 Energy expenditure

Research on energy expenditure during gaming is limited. However, some studies have shown that gaming may be more active than previously thought despite being a seated activity. Even though computer gaming may not involve the same level of physical activity as other forms of exercise, studies have shown that gamers tend to spend more energy during gameplay than at rest. However, more research is needed to understand this topic better. (Chaput et al., 2011; Kocak, 2022; Mellecker & McManus, 2008)

Kocak (2022) conducted a study involving 11 amateur esports players, which showed a 40% increase in energy expenditure while playing a MOBA game compared to sitting only. This is in line with a study by Chaput et al. (2011). Even though Mellecker & McManus (2008) targeted different demographics and measured energy expenditure in gaming children, they reached similar results.

5.1.2 Cardiovascular system

There is strong evidence that heart rate increases during a competitive gaming session. In a study by Andre et al. (2020), collegiate esports players were reported to have an increase in mean HR from 97.1 ± 19.9 beats per minute (bpm) pre-competition to 131.4 ± 19.0 bpm during gameplay. Valladão et al. (2020) reached similar results, comparing mean resting HR to mean HR during a Fortnite match. The HR went up from 76 ± 10 bpm at rest to 120 ± 16 bpm during the game. In a comparison of FPS (Overwatch) and MOBA (League of Legends) games, Sousa et al. (2020) found that the increase in HR was higher in FPS players compared to MOBA players. When it comes to PvE and PvP games, Watanabe et al. (2021) discovered that compared to the baseline of 79.240 ± 2.646 bpm, the HR increased to 85.569 ± 2.517 in PvE and 97.828 ± 3.568 in PvP, showing that playing against a human triggers a more stressful response. Additionally, Koshy et al. (2020) reported that in competition, the HR of the winning team increases more than the HR of the losing team.

Some studies have explored the effects of gaming on blood pressure (BP), with varying findings. In a comparison of first-person shooter (FPS) and multiplayer online battle arena (MOBA) games, Sousa et al. (2020) found that systolic BP increased during FPS play. At the same time, it decreased slightly during MOBA gameplay. Chaput et al. (2011) studied healthy male adolescents and observed a significant increase in systolic and diastolic BP during video game play. This is consistent with Dowdell's (2020) research on cardiovascular stress responses during Fortnite gaming sessions. Siervo et al. (2013) compared the effects of violent and non-violent video games and found that non-violent games did not significantly increase BP, whereas violent games did.

5.1.3 Digital eye strain

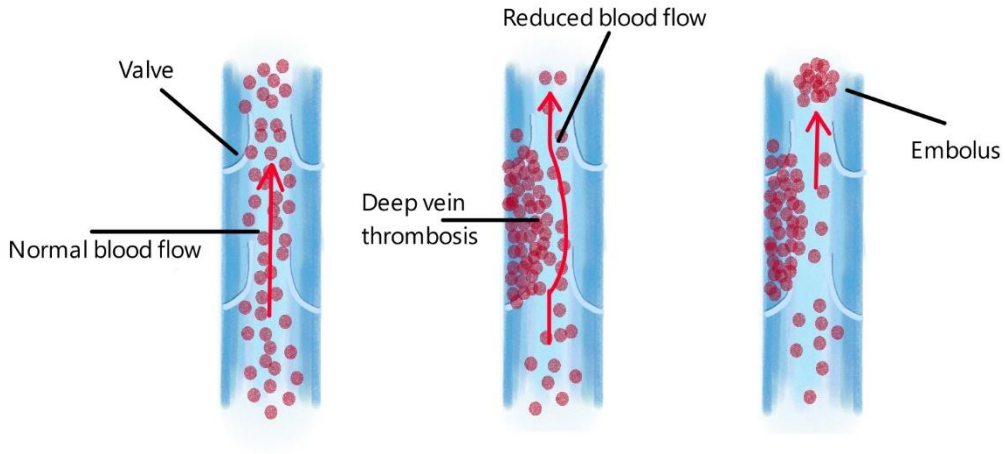
Digital eye strain, also known as computer vision syndrome, is a condition caused by prolonged viewing of digital screens of computers, laptops, smartphones, tablets, television, and similar devices. It is characterized by eye strain, headaches, blurred or double vision, dry or irritated eyes, fatigue, or neck and back pain. (Coles-Brennan et al., 2021) Computer use may reduce the blinking rate or change the gaze angle, and computer users may be disturbed by glare and blue light exposure (Rosenfield, 2016). Some studies claim that peak light damage to the eye occurs at approximately 440nm wavelength. Because the blue light wavelength is between 400 and 500nm, excessive exposure to blue light may potentially harm the eye. However, further research is needed to understand this topic better. (Sheppard & Wolffsohn, 2018) In addition, blue light negatively affects the circadian rhythm; flashing lights may overstimulate the autonomic system, and a sudden increase in BP may damage the eyes (Shen & Cicchella, 2023).

According to research by Difrancisco-Donoghue et al. (2019), eye fatigue was the most common health problem among esports players, with over half (56%) of them experiencing eye fatigue. Similarly, in a study by Gümüġdağ et al. (2021), 45% of those surveyed experienced eye fatigue, while results of Ekefjärd et al.'s (2023) research showed that 32.5% of professional esports players suffered from eye-related issues. Respondents in Monteiro Pereira et al.'s (2023) study cited vision problems as one of the main health issues associated with computer equipment. The players complained about dry eyes, vision problems, or headaches, which negatively impacted their gaming performance.

5.1.4 Venous thromboembolism

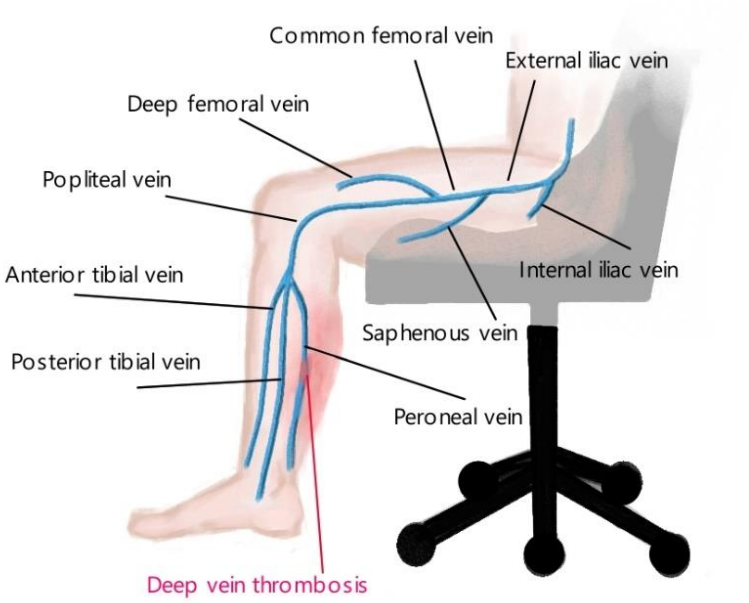
Venous thromboembolism (VTE) is a term for deep vein thrombosis (DVT) and pulmonary embolism (PE). It is a chronic disease that may result in long-term disability or

death. DVT is caused by a blood clot in a deep vein, most commonly a leg. However, this clot may travel to the lungs, causing PE (Picture 1). The most common symptoms of DVT include leg pain, swelling, redness, tenderness, or prominent veins, while PE is associated with breathlessness, tachycardia, chest pain, or hypoxemia. Environmental risk factors include obesity, hypertension, diabetes, and sedentary behavior. (Khan et al., 2021)



Picture 1. Left: healthy vein, middle: deep vein thrombosis, right: embolus traveling up the bloodstream (Pirklova, 2023).

Sedentary behavior as a risk factor puts computer users, including esports players, at risk. Prolonged, uninterrupted sitting may lead to hypercoagulation, increased hemoglobin concentration, and endothelial dysfunction in the legs, eventually leading to VTE (Picture 2). The excessive use of computers and higher numbers of VTE among younger populations have even led to the term “e-thrombosis” or “gamer’s thrombosis,” and several cases of VTE in gamers have been reported. In the case of VTE, immediate medical action is required. (Lippi et al., 2018; Migliore et al., 2021)



Picture 2. A sedentary lifestyle may lead to venous thromboembolism. DVT is pictured in the peroneal vein. (Pirklova, 2023)

5.1.5 Sleep problems

It is recommended by The National Sleep Foundation that school-age children should sleep for 9-12 hours, teenagers for 8-10 hours, and adults for 7 hours or more. (Hirshkowitz et al., 2015) When sleep is of insufficient quality or duration, it can have adverse effects on human health. Inadequate sleep duration has been linked to increased risks of morbidity and mortality, obesity, diabetes, cardiovascular disease, inflammation, mental health problems, and cognitive functioning. Cognitive impairments can involve issues with working memory, processing speed, executive function, or attention (Grandner, 2017). Furthermore, a lack of sleep can heighten the likelihood of injury, lower the pain threshold, and make one more susceptible to illnesses (Simpson et al., 2017).

It has been discovered through various studies that esports players often experience sleep issues. According to S. Lee et al. (2021), most professional esports players reported disturbed sleep, delayed bedtime, and an average of 6 hours and 48 minutes of sleep each night. Some players even exhibited signs of depression. Sanz-Milone et al. (2021) also found that CS: GO players had poor sleep quality, excessive daytime

sleepiness, lower sleep efficiency, and later bedtimes. A study on Norwegian esports students produced similar results, with an average of 6.8 hours of sleep on weekdays and players reporting that lack of sleep negatively impacted their performance. Late playing and delayed bedtimes were found to reduce sleep quality and make falling asleep more difficult. (Baumann et al., 2022) Similarly, the average sleep duration of esports players in Vatn's (2021) study was 07:12h with a late onset of sleep. Moen et al. (2022) also reported sleep issues, including late onset and offset sleep, decreased sleep efficiency, poor sleep quality, and trouble falling asleep.

It is a common issue among gamers to struggle to get sufficient sleep, which can be attributed to the blue light emanating from their screens. The blue light can disrupt the natural production of melatonin, which usually occurs at night. Exposure to artificial blue light at night can cause the body's internal clock to become misaligned with external light conditions, resulting in poor sleep quality. Additionally, extended periods spent in front of screens can lead to reduced sleep duration, longer time to fall asleep, and decreased rapid eye movement sleep. (Wahl et al., 2019) Furthermore, high stress levels, late gaming and training sessions, excessive caffeine consumption, and poor sleep hygiene are all factors that contribute to sleep disturbances in the esports community (Bonnar et al., 2019).

6 THE EFFECTS OF GAMING ON THE MUSCULOSKELETAL SYSTEM

Musculoskeletal disorders (MSD) are one of the leading causes of disability worldwide, causing work or school absences and reduced quality of life. According to WHO, up to 1.7 billion people live with musculoskeletal problems, with low back pain being the main contributor. (World Health Organization, 2022)

In a Danish study, 42.6% of competitive players claimed to be suffering from MSD (Lindberg et al., 2020). Difrancisco-Donoghue et al. (2019) reached similar results; 42% of gamers complained about neck and back pain, followed by wrist pain (36%) and hand pain (32%). In a recent study, 100% of female Saudi Arabian esports players and 84% of male players reported some degree of MSD (Fathuldeen et al., 2023). Additionally, Clements et al.'s (2022) study revealed that 26.8% of college varsity players experienced at least one musculoskeletal injury, out of which 7.1% required surgery and 17.1% missed a competition.

Neck, shoulder, hand, wrist, and back pain have been reported as the most common complaints among gamers. The main reasons behind MSD in gaming are poor ergonomics, repetitive movements, prolonged sitting, mood and sleep disturbances, and lack of physical activity. (Geer et al., 2023) Research has shown that excessive training and long gaming can significantly increase the chances of an esports-related injury. As a result of musculoskeletal pain, players tend to decrease their training volume, dramatically affecting their performance and even their careers. This highlights the importance of preventing musculoskeletal disorders in esports athletes. (Clements et al., 2022; Lindberg et al., 2020)

A few examples: An aspiring esports player, Julia Bright, tore a ligament and displaced a tendon in her hand. As a result, she needed to reduce her gaming time and end her career before it started. (WIRED UK, n.d.) In 2021, Thomas “ZooMaa” Paparatto, a professional Call of Duty player, retired due to his ongoing thumb injury (BBC News, n.d.). Similarly, Hai Lam, a League of Legends professional, retired in 2015 as a result of a wrist injury (The Independent, n.d.).

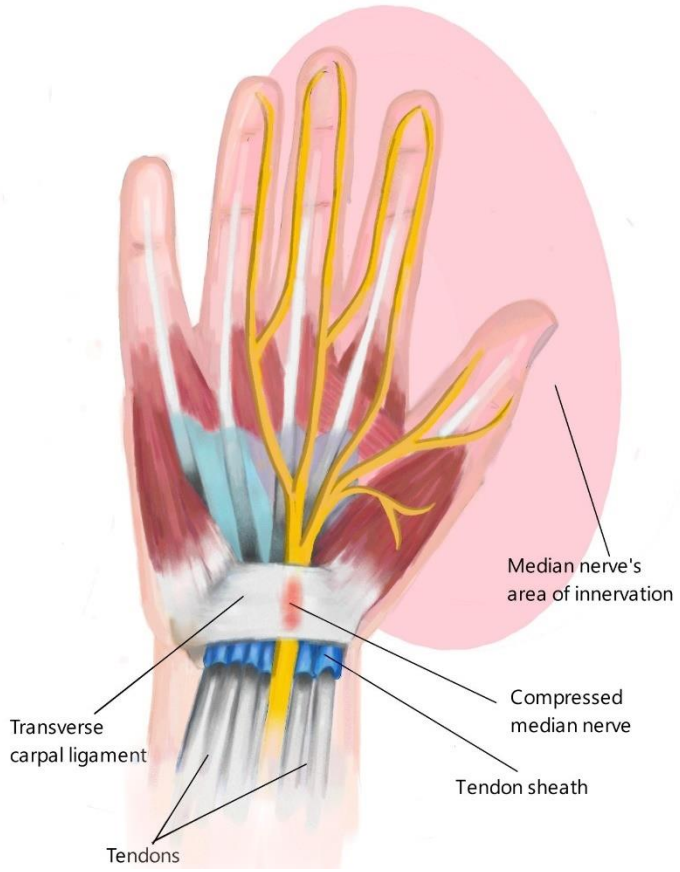
6.1 Hand and wrist

Maintaining hand and wrist health is crucial for gamers due to the potential for injuries caused by consistent keyboard and mouse use, which could negatively impact a gamer's career. A study by Forman & Holmes (2023) reported that up to 37.9% of esports

players suffer from hand or wrist injuries, while Fathuldeen et al. (2023) found that 44.8% of competitive players complained about wrist or hand pain. Sustained wrist extension, ulnar or radial deviation, wrist contractions, or repetitive finger movements, combined with unnatural twisting, bending, forceful contractions, and a high number of actions per minute, are factors that may lead to pain and overloading of the wrist and hand (McGee & Ho, 2021). These injuries usually develop over time and are a result of microtrauma. Consequently, players may not seek medical help immediately, resulting in a chronic injury, which may affect their career (Migliore et al., 2021).

6.1.1 Carpal tunnel syndrome

The carpal tunnel is an osteofibrous compartment between carpal bones and the flexor retinaculum. Within the carpal tunnel are nine tendons and the median nerve. This nerve further divides into sensory branches that provide sensation to the palm side of the first three fingers and the radial side of the fourth finger, alongside the thenar eminence (Picture 3). Though there is always some level of pressure present in this region, if the space within the tunnel reduces, the pressure may escalate and cause compression of the median nerve, ultimately leading to carpal tunnel syndrome (CTS). Common symptoms of CTS are tingling, numbness, pain, or paresthesia in the area innervated by the median nerve. (Aboonq, 2015; Migliore et al., 2021)



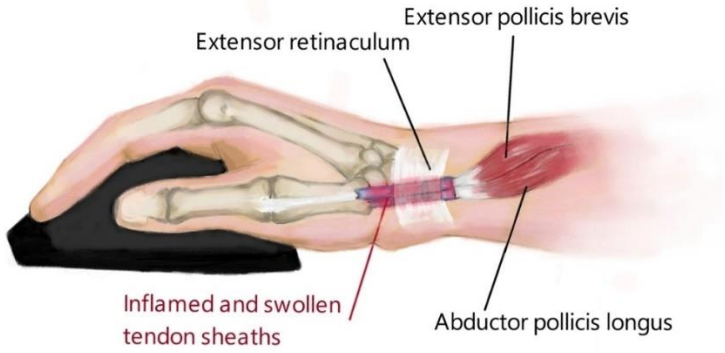
Picture 3. Median nerve passing through the carpal tunnel (Pirklova, 2023).

There has been an ongoing debate regarding whether computer work contributes to the development of CTS, with conflicting findings. While some studies suggest no significant negative relationship between computer work and CTS (Bhanderi et al., 2017; Wright & Atkinson, 2019), other research suggests otherwise. Although the work of an esports player may be similar to that of an office worker, it is not the same. Professional esports players perform up to three times as many actions as office workers, placing a more significant strain on their wrists (McGee & Ho, 2021). Moreover, studies have shown that the forcefulness of repetitive motions is a risk factor in gaming and an essential element in developing CTS (Aboonq, 2015; Migliore et al., 2021; Zwibel et al., 2019). Ivanova (2020) conducted a study on the occurrence of CTS in the esports community and found that there may be a greater likelihood of gamers experiencing symptoms of CTS. However, more research is needed to understand this topic thoroughly.

For cases of Carpal Tunnel Syndrome (CTS), the recommended treatment varies depending on the severity of the condition. While mild cases may benefit from conservative treatment, surgery may be necessary for more severe cases. Conservative treatment options may include rest, taking nonsteroidal anti-inflammatory drugs (NSAIDs), receiving corticosteroid injections, doing therapeutic exercises, receiving manual therapy, and using splints or modalities. It is important to avoid repetitive movements and keep the wrist in a neutral position to minimize nerve compression. In addition, wearing a wrist orthosis at night may also be beneficial. (Kisner et al., 2022, pp. 407-408) Therapeutic exercise includes various neurodynamic techniques, which are considered an effective form of therapy in CTS (Lim et al., 2017; Wolny & Linek, 2018), tendon mobilization, joint mobilization, and muscle strengthening exercises to reduce pressure inside the carpal tunnel, relieve pain and regain ROM in the wrist (Kisner et al., 2022, pp. 407-408).

6.1.2 De Quervain’s tenosynovitis (Gamer’s thumb)

De Quervain’s tenosynovitis is the thickening or swelling of the tendon sheath in the first compartment of the wrist. The tendons affected are those at the distal end of the abductor pollicis longus and extensor pollicis brevis muscles (Picture 4). This condition presents itself as pain in the lateral wrist around the thumb, and the pain appears in grasping, thumb extension, or palpation at the affected area. In addition, swelling and tenderness may occur in the affected area. De Quervain’s tenosynovitis is associated with chronic repetitive use and overloading of the wrist. (Frontera et al., 2018, pp. 149-152; Migliore et al., 2021, pp. 29-33)



Picture 4. De Quervain’s tenosynovitis (Pirklova, 2023).

Excessive use of smartphones, but also video game controllers or mouse and keyboard led to alternative names for De Quervain’s tenosynovitis, such as “gamer’s thumb,” “texting thumb,” or “Nintendo thumb” (Migliore et al., 2021, p. 29) Awais et al. (2020) and Arshad et al. (2023) performed a Finkelstein’s test on a group of computer operators and young adult esports players, respectively. Both studies showed similar results; while Awais et al. (2020) reported 67.3% of subjects testing positive, Arshad et al.'s (2023) result was 64.5%. This led to the conclusion that the prevalence of De Quervain’s tenosynovitis in esports players is high.

Treatment for De Quervain’s tenosynovitis varies depending on the severity of the condition. In severe cases, surgery may be necessary, while milder cases can be treated with non-surgical methods. Pain can be alleviated with rest and NSAIDs, while corticosteroid injections can effectively reduce swelling and irritation of the affected tendons. Therapeutic exercises, such as tendon gliding and strengthening exercises, can help restore the hand's range of motion and functionality. (Kisner et al., 2022, pp. 685-686) Therapeutic ultrasound, splinting, manual therapy, or Kinesio taping may be used as an accessory treatment (Fakoya et al., 2023; Frontera et al., 2018, pp. 149-152).

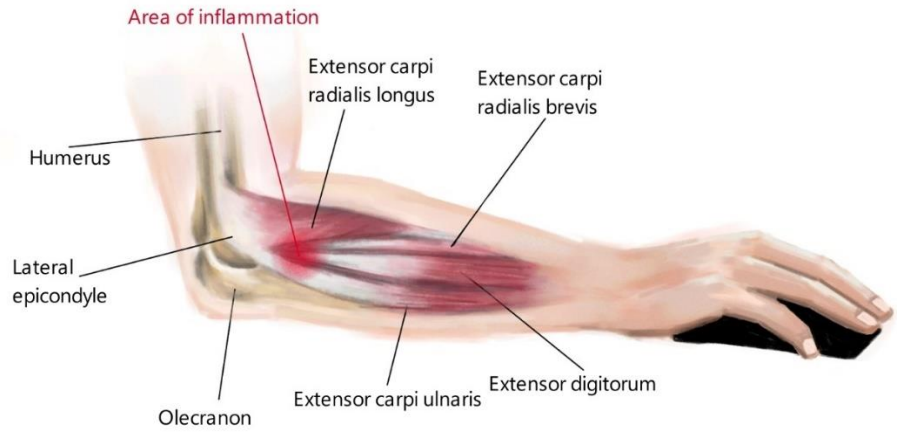
6.2 Elbow and shoulder

Elbow pain, strains, and injuries are not uncommon in gaming due to the anatomy of the arm. Several flexors and extensors of the hand and wrist originate in the elbow region (lateral and medial epicondyles of the humerus), while median, ulnar, and radial nerves pass through the whole arm, with the elbow being the possible area of nerve compression. (Tortora & Derrickson, 2021, pp. 391, 473) While not as common as wrist or neck pain, elbow and shoulder pain has been reported as frequent injuries in the gaming community (Clements et al., 2022; Lindberg et al., 2020).

6.2.1 Lateral epicondylitis (Tennis elbow)

The lateral epicondyle is a bony structure on the lateral side of the distal humerus. The epicondyle serves as the origin of the supinator muscle, alongside with extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris. These muscles are responsible for the extension of the wrist and fingers, as well as the adduction, and abduction of the wrist. (Tortora & Derrickson, 2021, p. 391)

Even though the term “epicondylitis” suggests an inflammation, lateral epicondylitis (LE) results from chronic tendinosis, primarily affecting extensor carpi radialis brevis, as seen in Picture 5. The most common symptom is pain in the lateral elbow, which can potentially radiate outward. The pain is usually exacerbated by wrist movements or gripping an object. Prolonged and repetitive movements are the primary factor behind lateral epicondylitis, indicating that working on a computer heightens the possibility of experiencing this condition. (Frontera et al., 2018, pp. 124-127; Graveling, 2019; Migliore et al., 2021, pp. 61-64)



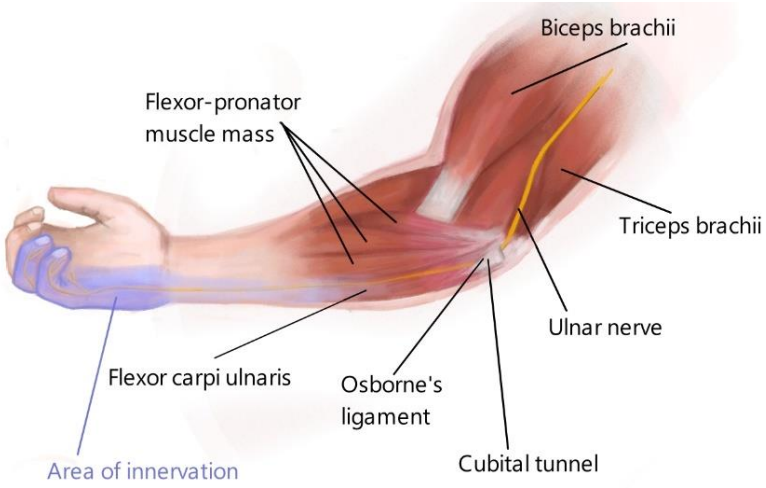
Picture 5. Lateral epicondylitis (Pirklova, 2023).

Rest and avoidance of repetitive movement are essential in terms of pain relief. This may lead to a modification of daily routines and jobs. Additionally, NSAIDs may be used. Even though corticosteroid injections may provide pain relief, they might cause adverse effects such as tendon rupture or delay in the healing process. Physiotherapy is an effective initial treatment for LE. Evidence shows that a combination of eccentric muscle strengthening, soft tissue, and joint mobilization through therapeutic exercise is beneficial. However, the benefits of orthoses, modalities, or stretching in LE treatment are unclear due to conflicting evidence. If conservative treatment fails, surgical treatment is an option.(Landesa-Piñeiro & Leirós-Rodríguez, 2022; Lenoir et al., 2019; Ma & Wang, 2020)

6.2.2 Cubital tunnel syndrome (Ulnar neuropathy)

Cubital tunnel syndrome refers to the compression and traction of the ulnar nerve, which is the second most common compressive neuropathy after carpal tunnel syndrome. Although nerve entrapment may occur in any part of the arm, the elbow is the most commonly affected area. The cubital tunnel comprises ligament, muscle, and bone tissue, with Osborne's ligament forming the tunnel roof and the medial collateral ligament, olecranon, and elbow joint capsule forming the bottom part. Nerve compression can happen in different elbow parts, but the most common area is below

Osborne's ligament (Picture 6). The usual symptoms include a tingling or numb feeling in the little finger and the ulnar part of the ring finger, which may be exacerbated by elbow flexion. If left untreated, cubital tunnel syndrome can lead to weakness, clumsiness in the hand, and muscle atrophy. Pain may also be felt on the medial side of the elbow. (Andrews et al., 2018; Stincel et al., 2023)



Picture 6. Cubital tunnel syndrome (Pirklova, 2023).

When the elbow is flexed, the volume of the cubital tunnel decreases. Cubital tunnel syndrome is caused by prolonged elbow flexion, leaning on the elbow, or repetitive flexion and extension movements of the elbow. (Boone et al., 2015; Staples & Calfee, 2017) Research has shown that computer users, including esports players, are at a high risk of developing this condition, especially those with poor ergonomics (Kuijer et al., 2020; Migliore et al., 2021, pp. 54-56).

Modifying activity by avoiding prolonged elbow flexion, repetitive elbow movements, and pressure on the affected area is recommended if symptoms occur. Additionally, using splinting may help prevent overloading the elbow. Most patients with mild cubital tunnel symptoms benefit from conservative treatment, but severe cases may require surgery. Physiotherapy treatment reduces pain, increases muscle strength, and improves nerve conduction. Therapeutic exercises may include strengthening pronator and flexor muscles, range of motion (ROM) exercises, and joint stabilization. (Frontera

et al., 2018, pp. 146-148; Kooner et al., 2019) There is conflicting evidence on the use of modalities (Kooner et al., 2019).

6.3 Neck, back, and lower extremities

Sedentary behavior and inadequate posture, often resulting from poor ergonomics, may lead to muscle weakness and imbalance, which may cause neck and back pain. As a result, neck and back pain is one of the most common complaints of esports players. (Gugliotti, 2018) Clements et al.'s (2022) study revealed that 14.7% of varsity esports players suffered from a neck injury, while 13.3% experienced a back injury. A study of Danish esports players reported that 31.3% of players had back pain and 11.3% had neck pain (Lindberg et al., 2020), while 34% of respondents in DiFrancisco-Donoghue & Balentine's (2018) study complained about neck and back pain. Forman & Holmes's (2023) study revealed that up to 43.9% of respondents suffered from neck pain and 41.4% reported back pain. Fathuldeen et al. (2023) reported an even higher number; 50% of competitive gamers experienced neck pain and 63.8% had lower back pain. Injuries in lower extremities are less common and they are usually a result of prolonged sitting rather than overuse (Migliore et al., 2021, p. 119).

6.3.1 Forward head posture (“Gamer’s neck,” “Nintendo neck,” “Texting neck”)

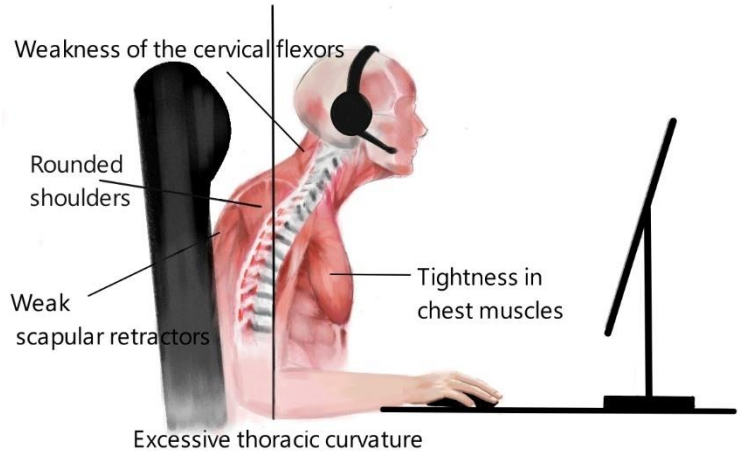
Forward head posture (FHP) is a postural malalignment characterized by excessive occipital and upper cervical spine extension and excessive upper thoracic and lower cervical flexion. It is typically accompanied by excessive thoracic kyphosis and rounded shoulders. This malalignment results in the shortening of cervical extensors and the lengthening and weakness of cervical flexors. This imbalance causes increased load on the facet joints, muscles, and ligaments. FHP is associated with pain and tension in the neck, back, and shoulders, headaches, temporomandibular pain, poor sleep, or other musculoskeletal problems. (Koseki et al., 2019; Kwon et al., 2015; Migliore et al., 2021, pp. 85-89) Furthermore, FHP has been linked with decreased respiratory capacity and proprioceptive dysfunction (Koseki et al., 2019).

One of the primary causes of FHP is poor ergonomics and weak muscles. Prolonged computer work and the absence of armrests may increase the likelihood of experiencing neck and back pain. A slouched posture and 45-degree neck flexion, which are commonly observed in computer users, are significant factors that contribute to such discomfort. Studies have shown that forward head posture is prevalent among IT professionals, computer users, and gamers alike. (H. S. Lee et al., 2015; Migliore et al., 2021, pp. 85-89; Stincel et al., 2023)

Ergonomic adjustments to one's workstation have been shown to reduce symptoms of FHP and maintain proper posture effectively. Additionally, using a suitable pillow during sleep can ensure optimal spine curvature. Therapeutic exercise has also been identified as an effective treatment for FHP, with recommended exercises including cervical and scapular retractions, isometric neck exercises, and cervical flexor strengthening. Kinesio taping has also been a helpful supplementary treatment to therapeutic exercise. Implementing these practices can significantly improve one's posture and alleviate symptoms associated with FHP (Harman et al., 2013; Shih et al., 2017).

6.3.2 Excessive thoracic kyphosis (Hyperkyphosis)

Thoracic kyphosis is a natural forward curvature of the spine in the upper back, between the T2 and T12 vertebrae. Excessive kyphosis, or hyperkyphosis, is a condition where the curvature exceeds the natural angle (Picture 7). Vertebral fractures, degenerative disc disease, and various other pathologies may cause nonpostural hyperkyphosis. However, postural hyperkyphosis, as the name suggests, results from poor posture caused by tight chest muscles and weak thoracic extensor and scapular retractors.



Picture 7. Thoracic hyperkyphosis with forward head posture (Pirklova, 2023).

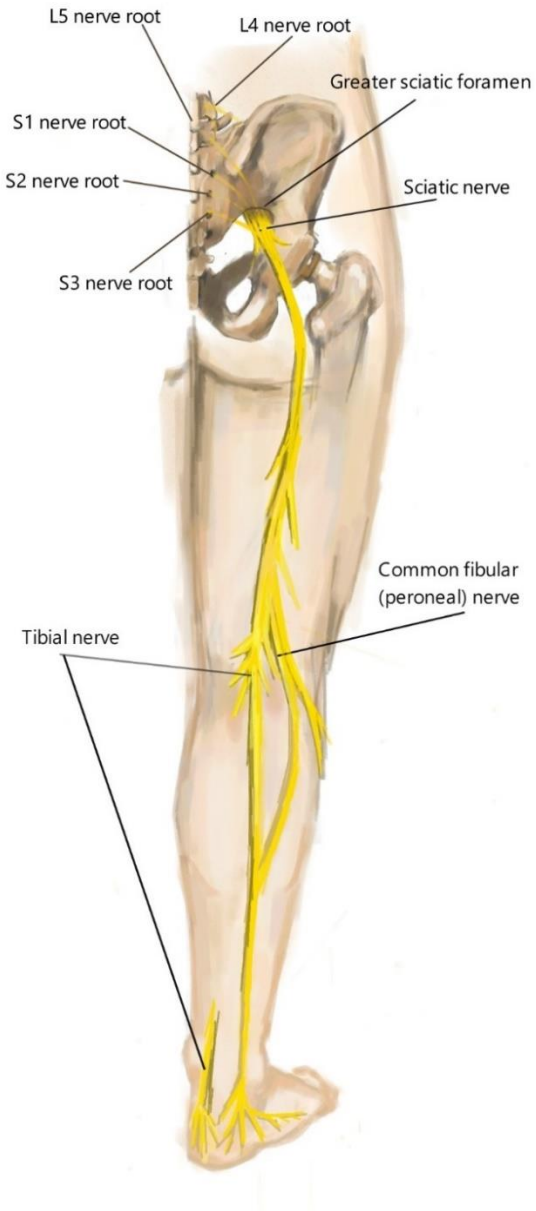
Common symptoms are pain and tightness in the upper back, tightness of chest muscles, limited thoracic mobility, and possible shoulder pain. Hyperkyphosis may cause adverse health effects such as a higher risk of falls, increased mortality, or vertebral fractures. Evidence shows that postural hyperkyphosis is common among computer users and is caused by prolonged sitting, poor ergonomics, or lack of exercise. Additionally, it is often combined with a forward head posture. (Koelé et al., 2020; Migliore et al., 2021, pp. 90-91; Rehman et al., 2018; Zappalá et al., 2021)

Reducing the angle of thoracic kyphosis, similar to treating forward head posture (FHP), involves making ergonomic adjustments and performing therapeutic exercises. The most common type of exercise involves strength and flexibility training to strengthen back extensors and improve mobility. Additional treatments, such as Kinesio taping and manual therapy like thoracic joint mobilization, may be used in combination with exercise therapy. (Jenkins et al., 2021; Kamali et al., 2016)

6.3.3 Lumbar radiculopathy (Sciatica)

Sciatica is a condition caused by compression, irritation, or inflammation of the sciatic nerve root, often caused by disc herniation. The nerve originates in the L4-S1 nerve roots before passing through the pelvis and greater sciatic foramen. The nerve then exits through or around the piriformis muscle and innervates muscles of the leg and

foot's posterior, anterior, and lateral compartments (Picture 8). Pain is the most common symptom, and it can occur anywhere in the innervation area, depending on which root is irritated. Other symptoms include paresthesia and weakness, and rarely, bladder or bowel problems may occur. Sciatica can be triggered by prolonged sitting, pressure, or hamstring injuries. As such, people with sedentary lifestyles are at risk of developing this condition. (Frontera et al., 2018, pp. 257-261; Migliore et al., 2021, pp. 106-113)

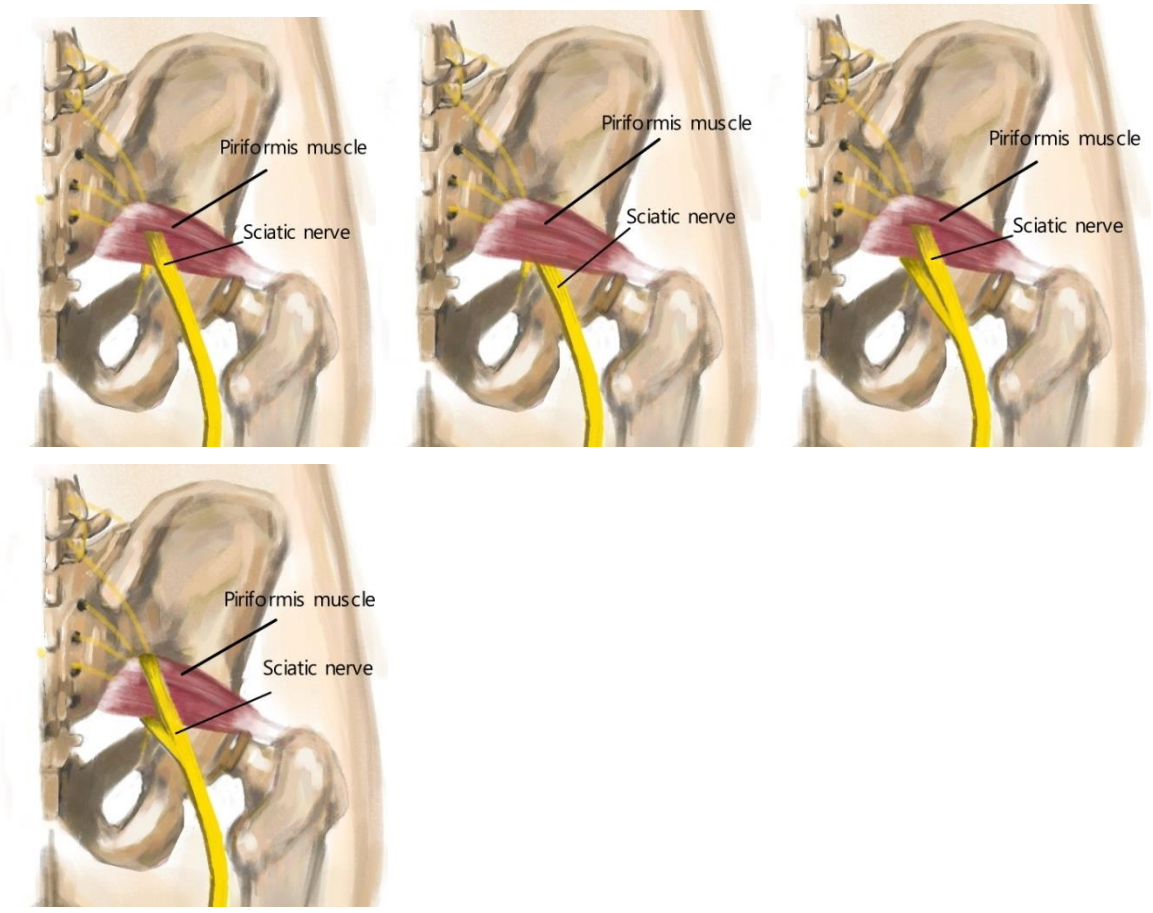


Picture 8. Sciatic nerve (Pirklova, 2023).

Initial treatment for this condition involves symptom management, with nonsteroidal anti-inflammatory drugs effectively reducing pain. Patients should maintain an active lifestyle and avoid prolonged bed rest, taking care not to exert undue pressure on the affected area. Once the inflammation has subsided, exercise is recommended to alleviate symptoms further. This exercise routine will focus on strengthening the core and stabilizing the lumbar region. If the condition is severe or chronic, surgical intervention may be necessary. (Frontera et al., 2018, pp. 257-261; Jensen et al., 2019)

6.3.4 Piriformis syndrome

The sciatic nerve travels through the greater sciatic foramen and then either around, through or below the piriformis muscle, as seen in Picture 9. The piriformis muscle can compress the nerve, leading to the development of piriformis syndrome.



Picture 9. Variations of the sciatic nerve passing through piriformis (Pirklova, 2023).

Various factors, including muscle spasms, overuse, direct compression or trauma, muscle hypertrophy, or the muscle's anatomy, cause this condition. Symptoms of piriformis syndrome can manifest as pain in the buttocks that can radiate down the thigh or paresthesia. (Frontera et al., 2018, pp. 325-327; Migliore et al., 2021, pp. 134-138)

Certain activities, such as sitting for long periods, walking, or hip adduction and internal rotation, can exacerbate the symptoms. It is worth noting that a sedentary lifestyle can also lead to muscular imbalances and weak gluteal muscles, which can ultimately cause strain and tightness of the piriformis and contribute to the development of the syndrome. (Othman et al., 2020)

Stretching exercises are a helpful way to treat pain conservatively through physiotherapy. These exercises aim to elongate the piriformis muscle and reduce nerve compression by focusing on external rotation, hip flexion, and hip adduction. To provide stability in the affected area and reduce symptoms, strengthening exercises for the hip and pelvic region and lumbar stabilization exercises can be helpful. Finally, manual therapy may also provide relief. (Probst et al., 2019; Vij et al., 2021)

7 PREVENTING OVERUSE AND OPTIMIZING PERFORMANCE

The esports field is relatively new and needs more information on optimizing players' performance. Training often focuses on strategy, reaction time, and techniques, while physical well-being is often ignored. However, research suggests that physical exercise, ergonomics, sleep hygiene, and healthy habits are crucial to a player's success. Therefore, making these practices a part of daily training is essential. Prioritizing physical and mental well-being can lead to a more prosperous and longer gaming career. (De Las Heras et al., 2020; Difrancisco-Donoghue et al., 2019; Schary et al., 2022)

7.1 Exercise

Incorporating regular physical exercise into an esports player's routine can have numerous benefits, such as improving both physical and mental health, preventing injuries related to esports, and enhancing performance (Migliore et al., 2021, pp. 228-233).

When it comes to exercising, different types serve different purposes. Some focus on strengthening muscles, while others aim to improve cardiovascular endurance, flexibility, mobility, balance, stability, or coordination. However, it is crucial to bear in mind that each of these interventions requires specific knowledge of proper posture, intensity, speed, duration, and correct movement patterns to avoid injury or fatigue. (Kisner et al., 2022, pp. 1-3)

7.1.1 Resistance training (anaerobic training)

Resistance training aims to increase strength (maximum force-producing capacity of the muscle) by overloading the muscle with various degrees of intensity. An effective strength training program can improve joint stability and muscle control while addressing muscle imbalances in the body, ultimately lowering the risk of injury. (McArdle et al., 2015, ch. 22)

The duration and intensity of resistance training differ for each individual based on their goals, health status, capability, and physical fitness level. For beginners and intermediate training, doing one to three sets with eight to twelve repetitions and taking one to three minutes of rest between sets is generally recommended. The ideal movement velocity for the concentric and eccentric phases is one to two seconds each. For more experienced individuals, it is recommended to do higher amounts of sets with shorter breaks. Beginners are advised to train two to three times a week, while advanced individuals may train more frequently. (McArdle et al., 2015, ch. 22)

7.1.2 Cardiovascular training (aerobic exercise)

Engaging in cardiovascular training involves performing repetitive movements that vary in intensity and involve large muscles. These movements cause the heart rate and respiration to increase, which in turn leads to an increased demand for oxygen from the muscles. To meet this demand, blood vessels transport oxygen throughout the body. Good cardiovascular fitness results in an increase in the number of capillaries in the muscles, which makes oxygen transport easier. With this increased efficiency, muscles are able to sustain physical activity for longer periods and reduce fatigue. (Kisner et al., 2022, ch. 21)

Engaging in regular aerobic exercise has a multitude of health benefits. Not only does it decrease the risk of morbidity and mortality, but it also reduces the likelihood of developing coronary artery disease. Furthermore, it improves cardiovascular and respiratory function. In addition to the physiological advantages, cardiovascular training has been shown to have a positive impact on mental health, cognitive function, and executive function. (Brody & Hall, 2018; Chang et al., 2014)

7.1.3 Exercise interventions for esports players

Hand and wrist exercises may have a positive impact on blood circulation, muscle strength, and tendon health. These exercises can also aid in stabilizing the hand and enhancing joint mobility. Performing these exercises into a daily routine may prevent common gaming overuse injuries such as CTS, De Quervain’s tenosynovitis, and lateral epicondylitis. (Migliore et al., 2021, pp. 228-233) A list of selected hand and wrist exercises is pictured in Table 1. Detailed descriptions can be found in Appendix 1.

Exercise	Purpose
Tendon gliding	Improving the movement of tendons through the tendon sheath. Finger mobilization.
Finger abduction	Strengthening the finger abductors (dorsal interossei of the hand, abductor digiti minimi). Finger mobilization.
Finger flexion with a ball	Strengthening the finger flexors (flexor digitorum superficialis and profundus, flexor pollicis longus). Finger mobilization.
Thumb abduction	Strengthening the thumb abductors (abductor pollicis longus and brevis). Thumb mobilization.
Wrist flexion	Strengthening the wrist flexors (flexor carpi radialis and ulnaris, palmaris longus*).
Wrist extension	Strengthening the wrist extensors (extensor carpi radialis longus and brevis, extensor carpi ulnaris).

*Absent in some people.

Table 1. Hand and wrist exercises.

The purpose of strengthening the neck muscles is to stabilize the cervical spine and improve muscle balance in the neck. This will help prevent or reduce postural problems such as forward head posture. Additionally, an exercise intervention may prevent or reduce neck pain or headaches stemming from neck tension. (Migliore et al., 2021, pp. 228-233) A list of selected neck exercises is pictured in Table 2. Detailed descriptions can be found in Appendix 1.

Exercise	Purpose
Chin tuck	Strengthening the deep cervical flexors (rectus capitis anterior and lateralis, longus capitis, longus colli), stabilizing the cervical column.
Isometric neck flexion	Strengthening the head and neck flexors (rectus capitis anterior, longus capitis, longus colli, anterior scalenes, sternocleidomastoid), stabilizing the cervical column.
Isometric neck extension	Strengthening the head and neck extensors (levator scapulae, splenius capitis and cervicis, semispinalis, sternocleidomastoid, trapezius, superior oblique, erector spinae, rectus capitis posterior major and minor), stabilizing the cervical column.
Isometric neck lateral flexion	Strengthening the neck lateral flexors (longissimus cervicis and capitis, splenius cervicis and capitis, sternocleidomastoid, longus colli, erector spinae, scalenes, trapezius, levator scapulae, rectus capitis lateralis), stabilizing the cervical column.

Table 2. Neck exercises.

Exercises of the shoulder girdle, back, and core help achieve correct posture by strengthening the muscles supporting these structures. Stretching and mobility exercises improve ROM and reduce tension in the muscles. These interventions may help prevent or reduce musculoskeletal problems such as forward head posture, hyperkyphosis, back pain, or rounded shoulders. (Migliore et al., 2021, pp. 91, 228-233) A list of selected shoulder girdle, core, and back exercises is pictured in Table 3. Detailed descriptions can be found in Appendix 1.

Exercise	Purpose
Shoulder elevation	Strengthening the trapezius and levator scapulae.
Bent over lateral raise	Strengthening the upper back and shoulder girdle (posterior deltoids and infraspinatus, teres minor, lateral deltoid, trapezius, rhomboids).
Back to wall shoulder flexion	Improving shoulder girdle stability, strength and control.
Scapular retraction	Strengthening and stabilizing the scapular region (rhomboids, trapezius, levator scapulae).
Thoracic rotation	Improving mobility and strengthening the upper back (multifidus, rotatores, semispinalis, internal and external oblique).
Plank	Strengthening and stabilizing the core (primarily transversus abdominis, rectus abdominis, internal and external obliques).
Chest stretch	Stretching the pectoralis major and minor.

Table 3. Shoulder girdle, back, and core exercises.

The sedentary nature of gaming requires exercises of the lower limbs in order to improve blood circulation, strengthen and stretch the muscles, and enhance mobility. These exercises may help prevent pain in the lower back and lower extremities and pressure on the sciatic nerve. (Migliore et al., 2021, pp. 228-233) A list of selected lower limb exercises is pictured in Table 4. Detailed descriptions can be found in Appendix 1.

Exercise	Purpose
Knee extension	Strengthening the quadriceps femoris (rectus femoris, vastus lateralis, vastus medialis, vastus intermedius) and tensor fascia lata.
Squat	Strengthening primarily the glutes (gluteus maximus, medius and minimus), quadriceps femoris and hamstrings (semitendinosus, semimembranosus, biceps femoris), but also adductor magnus, gastrocnemius, soleus, erector spinae and core stabilizers.
Bridge	Stabilizing the pelvic girdle. Strengthening the glutes, hamstrings and quadriceps femoris, and improving the trunk stability by strengthening the obliques and erector spinae.
Ankle pumps	Strengthening the dorsiflexors (tibialis anterior, extensor digitorum longus, extensor hallucis longus, peroneus brevis) and plantaflexors (gastrocnemius, soleus, plantaris, peroneus longus and brevis, tibialis posterior, flexor digitorum longus, flexor hallucis longus).
Glute stretch	Stretching the glutes and piriformis.
Hip flexor, quadriceps femoris and hamstring stretching sequence	Stretching the hip flexors (iliacus, psoas, pectineus, rectus femoris, and sartorius), quadriceps femoris and the hamstrings.

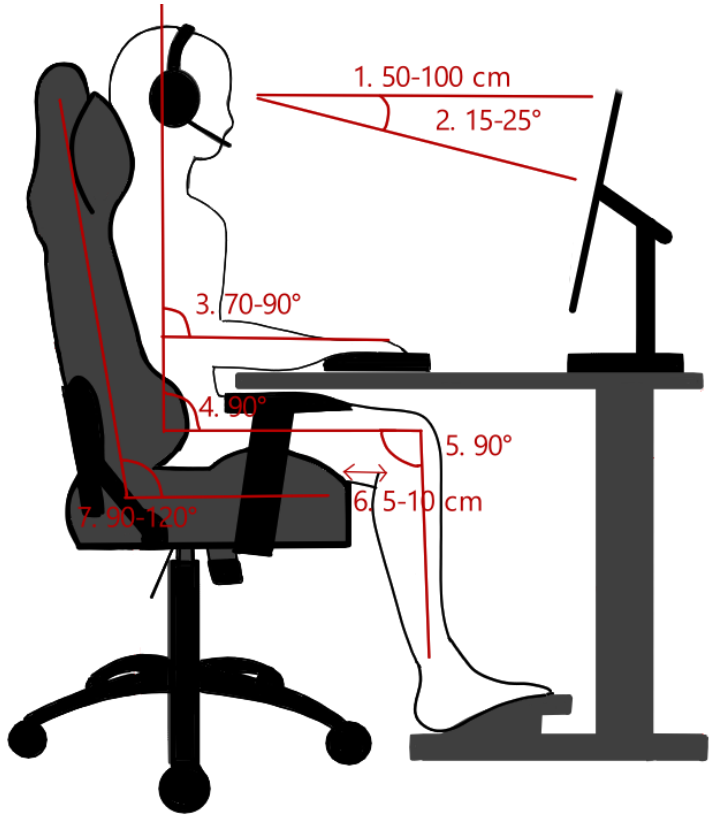
Table 4. Lower limb exercises.

7.2 Ergonomics

Several external factors can have a negative impact on gamers; however, these factors can be eliminated with optimal ergonomics. The goal of ergonomics is to keep body structures in as neutral position as possible, reduce muscular load, and keep the work-space comfortable and safe. (Redivo & Olivier, 2021) The sedentary nature of gaming and consistent repetitive movements requires an ergonomic setup, portrayed in Picture 10, that will reduce the strain on the body and optimize performance (Law et al., 2023).

7.2.1 Physical ergonomics

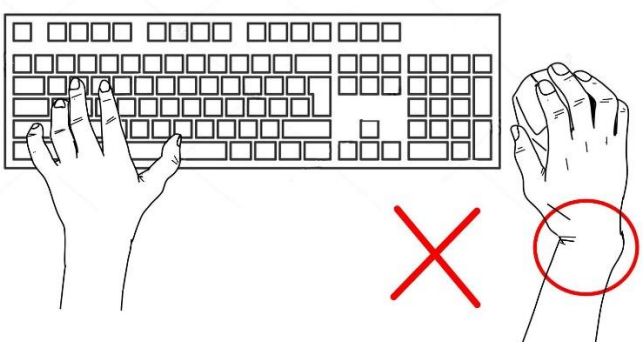
It is important to consider the ergonomics of seating arrangement when engaging in gaming activities. To prevent any strain on the body, it is essential to have a chair that provides adequate support. It is recommended that the height of the chair seat keeps the hip and knee joints at approximately a 90° angle, with feet firmly planted on the floor or another stable surface. The backrest should be of appropriate length and width, tailored to each individual's body constitution. It is generally recommended that the backrest angle should not be less than 90°, as anything lower can cause discomfort. Studies have shown that an angle between 110-120° can help reduce disc pressure and muscle activity in the back. When selecting a chair for computer use, it is crucial to carefully consider the size of the seat pan. When sitting fully back, the ideal gap between the front of the seat and the user's knee is 5-10 cm. If the seat is too long, it can cause the user to lean forward and lose back support, while if it is too short, it can increase pressure on the thighs. In addition, the armrests must be considered to ensure that they provide a comfortable position for the arms, with relaxed shoulders and elbow flexion of 70-90°. The optimal length of the armrests is also essential, as armrests that are too long will obstruct the chair from getting close enough to the desk, resulting in improper posture. Moreover, the padding on the armrests can help to minimize pressure on the arms and elbows. (Emerson et al., 2021; Kumar & Kumar, 2017)



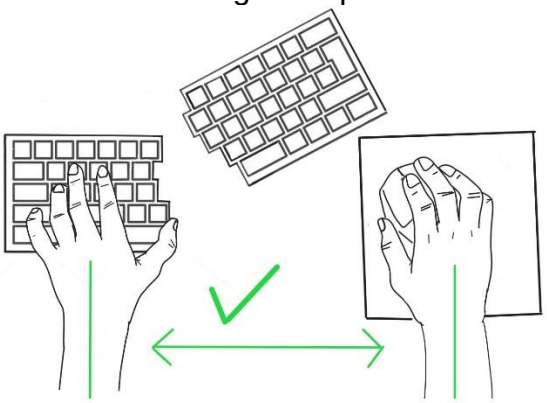
Picture 10. Ergonomic gaming posture. 1. Distance between the monitor and the gamer 2. Viewing angle 3. Elbow flexion 4. Hip flexion 5. Distance between the knee and the edge of the chair 6. Knee flexion 7. Backrest angle. (Pirklova, 2023)

Achieving a comfortable and ergonomic workspace requires a desk with adjustable settings that allow for proper positioning of the keyboard, mouse, and screen. Inappropriate desk height can cause shoulder elevation and neck pain, while a too low desk can lead to leaning forward. A curved desk edge and an appropriate height can provide relief from pressure on the elbows and wrists.

A keyboard needs to be positioned in a way that keeps the wrist in a neutral position. To avoid wrist strain, the wrist should not exceed 15° of extension and 5° of ulnar deviation (Pictures 11 and 12). Placing the keyboard at a distance of 10-2 cm from the edge of the desk can provide optimal wrist support. (Emerson et al., 2021; Kumar & Kumar, 2017).



Picture 11. Wrong hand placement with excessive ulnar deviation (Pirklova, 2023).

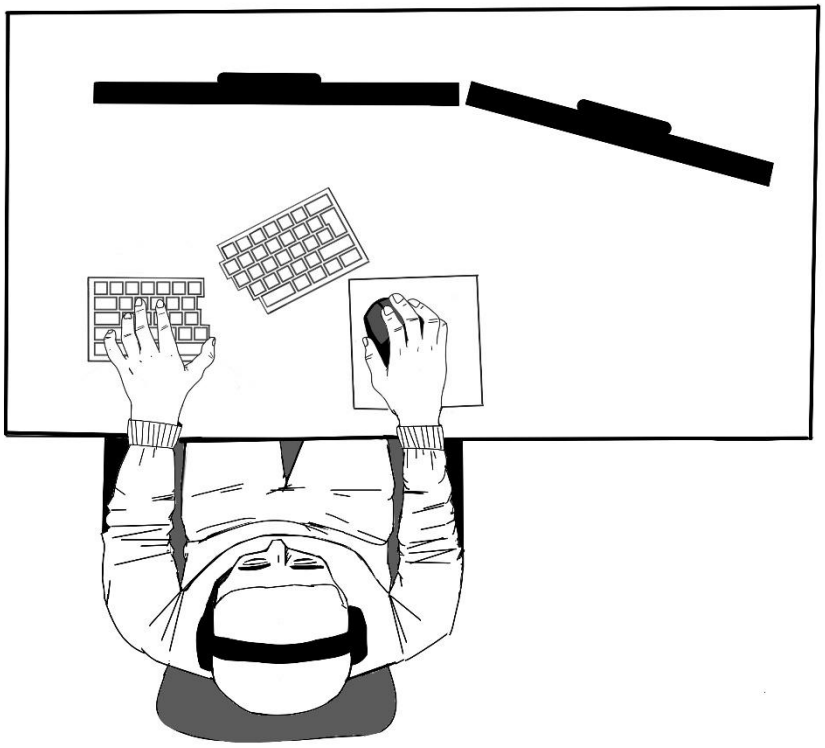


Picture 12. Correct hand placement with hands shoulder width apart and in a neutral position, using a split keyboard (Pirklova, 2023).

When it comes to computer mice, many variations are available, and the optimal choice can vary depending on one's gaming style. It is important to choose a mouse that is of the right height, as using a too-tall mouse can increase wrist extension and pressure in the carpal tunnel. There are three different mouse grips, each of which can strain the hand and wrist differently. A heavier mouse is usually more suitable for a palm grip, while a finger grip may require a lighter and shorter mouse. It is important for computer users to find a mouse that suits their own preferences. (Migliore et al., 2021, pp. 154-157)

When setting up a computer monitor, it is important to consider the optimal height to prevent strain on the neck and back. Improper positioning of the monitor may cause discomfort and pain. The recommended viewing angle for the monitor is generally between 15 and 25° below gaze inclination. (Emerson et al., 2021) Additionally, the distance between the monitor and the computer user should be 50-100 cm to prevent eye strain and improper posture. To avoid excessive cervical rotation, it is recommended

to center the primary monitor with the keyboard and mouse (Picture 13). (Migliore et al., 2021, pp. 153-154)



Picture 13. Optimal set-up. The primary monitor is aligned with the keyboard and mouse. (Pirklova, 2023)

7.2.2 Environmental ergonomics

Environmental ergonomics is often overlooked. Creating an ideal environment means designing a space that is pleasant and doesn't overload the senses. To minimize the risk of digital vision syndrome and its associated health issues, it is advisable to optimize the lighting conditions in the room. The recommended lighting level falls between 300-500 lux, and it's essential to avoid any reflections from windows or other light sources which may interfere with the optimal lighting conditions. For optimal eye health and comfort during gaming, it is recommended to use a desk lamp instead of an overhead light and position it on the side of the screen. Additionally, wearing eyeglasses instead of contact lenses and using an air humidifier in the room can effectively reduce eye strain and dryness. To further minimize the harmful effects of blue light, blue filter

glasses or a blue light screen filter can be used. Finally, it is important to follow the 20-20-20 rule, which suggests taking a break every 20 minutes by looking at an object 20 feet (6 meters) away for 20 seconds to allow the eyes to rest. Following these guidelines allows gamers to create a more comfortable and safer gaming environment. (Kumar & Kumar, 2017; Turgut, 2018)

Excessive noise levels in a gaming space can negatively impact hearing, cognition, performance, and mood (Salvendy, 2012). It is important to minimize background noise when gaming to avoid negative effects during breaks and prevent the need to increase volume. Wearing headphones at high volume may have a damaging effect on the ear, causing problems such as hearing loss, tinnitus, or feeling of blocked ears. (Herrera et al., 2016; Mohammadpoorasl et al., 2019) According to the Institution of Occupational Safety and Health (IOSH), the standard limit for workplace noise exposure is 85 dB of a time-weighted average of 8 hours (Noise | Sound Levels and Their Relevance | IOSH, n.d.), whereas headphones may reach levels over 100 dB. Therefore, the optimal volume is at 60% or less (Mayes & Fink, 2021). For optimal comfort, it is recommended to choose headphones or a headset that are lightweight, do not cause excessive pressure on the head or ears, and feature soft materials such as leather. (Preventing Hearing Loss While Gaming With Headphones and Earbuds, n.d.)

7.3 Breaks, recovery, and sleep

Just as any other athletes, esports players need rest and sleep to recover from hours of training. The demanding nature of esports on cognition further underlines the need for rest in order to recover both mentally and physically. A successful recovery may positively affect players' mood, memory, accuracy, speed, and focus. The importance of recovery should be understood by players, coaches, and other team members to optimize training schedules, incorporate breaks into training sessions, and find methods to improve the quality of sleep. (Bonnar et al., 2022; Monteiro Pereira et al., 2023)

7.3.1 Regular breaks

As previously stated, extended periods of gameplay characterized by repetitive motions, prolonged sitting, and excessive screen time can result in physical and mental exhaustion, leading to health complications and reduced performance. The rigorous training and competition that esports athletes undergo expose them to varying stress levels. Numerous players have voiced their desire for more breaks to mitigate game-induced stress and fatigue. (Difrancisco-Donoghue et al., 2021; A. Pereira et al., 2023)

An effective approach to managing stress and enhancing performance is incorporating frequent breaks into training sessions, such as light exercise, or engaging in other enjoyable activities that can alleviate physiological and psychological strain. (Hiltscher & Scholz, 2021; A. Pereira et al., 2023) Difrancisco-Donoghue et al.'s (2021) study shows a positive impact of a 6-minute walking break on performance, improving executive functions such as decision-making and increased speed without a decline in accuracy. Interestingly, taking a rest break did not result in any cognitive benefits.

7.3.2 Sleep

Optimal sleep habits will help reduce the adverse effects of sleep deprivation on cognitive and physical health. Staying awake for longer than 16 hours slows reaction time, reduces accuracy and alertness, impairs visual and memory processing, and has a negative effect on judgment and decision-making. (Killgore, 2010) All of these factors can have a significant impact on gaming performance and should be avoided. Esports players and coaches need to be educated on the importance of proper sleep hygiene to achieve quality rest. (Bonnar et al., 2019)

There are several ways of improving the quality of sleep. It is recommended to sleep at least seven hours each and keep a consistent sleep schedule. Behavioral therapy suggests using the bed exclusively for sleeping purposes, refraining from spending excessive amounts of time in bed and only going to bed when truly tired. (Bonnar et al., 2022)

The blue light emitted by screens can disrupt natural sleep patterns, which puts gamers at risk of poor sleep. This may be prevented by limiting screen time before bed or wearing blue light-blocking glasses. (Wahl et al., 2019) In addition, consuming an excessive amount of caffeine, for example, from energy drinks or coffee, can hinder the start of sleep and lower its quality. It is advised to refrain from consuming caffeinated beverages for at least six hours before going to bed. (Drake et al., 2013)

Finally, improving sleep quality can be achieved through different relaxation techniques. Some possible relaxation methods might include listening to soothing music or audiobooks, practicing breathing exercises, or engaging in progressive muscle relaxation. However, in the case of insomnia, cognitive behavioral therapy could be a helpful option to consider. (Friedrich & Schlarb, 2018)

7.3.3 Sleep ergonomics

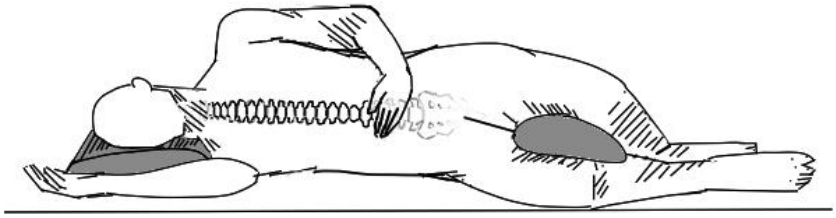
Humans spend approximately one-third of their lives sleeping. During this time, the effect of gravity on the body differs from when standing upright. An appropriate sleeping posture helps avoid overloading muscles and joints, which can lead to headaches and shoulder, back, or neck pain. This discomfort can negatively impact sleep quality and the ability to recover fully. If left unaddressed, these problems may develop into chronic pain. Ideally, the body should be in a neutral position so that the body weight is distributed evenly, which can be achieved by choosing the right mattress and pillow. (Frange & Santos Coelho, 2021)

A well-designed mattress maintains proper spinal alignment and prevents excessive pressure on the body. A mattress that is too soft or firm can lead to poor spinal support and discomfort. Opting for a custom-made or carefully selected mattress that provides optimal support will ensure that the spine stays in a healthy position. Choosing the appropriate pillow can have a significant impact on maintaining the cervical spine in a neutral position and reducing excessive strain. With a wide range of sizes, thicknesses,

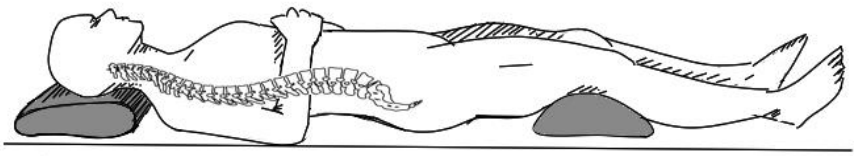
materials, and fillings available, it is advisable to try the pillow in person to determine which pillow suits the body's constitution and needs. Furthermore, selecting a pillow with materials that keep the surface cool can potentially enhance sleep quality. (Frange & Santos Coelho, 2021; Turun TULE Tietokeskus, n.d.)

Research suggests that sleeping on one's back (supine) can increase the likelihood of experiencing sleep apnea or snoring. Back sleepers are advised to place a small pillow under their knees to promote a comfortable and natural sleeping position that does not place excessive strain on the lumbar spine (Picture 14). (Turun TULE Tietokeskus, n.d.; Sleep Foundation, n.d.)

Sleeping on the side can lead to pressure on the shoulder or pelvis. To keep the spine aligned and reduce pressure on the hips, it is recommended to place a pillow between the knees (Picture 15). It is also worth noting that sleeping on the right side may exacerbate acid reflux in individuals who experience it, as it can cause pressure on internal organs. (Turun TULE Tietokeskus, n.d.; Sleep Foundation, n.d.)



Picture 14. Optimal sleeping position on the side, using supporting pillows (Pirklova, 2023).



Picture 15. Optimal sleeping position in supine, using supporting pillows (Pirklova, 2023).

Sleeping on the stomach (prone) can cause significant stress on the spine, mainly due to the rotation of the cervical and thoracic spine. Individuals who prefer this sleeping position should consider placing a pillow under the stomach and pelvis to minimize

spinal strain and use a thin or no pillow under the head. In situations where it is feasible, it is recommended to consider other sleeping positions to avoid unnecessary pressure on the spine. (Frange & Santos Coelho, 2021; Turun TULE Tietokeskus, n.d.)

8 METHODOLOGY

This thesis and its product, a guidebook for esports players, was created for the Czech Esports Association. The method used for this thesis was action research. Action research is a qualitative method that combines theoretical research with action in the form of a practical solution for a given problem. The action research started with a thesis question and continued with a cyclic procedure, refining the questions, and reaching clearer answers in each cycle.

The initial thesis questions were: What are the most common health problems in esports? What can be done to prevent them? With the thesis question ready, the next phase focused on gathering relevant data.

A literature review was conducted to collect theoretical information on the physical activity of esports players, the physiological effects of gaming, and the most common injuries and health problems in the gaming community. The databases used for the data collection were SAMK Finna, Google Scholar, PubMed, and ResearchGate. The keywords used in this search were combinations of “esports”, “physical activity of esports players”, “esports injuries”, “gaming”, “esports and exercise” “esports and sleep” or “ergonomics”. The publication date was limited to articles and studies from 2013 to 2023 to use the latest evidence. However, older publications were included if they contained useful information for the thesis. Excluded were studies on mobile or console gaming, as this thesis is focused primarily on computer gaming, and case studies that did not provide a large enough sample size to make conclusions.

After collecting the data, it was analyzed to find answers to the research questions. The collected data revealed that esports players often experience pain in their hands, wrists, neck, and back, which is caused by a sedentary lifestyle, repetitive motions, and poor ergonomics. To address this issue, educating players, coaches, and teams on proper methods would be a viable solution.

After creating a theoretical solution, it was turned into a practical one by creating a comprehensive guidebook. The guidebook includes evidence-based exercises that aim to prevent overuse injuries and reduce musculoskeletal pain, advice on ergonomics for an optimal computer set-up, and information about recovery, sleep, and sleep ergonomics.

Finally, the research analyzed current problems in esports and healthcare, concluding with recommendations for further research.

9 DISCUSSION

Gaming and esports are a topic close to the author's heart; both personal and second-hand experiences helped shape the idea for the thesis. The esports industry has gained significant momentum in recent years; however, the health of esports players is not receiving the attention it deserves. Due to the limited scope of the available data, it is challenging to draw definitive conclusions regarding the impact of gaming on the health and well-being of gamers. For the author of the thesis, this was one of the challenges during the thesis process. While there are numerous studies conducted on amateur or hobby gamers, there is still a lack of studies focusing on the health of professional esports athletes. Although the author aimed to provide information for esports players of all levels, it was difficult to find suitable publications due to the need to exclude studies that focused on occasional hobby video gaming.

Unfortunately, the stereotype that those who enjoy gaming are lazy and inactive persists. Although the popularity of esports has increased significantly, many individuals who do not actively follow esports or play games themselves fail to recognize the immense amount of effort, training and stress that esports players undergo. While there may be some gamers who simply play for fun, professional and competitive gameplay is an entirely different game.

The process of writing the thesis proved to be an invaluable learning experience for the author. It allowed them to acquire new information about the intersection of esports and healthcare, and to gain a better understanding of the current situation in that field. Creating the illustrations aimed to aid the reader's understanding of the topic while allowing the author to explore human anatomy from a unique perspective.

The author observed that a lot of people were not familiar with the topic of esports. Many individuals did not acknowledge esports as a sport and were unaware of the competitive nature of gaming. Furthermore, some people had heard of esports but had not considered the level of effort and dedication required to become a professional esports player. The author noted that even healthcare professionals lacked knowledge of esports injuries, which is not surprising given that it is a relatively new and unknown field. Conducting further research could greatly benefit physicians, physiotherapists, psychologists, and other healthcare professionals in understanding the physical and mental demands of gaming. With this knowledge, healthcare providers can offer improved care for esports players, prevent injuries, and help prolong their careers.

It is not only healthcare professionals who should be educated about the health strain gaming brings. Coaches and staff need to obtain knowledge about overuse injury prevention and optimal recovery. Not only can it keep the players healthy, but it may improve their gaming performance, which will benefit the whole team. Moreover, it is essential to provide accurate information on achieving ideal ergonomics. As gamers spend a significant amount of time sitting down, it is crucial to have an optimal setup and environment. The author has noticed that many ergonomic chairs, tables, keyboards, headsets, and other equipment are available on the market. However, the

gamer must know the proper heights, angles, and distances for an ergonomic setup to make use of such equipment, which is not always the case. Additionally, the topic of environmental ergonomics should not be taken lightly; disturbing light or noise may significantly affect the player’s performance.

Further research is necessary to provide a more comprehensive understanding of this topic and to shed light on the potential effects of prolonged gaming on individuals' physical and mental health. This thesis was written with the hope of increasing awareness regarding the physical and mental demands of gaming, and offering helpful strategies for preventing injuries that can benefit everyone involved in esports, including players, coaches, and team members alike.

Let's embrace the ever-evolving technology and cultivate habits that will enable us to thrive both in the digital and physical realms.

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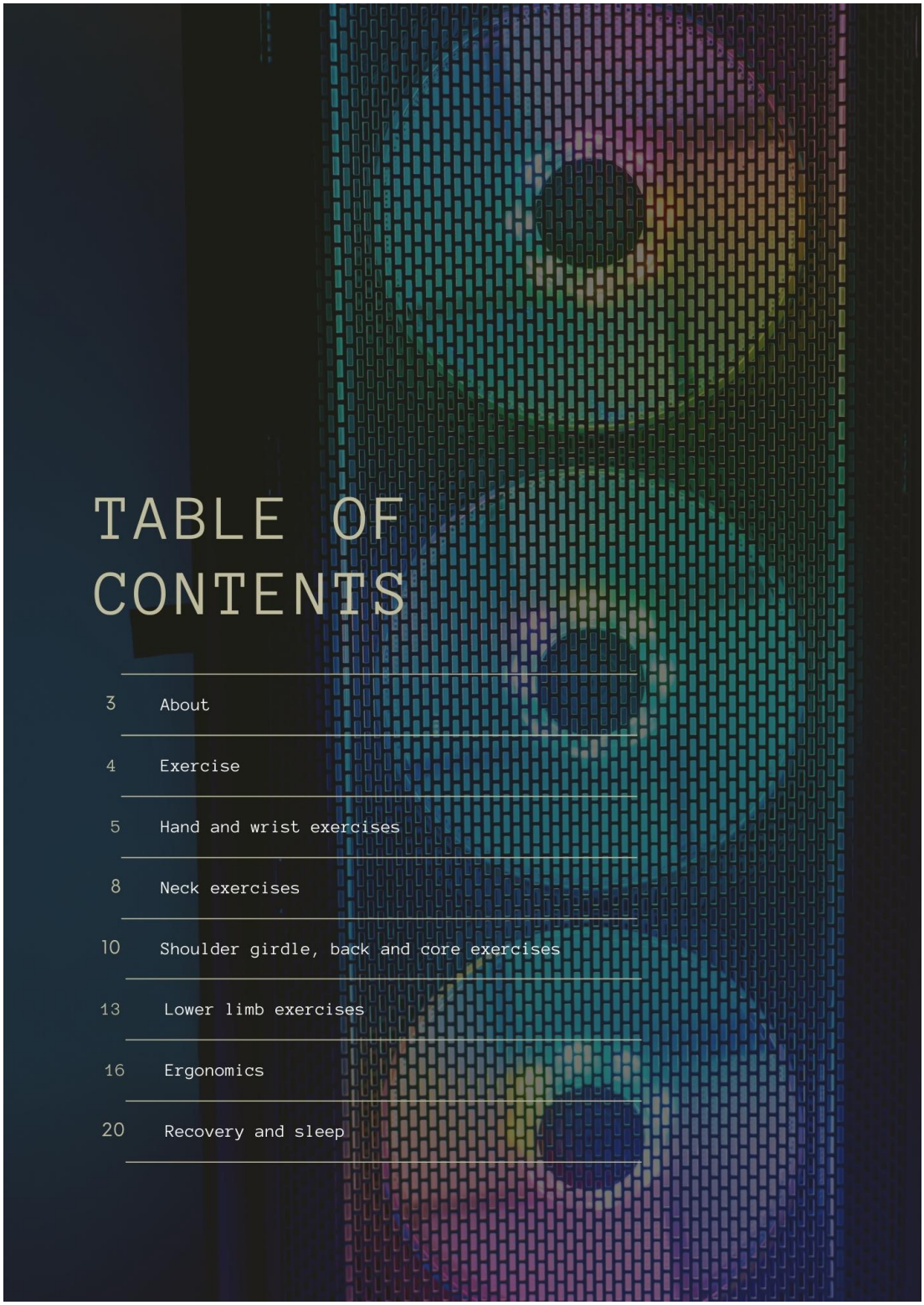
APPENDIX 1: GUIDEBOOK



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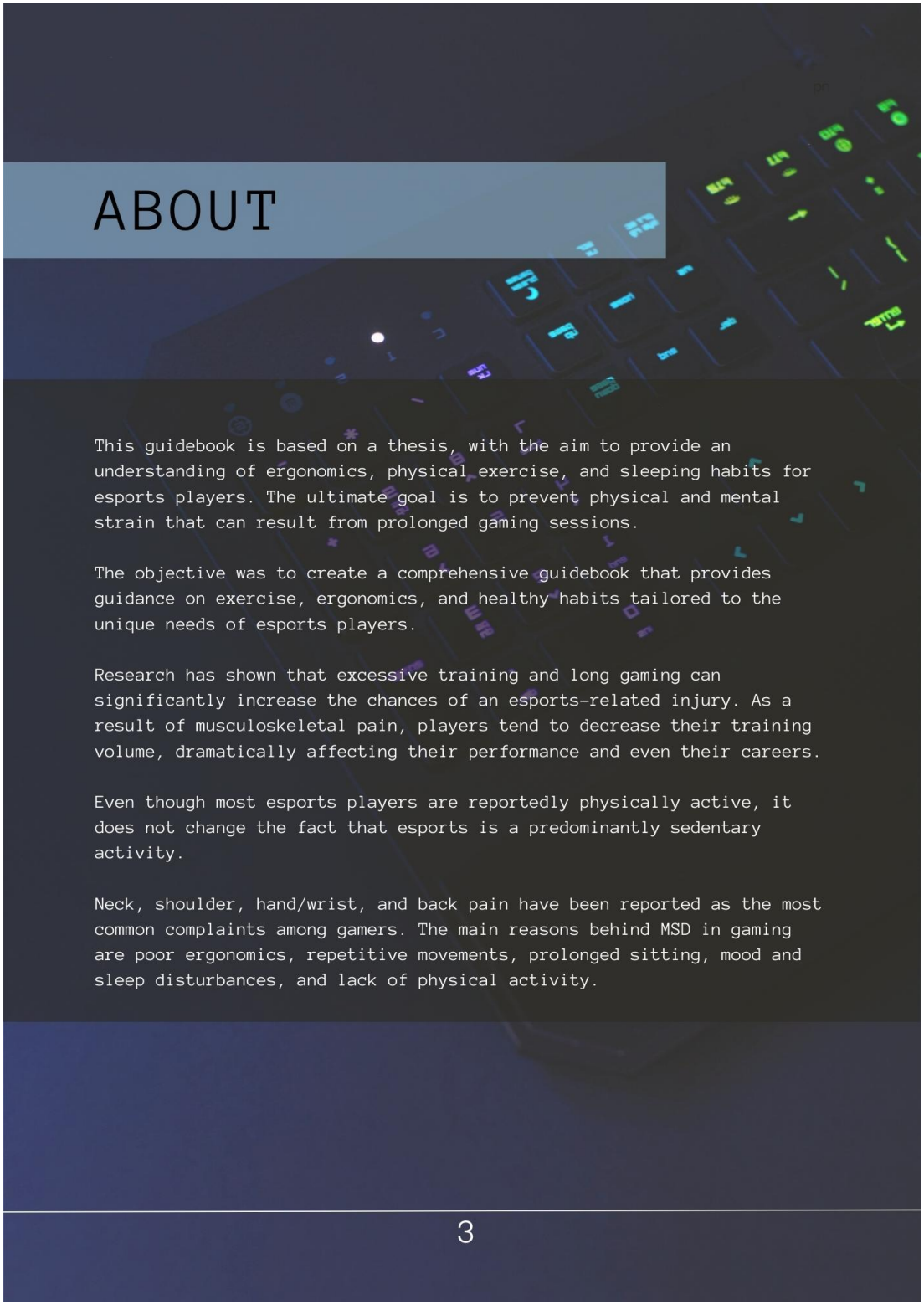


ABOUT

This guidebook is based on a thesis, with the aim to provide an understanding of ergonomics, physical exercise, and sleeping habits for esports players. The ultimate goal is to prevent physical and mental strain that can result from prolonged gaming sessions.

The objective was to create a comprehensive guidebook that provides guidance on exercise, ergonomics, and healthy habits tailored to the unique needs of esports players.

Research has shown that excessive training and long gaming can significantly increase the chances of an esports-related injury. As a result of musculoskeletal pain, players tend to decrease their training volume, dramatically affecting their performance and even their careers.

Even though most esports players are reportedly physically active, it does not change the fact that esports is a predominantly sedentary activity.

Neck, shoulder, hand/wrist, and back pain have been reported as the most common complaints among gamers. The main reasons behind MSD in gaming are poor ergonomics, repetitive movements, prolonged sitting, mood and sleep disturbances, and lack of physical activity.

EXERCISE

- Lowers the risk of chronic disease and premature mortality.
- Reduces the risk of hypertension, heart attack, and dyslipidemia.
- Decreases the likelihood of obesity, some cancers, stroke, and type 2 diabetes.
- Enhances bone density, reducing the risk of osteoporosis.
- Improves well-being by promoting bone health, body composition, and glucose homeostasis.
- Enhances overall mood and may prevent depression or anxiety or alleviate symptoms.

The recommended amount of physical activity for adults is at least 150-300 minutes of moderate-intensity physical activity or 70-150 minutes of vigorous physical exercise per week, including both aerobic and anaerobic training.

According to studies, physical exercise may have a positive impact on esports performance.

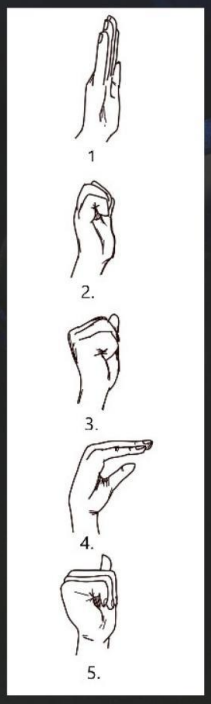
Exercise may improve muscle strength, cardiovascular endurance, flexibility, mobility, balance, stability, or coordination. However, bear in mind that each of these interventions requires specific knowledge of proper posture, intensity, speed, duration, and correct movement patterns to avoid injury or fatigue.

The following part of this guide includes exercises specifically picked to match the physical demands of gaming and to prevent overuse injuries. You can perform the exercises every day. It is enough to pick 1-2 exercises from each group, however, feel free to do as many as you want. The exercises can be done also as a warm-up before a game or during breaks in between gaming sessions. If you feel pain or suffer from an injury, discuss the exercises with your doctor or physiotherapist first.

Hand and wrist exercises

Hand and wrist exercises may have a positive impact on blood circulation, muscle strength, and tendon health. These exercises can also aid in stabilizing the hand and enhancing joint mobility. Performing these exercises into a daily routine may prevent common gaming overuse injuries such as CTS, De Quervain's tenosynovitis, and lateral epicondylitis.

Tendon gliding



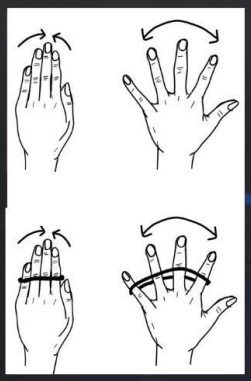
INSTRUCTIONS

1. Keep your palm and fingers all aligned in a straight line.
2. Bend your knuckles and middle finger joints by curling your fingers downwards.
3. Make a complete fist with your hand, thumb over your fingers.
4. Bend your hands at the third knuckle to curve down toward the wrist, forming an upside-down "L."
5. Bend your hand down to form an upside-down "U." Try touching the base of your hand with your fingertips.

PURPOSE: Improving the movement of the tendon through the tendon sheath. Finger mobilization.

INTENSITY: 3 sets of 8 repetitions.

Finger abduction



INSTRUCTIONS: Place your hand on the table with your elbow flexed. Abduct and adduct the fingers without moving any other part of the arm.

PURPOSE: Strengthening the finger abductors. Finger mobilization.

INTENSITY: 3 sets of 8 repetitions.

VARIATIONS: Use a rubber band to increase resistance.

Finger flexion with a ball

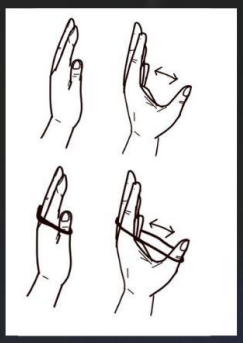
INSTRUCTIONS: Place your forearm on a table and hold a soft ball. Squeeze the ball.

PURPOSE: Strengthening the finger flexors. Finger mobilization.

INTENSITY: 3 sets of 8 repetitions.

VARIATIONS: Use balls of various resistances to increase difficulty.

Thumb abduction



INSTRUCTIONS: Abduct your thumb away from the palm.

PURPOSE: Strengthening the thumb abductors. Thumb mobilization.

INTENSITY: 3 sets of 8 repetitions.

VARIATIONS: Use a rubber band to difficulty.

Shoulder girdle, back and core exercises

Exercises of the shoulder girdle, back, and core help achieve correct posture by strengthening the muscles supporting these structures. Stretching and mobility exercises improve ROM and reduce tension in the muscles. These interventions may help prevent or reduce musculoskeletal problems such as forward head posture, hyperkyphosis, back pain, or rounded shoulders.

Shoulder elevation

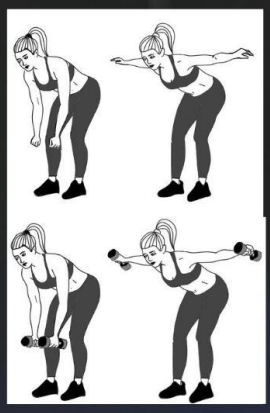
INSTRUCTIONS: Stand or sit upright and elevate your shoulders, bringing them up towards your ears.

PURPOSE: Strengthening the trapezius and levator scapulae muscles.

INTENSITY: 3 sets of 8 repetitions.

VARIATIONS: Use hand weights or a resistance band to increase difficulty.

Bent over fly



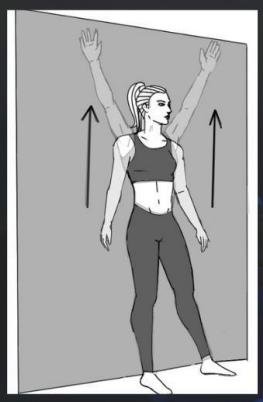
INSTRUCTIONS: Stand with slightly bent knees, keeping your back straight. Bend forward at the hip joint and lift both arms out to the sides. Squeeze your shoulder blades together.

PURPOSE: Strengthening the upper back and shoulder girdle.

INTENSITY: 3 sets of 8 repetitions.

VARIATIONS: Use hand weights or a resistance band to increase difficulty.

Back to wall shoulder flexion



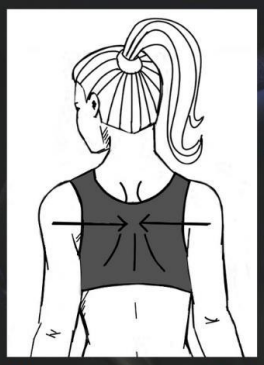
INSTRUCTIONS: Stand with a back against a wall, feet approx. 15-20cm away from the wall. Slowly raise the arms up, keeping the core and back stable. Lower the arms down and repeat.

PURPOSE: Improving shoulder girdle stability, strength and control.

INTENSITY: 3 sets of 10-15 repetitions.

VARIATIONS: Use hand weights or a resistance band to increase difficulty.

Scapular retraction



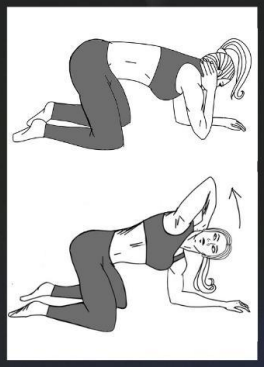
INSTRUCTIONS: Sit or stand in a neutral position. Pull your shoulder blades together without lifting the shoulders. Relax and repeat.

PURPOSE: Strengthening and stabilizing the scapular region.

INTENSITY: 3 sets of 10-15 repetitions.

VARIATIONS: Pull a resistance band to increase difficulty.

Thoracic rotation



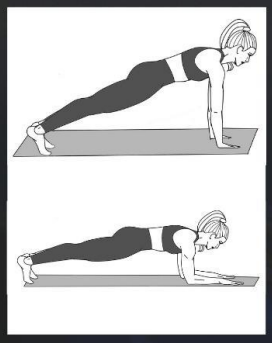
INSTRUCTIONS: Get onto all fours, knees under the hips, and hands under the shoulders, and the spine in a neutral position. Place your hand on the back of the neck and rotate the thoracic spine, keeping the opposite arm stable. Keep the spine aligned. Return back to the starting position and repeat.

PURPOSE: Improving mobility and strengthening the upper back.

INTENSITY: 3 sets of 8 repetitions on each side.

VARIATIONS: Pull a resistance band to increase difficulty.

Plank



INSTRUCTIONS: Start on the floor on all fours, and keep the wrists, hands, and shoulders aligned. Step the feet back, shoulder width apart. Maintain a straight line from the head to your feet. Keep your core and glutes tight.

PURPOSE: Strengthening and stabilizing the core.

INTENSITY: Hold the plank for 30-60 seconds and repeat 2-3 times.

VARIATIONS: You can try an easier version with elbows flexed.

Chest stretch

INSTRUCTIONS: Place both arms on the other side of the door frame. Step forward through the door frame with one leg and feel the stretch in your chest muscles.

PURPOSE: Stretching the chest muscles and improving mobility.

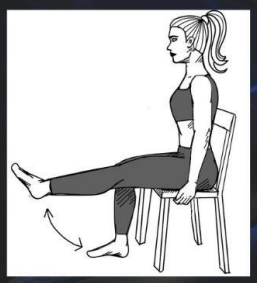
INTENSITY: Hold for 20-30 seconds and repeat 2-3 times.

VARIATIONS: Stretch different parts of the chest by positioning your arms higher or lower on the door frame.

Lower limb exercises

The sedentary nature of gaming requires exercises of the lower limbs in order to improve blood circulation, strengthen and stretch the muscles, and enhance mobility. These exercises may help prevent pain in the lower back and lower extremities and pressure on the sciatic nerve.

Knee extension



INSTRUCTIONS: Sit with spine in neutral positions, knees and ankles aligned. Flex the knee.

PURPOSE: Strengthening the front thigh (quadriceps femoris and tensor fascia lata).

INTENSITY: 3 sets of 8 repetitions.

VARIATIONS: Use ankle weights or a resistance band to increase difficulty.

Squat

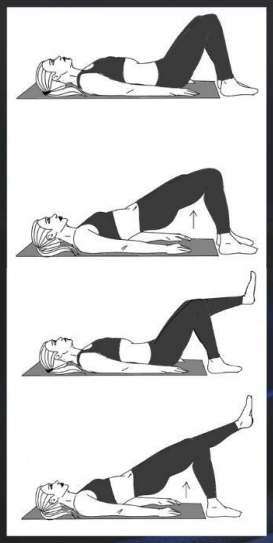
INSTRUCTIONS: Stand with feet shoulder-width apart, spine in a neutral position. Bend your knees and lower down, with the movement starting from your hip joints. Keep your head up, core tight, back straight, and knees and ankles aligned. return back to the starting position and repeat.

PURPOSE: Strengthening primarily the glutes, quadriceps femoris, and hamstrings, stabilizing the core.

INTENSITY: 3 sets of 8 repetitions.

VARIATIONS: Use hand weights or a resistance band to increase difficulty. Choose the depth of the squat according to your abilities.

Bridge



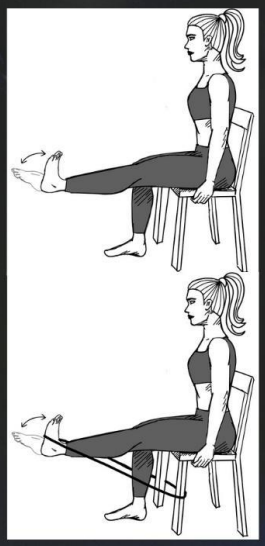
INSTRUCTIONS: Lie down on your back and flex your knees to approx. 90 degrees. Slowly lift your pelvis up while keeping the core tight and knees and ankles aligned. Lower the pelvis back down and repeat.

PURPOSE: Stabilizing the pelvic girdle.Strengthening the glutes, hamstrings, and quadriceps femoris. Improving trunk stability.

INTENSITY: 3 sets of 10-15 repetitions on each side.

VARIATIONS: Keep one leg lifted up.

Ankle pumps



INSTRUCTIONS: Sit in a neutral position, straighten your leg, and start pumping the ankle up and down.

PURPOSE: Strengthening the calves. improving ankle mobility and blood circulation in the feet.

INTENSITY: 3 sets of 10-15 repetitions on each side.

VARIATIONS: Use a resistance band to increase difficulty.

Glute stretch

INSTRUCTIONS: Lie on your back and bend both knees. Cross the right leg over the left and bring the knees toward your chest. Lightly pull the left leg toward you. Feel the stretch, return back to starting position and switch legs.
The stretch is not supposed to not cause any pain.

PURPOSE: Stretching the glutes and piriformis.

INTENSITY: Hold for 20-30 seconds and repeat 2-3 times on each side.

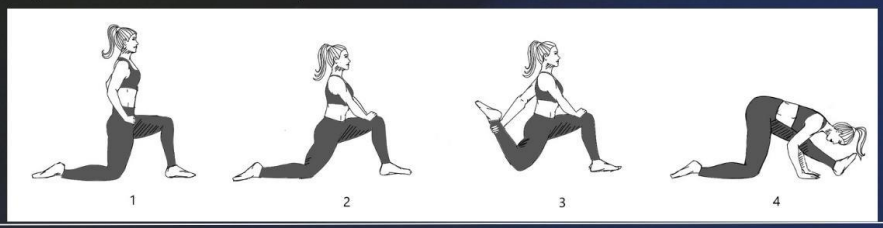
VARIATIONS: This stretch can be done seated.

Hip flexor, quadriceps femoris and hamstring stretching sequence

INSTRUCTIONS:
1. Kneel on one knee and keep the other leg flexed in front of you.
2. Keep your back straight and push your hips slowly forward. Keep the stretch, then return back to the starting position.
3. Grab the foot on the floor and lift it up. Keep the stretch and return back to the starting position.
4. Straighten one leg in front of you and bend from your hips forward, keeping your back straight. Try not to bend your knee. Go back to the starting position and switch legs. The stretch is not supposed to not cause any pain.

PURPOSE: Stretching the hip flexors, the hamstrings and the quadriceps. Improving mobility.

INTENSITY: Hold for 20-30 seconds. Switch sides after completing the sequence. Perform the sequence 1-2 times on each side.



RECOVERY AND SLEEP

REGULAR BREAKS

Repetitive motions, prolonged sitting, and excessive screen time can result in physical and mental exhaustion, leading to health complications and reduced performance.

Incorporate frequent breaks into training sessions, such as light exercise, or engaging in other enjoyable activities that can alleviate physiological and psychological strain.

SLEEP

Optimal sleep habits will help reduce the adverse effects of sleep deprivation on cognitive and physical health. Staying awake for longer than 16 hours slows reaction time, reduces accuracy and alertness, impairs visual and memory processing, and has a negative effect on judgment and decision-making.

How to get better sleep?

- Schedule the day in a way that allows for at least seven hours of quality sleep
- Maintain a consistent wake-up and bedtime routine.
- Use the bed solely for sleeping purposes.
- Avoid spending too much time in bed.
- Only go to bed when feeling genuinely sleepy.

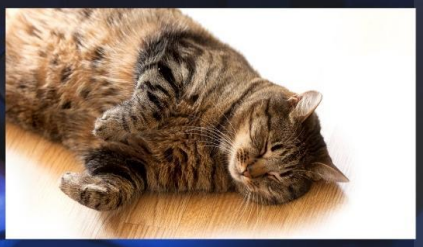
- Limit screen time before bed or wear blue light-blocking glasses.
- Refrain from consuming caffeinated beverages for at least six hours before going to bed.
- Try relaxation methods such as listening to soothing music or audiobooks, practicing breathing exercises, or engaging in progressive muscle relaxation.
- Try cognitive behavioral therapy in case of insomnia.

SLEEP ERGONOMICS

Approximately one-third of our life is spent sleeping. An appropriate sleeping posture is essential to avoid overloading muscles and joints, which can lead to headaches and musculoskeletal pain.

- Sleeping on the back can increase the likelihood of sleep apnea or snoring. Back sleepers are advised to place a small pillow under their knees to promote a comfortable and natural sleeping position that does not place excessive strain on the lumbar spine.

- Sleeping on the side can lead to pressure on your shoulder or pelvis. Place a pillow between the knees to keep the spine aligned and reduce pressure on the hips. If you suffer from acid reflux, try sleeping on the left side.

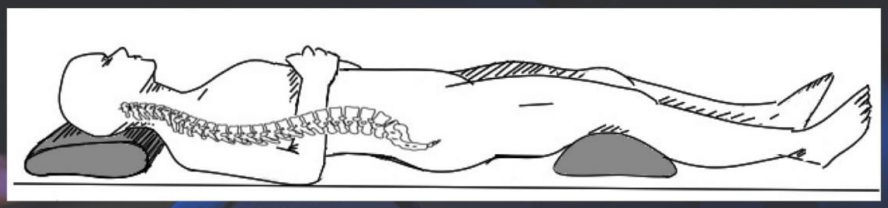


- Sleeping on the stomach can cause significant stress on the spine. It is recommended to place a pillow under the stomach and pelvis to minimize spinal strain. However, consider other sleeping positions.

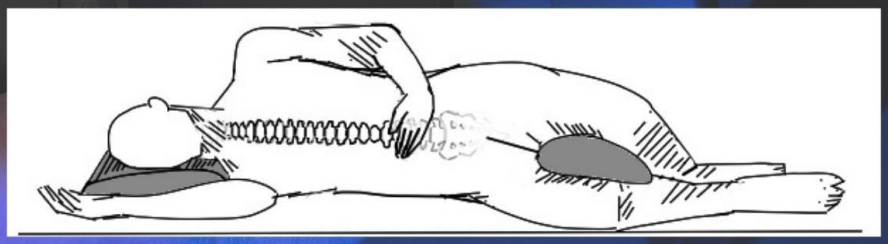
SLEEP ERGONOMICS

A mattress that is too soft or too firm can lead to poor spinal support and discomfort. Choose a mattress that will keep the spine in a neutral position. Too soft mattress won't support the spine, while too hard mattress will cause excessive pressure on your body.

Choose a pillow that will maintain the cervical spine in a neutral position. Try the pillow in person to determine which pillow suits your body's constitution and needs. A pillow with materials that keep the surface cool can potentially enhance sleep quality.



An optimal sleeping position in supine with the help of supportive pillows.



An optimal sleeping position on the side with the help of supportive pillows.

A sub-optimal sleeping position.

The goal of this project is to promote a healthy lifestyle among the gaming community. Esports has gained enormous popularity, but the health aspect is still being forgotten. With healthy habits, the quality of life will increase, and, gaming performance might actually improve.

Hopefully, this guide provided useful information to both gamers and their coaches or teams. Bear in mind, that excessive gameplay training may cause more harm than good. If you suffer from health problems, seek a doctor as soon as possible and start your recovery.

If you finished reading this guide, congratulations! Now go take an active break and do a couple of stretches.

GLHF!

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2023