

THE UNIVERSITY OF NORTH CAROLINA AT PEMBROKE

The Injured Student Musician

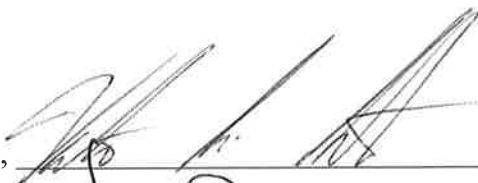
Prepared by:

Christopher James Colón

In partial fulfillment of the requirements for the
Master of Arts in Music Education

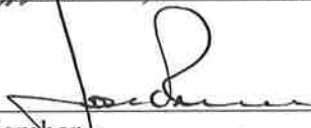
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Abstract

Music students at the university level often get injured. The demands of a music department, the intense competition within a program, and students' high standards to excel can lead the student to play beyond their physical limits. Injured students encounter many problems that negatively affect the student musician's physical, financial, and psychological well-being. Injured student musicians are often left incapable of learning new repertoire because their injury physically limits the amount of time they can perform or practice. In some extreme cases, the injured student musician decides to change their major completely. Since injuries affect a musician psychologically injured student musicians may develop problems such as depression, anxiety, and lack of self-worth, making it more difficult to perform or to return to performing. The innate desire to make music leads an injured musician to continue playing through pain aggravating the injury and often causing permanent damage. Dealing with a performance or practice induced injury, can leave a student in more debt with the medical bills they acquire. Student musicians are hesitant to seek medical attention since the medical profession is quite new to this field. Research literature about diagnosing and treating an injured musician is still fairly limited. This paper will address a variety of ways on how practicing or performance induced injuries affect a student musician, thus facilitating the process of rehabilitation where the injured student musician can return back to performing with minimal physical, psychological, and financial distress.

RESEARCH QUESTIONS

1. What are some of the causes of the injury for student musicians?
2. What does the literature say about injuries among student musicians?
3. In what ways do playing-related injuries affect the student musician?
4. What are some of the preventive measures students can take in order to minimize injury?

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CHAPTER 1 – REVIEW OF LITERATURE

Introduction

Playing-related injuries among student musicians are common. This area of research is growing due to the increase of injuries among musicians. Several researchers have investigated the causes of injury among musicians. In a study by Furuya, Nakahara, Tomoko and Kinoshota (2006), 67% of the respondents reported having sustained a playing-related injury. While numerous risk factors and medical conditions have been discussed at length in journals, difficulties exist in generating accurate assessments of the extent of these problems among musicians. Some issues include the causes of injury, labeling these injuries, and effective treatments available to injured student musicians. Similarly, Furuya et al. (2006) found that 26% of the respondents who reported experiencing a playing-related musculoskeletal disorder (PRMD) were high school students while 41% were college students. Brandfonbrener (2009) did a study on university freshman music students and found that 83% of the participants experienced a performance-related injury prior to their enrollment in college. The increase of injuries does not only apply to the professional world but also to aspiring musicians. Furuya et al. (2006) believe that younger pianists tend to practice more technically demanding pieces in order to compete with other pianists. With the increasing number of student musicians getting injured literature available on musicians' injuries is limited (Heinan, 2008).

Others studies have investigated injuries among working musicians. Manchester (2006) states that more reviews on injuries amongst musicians are warranted. Zaza (1998) believes, "that until musicians' playing-related health problems receive greater

recognition, it is unlikely that their occupational health and safety issues will be adequately addressed” (p.1024). In 1975, due to the increasing number of musicians experiencing hand problems, Dr. Raoul Tubiana (2003) established a medical clinic for musicians, in Paris, France. From 1975 to 2003, Dr. Tubiana saw more than 4000 musicians with playing-related medical problems. In a study by Hansen and Reed (2006), 50% to 80% of musicians experienced physical problems. These playing-related injuries debilitate the performer in ways which include physical, emotional, and financial well-being. Pak and Chesky (2001) reported that most research on keyboard related injuries usually have a limited or small population and because of this it is difficult to establish prevalence of medical problems in pianists. No research was found to determine whether this applies to studies that use other musical instruments. The disadvantage of having a small population is that it is more difficult to generalize outcomes in current research studies. Most research in the area of performance-related injuries has to do with orchestra musicians. Zaza believes research in the area of playing-related musculoskeletal disorder (PRMDs) among musicians should focus more on data collection in order to reduce studies that produce biased results. Zaza (1998) states, “A systematic review of evidence of risk factors would improve our understanding of the causes of PRMDs and help guide prevention programs” (p. 1024).

Several researchers have found that injuries among musicians had a higher or lower correlation to injury than others. According to Hansen and Reed (2006), risk for injury is highest among keyboard and string players. On the other hand, (as cited in McCready & Reid, 2007, p. 144) rate piano and guitar as being highest in incidence of injury. Brandfonbrener (2009) found that voice students ranked lowest as far as

experiencing pain while percussionists ranked highest. Brass, woodwinds, piano, and strings students ranked within the same percentages (between 84%-87%). Zaza (1998) stated string players are at higher risk for playing-related injuries.

Common Injuries among Injured Student Musicians

There is not a universal name to categorize all types of playing-related injuries among musicians because these injuries are difficult to generalize (McCready & Reid, 2007). The types of injuries musicians often report include repetitive strain injury, overuse syndrome, playing-related musculoskeletal disorders, carpal tunnel syndrome, focal dystonia and others. In a recent study, Wood (2014) found that injured musicians were diagnosed with musculoskeletal problems (73.3%), overuse syndrome (22.7%), and nerve entrapments (4%). Other injuries such repetitive strain injury is common among musicians due to the number of times a musician has to play a passage in order to learn it (Heinan, 2008). Injured musicians who suffer from repetitive strain injury experience stiffness, weakness, and cramping in the impacted area.

Other types of injury common among musicians are playing-related musculoskeletal disorders (PRMDs) which include overuse injuries, such as tendinitis, and nerve entrapments, such as carpal tunnel syndrome (Bruno, Lorusso, & L'Abbate, 2008). Zaza (1998) reported that, "prevalence of PRMDs ranged from 87% in adult musicians and from 34% to 62% in secondary school music students" (p. 1023). Furuya et al. (2006) found that PRMDs among pianists were highest among those who played chords at the level of fortissimo. These authors also reported that 32% of the respondents reported having excessive muscles tension. Zaza (1998) states women are at higher risk for PRMDs than men. Furuya et al. (2006) found that "more eager pianists are prone to

have PRMDs” (p. 115). Musicians who considered themselves to be nervous demonstrated a higher incidence of PRMD’s. One of the most common nerve-entrapment disorders that affects musicians is Carpel Tunnel Syndrome (Heinan, 2008, p. 46). This syndrome can cause paresthesia, discomfort, and pain. Lack of treatment of this syndrome can lead to muscle atrophy and loss of motor control. Carpel Tunnel Syndrome is commonly found among string players due to the extended or bent wrist position in their left hands.

Another type of musculoskeletal disorder that is increasing among musicians is Focal dystonia. Focal dystonia, also known as *musicians’ cramp*, is a neurological disorder that decreases the voluntary control of the muscles (Tubiana, 2003). Focal dystonia causes involuntary muscle spasms, uncontrolled repetitive movements, twisting, and abnormal postures (Heinan, 2008). Among the 4000 injured musicians that Tubiana (2003) treated, 600 were diagnosed with focal dystonia. Compared to other disorders experienced by musicians, physical rest usually does not alter the state of focal dystonia (Lie-Nemeth, 2006). Although the causes of this disorder remain unknown, the onset of focal dystonia was found to coincide with a period of especially intense musical activity or a change in musical behavior (Tubiana, 2003). Hoppman, as cited in Heinan (2008), claims that “focal dystonia affects keyboard, string, and woodwind players more than other instrumentalists” (p. 47).

Brass and woodwind players can also develop focal dystonia making it difficult to play one’s instrument, maintain a good embouchure, and sustain high or long notes. (Heinan, 2008). In 1935 Louis Armstrong suffered from this, known as Satchmo’s syndrome, at which point he had to take a year off from playing. For some, focal

dystonia among musicians can make it difficult to write, type, use eating utensils, and brush one's teeth. Focal dystonia experienced by wind players can make it difficult to talk and to eat. Stiffness in the facial muscles can be visible on wind players with focal dystonia (Lie-Nemeth, 2006). Pain is usually not associated with focal dystonia unless the injured musician is using other motions to compensate for the disorder. Other types of syndromes impact musicians.

Overuse syndrome is another type of playing-related injury common to musicians that is caused by repetition and overload of movements that inflict micro-tears in the muscles and ligaments when one has surpassed their biomechanical limits (Heming, 2004). In a study on injury prevention among university music students, Blackie, Stone and Tiernan (1999) found that prolonged repetitive motions, increased playing time, and compromised position due to fatigue increase the risk of overuse syndrome. Heming (2004) defines Overuse Syndrome and how it affects musicians, stating that symptoms often begins with pain, discomfort, functional loss and, occasionally, paresthesia, which can be either a cold, burning, prickling or tingling sensation in the affected part usually after intensive hand activity. Fry, (as cited in Hansen et al., 2006), found that overuse syndrome was present in up to 50% of professional symphony musicians. Sakai (2002) conducted a study on pianists who experienced hand pain due to overuse. The author used the following criteria to determine whether the musicians had acquired an overuse syndrome. The injured musicians had no other pre-existing medical condition and most symptoms occurred during or immediately after playing their instrument and not due to some other non-musical activity. These injured musicians' ability to practice became more and more difficult due to the symptoms of the injury. Overuse Syndrome and other

playing-related injuries can be precipitated by a sudden change in technique or increase in playing time (Heming, 2004).

Causes of Injury among Student Musicians

Understanding the causes of injury is beneficial for developing preventive measures (Hansen & Reed, 2006) given that “about 10% of college instrumental majors sustain an injury each year” (Fry, as cited in Manchester 2006, p. 1). Hansen asserts that knowing the causes of injury is essential in developing prevention procedures for musicians. Manchester (2006) believes that in order to provide injury prevention strategies for musicians, we need a detailed description of the different types of injuries, how often they occur, and knowledge of the possible risk factors. Blackie et al. (1999) anticipate that by increasing awareness of potential risk factors related to overuse injuries and developing good techniques and practice strategies in music schools, performing musicians may anticipate careers less affected by injury. Sakai (2002) affirms that the cause of overuse in musicians should be determined in order to prevent injuries from reoccurring.

Manchester (2006), Pat and Chesky (2001), identify intrinsic and extrinsic risk factors that are often associated with playing-related injuries. Intrinsic risk factors can include size, strength and tone of the muscles in the hands and wrists, flexibility of the joints and fingers, and presence of any underlying musculoskeletal disease. Extrinsic factors include instrument type, technique, and the musician’s environment. According to Manchester (2006) these risk factors are also modifiable and non-modifiable. Some factors, although modifiable are more difficult to achieve. For example, pianos with a smaller width of the keys exist but are difficult to find.

Certain techniques were found to be associated with injuries than others among student musicians. In a study of hand pain among professional pianists, Sakai (2002) found 35% of respondents experienced overuse while they were practicing a specific technique, where "Octaves and chords accounted for 74% of the techniques practiced at the onset" (p. 179). The author did not state at what dynamic intensity these techniques were practiced. Furuya et al. (2006) conducted a study on the prevalence of PRMD's among 203 female Japanese pianists and students. The authors reported that 33% of the respondents stated they felt tense while playing arpeggios with a *legato* articulation, but this type of technique did not show a prevalence of PRMDs among pianists. Contrary to Sakai (2002), pianists who practiced with repetitive motions at higher dynamic intensities, such as *fortissimo* were at risk for PRMDs (Furuya et al., 2006). For pianists, repetitive practice of octaves and chord techniques proved to be the cause of overuse injuries. Sandell et al. (2009) state that playing-related disorders have been attributed to several factors, such as sustained repetition, excessive force, static muscle load, and awkward positioning.

Researchers have found many factors that are associated with injury. Age is a factor, and although increasing age is associated with an increase in injuries (Furuya et al., 2006), information available on younger musicians is limited (Manchester, 2006). This area merits more research since playing-related injuries are also increasing among children musicians (Ranelli, Straker, & Smith, 2008). Another factor that may be risk of injury is gender, although Brandfonbrener (2009) found no significant difference between male and female participants. On the contrary, Heinan (2008) reported that women are

more susceptible to injury, and for this reason the author believes more studies are needed to determine why this is the case.

The research is inclusive about whether there is a positive correlation between injury and hand span among musicians. Furuya et al. (2006) found, "through the use of chi-square tests, that no significant effect of PRMD's was attributed to hand span and muscle strength" (p. 114). One of the environmental factors for student musician is the hand-size ratio to the keyboard. Most of the keyboard instrument instruments older than the modern pianoforte invented around 1700 were smaller in size. Music for the keyboard was composed for a smaller instrument, meaning that the modern piano has a greater width that requires the performer to extend the hand in various and repetitive ways that are potential to harm or injury. Musicians today have to stretch to play pieces that were written for keyboard instruments with smaller key width. A large portion of the repertoire was only playable by a handful of musicians of that era and now these pieces have become part of the standard repertoire. Hand span among student musicians may have some implications on music education. Heming (2004) believes that little attention is paid to physical characteristics of children choosing instruments to play, and this can result in children playing instruments larger than their hand span.

Despite the growing number of studies in musicians there are many factors that are associated with injury. Ackerman and Adams (2004) did a study to see what causes of injury were perceived by violinists and music health experts. Respondents believed that one of the most significant risk factors for injury was poor posture. Musicians generally practice for hours and certain instruments require student musicians to be in awkward and asymmetrical posture formations (Heming, 2004). Asymmetry of the

muscles can develop due to practice postures that are specific to each instrument (Heinan, 2008). Musicians typically adjust or modify their technique to surpass pain and continue playing, however, these adjustments in a way can cause injury to another part of the body due to some type of compensation of the muscles. Wood (2014) found that posture modification occurred more during practice than in performance.

In some cases, playing-related injuries are not caused by the musicians' practice habits but by the instrument which they play (Bruno, Lorusso & L'Abbate, 2008). Developing standardized practice advice for playing-related injuries is difficult, in part, because even instruments of the same brand can differ in the amount of resistance and rebound in the keys. Keyboards, for example, differ in key weight. Bruno et al. (2008) state that information about instrumental characteristics of the piano played is not available in the literature. This includes brand and model, year of construction, vertical versus coda instrument, presence or absence of double escapement mechanism, and other factors. For this reason it may be difficult to distinguish whether injuries are instrument specific even within the same instrument family. Other issues are encountered in the area of ergonomics and playing. For example, university students practice on pianos found in different practice rooms. Some of these pianos are mounted on piano trucks, which raise the height of the piano significantly. Piano benches may or may not be adjustable, meaning the student musician practices on pianos that vary in heights, which may not be appropriate for their build.

Galmain, (as cited in Ackerman and Adams, 2004), believes that the individuals' physical attributes and mental characteristics must also be taken in to account when considering causes of injury. The musician's desire to play music may put

the student musician more at risk to exposure to playing-related injuries due to the numerous repetitions required to learn music (Shafner-Crane, 2006). Heming (2004) states that musicians who want to take their playing to a higher standard will rehearse for a minimum of three hours a day with few breaks. When a musician does not allow sufficient resting time in between practice sessions, proper healing is often delayed.

There are different beliefs on whether warming up is beneficial to the student musician. Wood (2014), reported, "Warm-up among the respondents was at the rate of 68.7% before practice and 68% before performance" (p. 40). Yoshimura et al. (2008) found that warming up before playing was positively correlated with pain. The term warming up included hand stretching by 95% of the participants. These authors did not mention whether or not injury was attributed to stretching. On the other hand, Brandfonbrener (2009) did find a positive correlation of injury between those who did or did not include hand stretching as part of their playing routine. Yoshimura (2008) recommends that stretching needs to be explored more in terms of how much, how long, and how often. Practice routines are specific to each individual, so assessing which practice habits cause injury could be difficult to establish. Length of practice sessions, how often one practices, emphasis on technique, intensity of playing, sight-reading, and level of difficulty of pieces are some ways where every SM's practice routine differs. Even length of practice session can significantly differ from musician to musician. Student musicians can practice anywhere from less than 30 minutes to several hours (Brandfonbrener, 2009). Participants in a study by Wood (2014) had an average practice time that was 15.99 hours during a regular week and 22.8 hours during a peak week.

The research on injuries among marching band members is growing, providing

new perspectives on other ways musicians get injured. Granata, (as cited in Rauchscher, 2009), states that marching bands have evolved significantly in the past 20 years. Marching bands put on highly choreographed performances that involve moving, running, and playing demanding passages while carrying and supporting the weight of their instrument. The physical exertion of a marching band member can be comparable to athletes from a division I program. Rauscher found that more than 95% of marching band members experienced stiffness or muscle soreness, heart-related illnesses, feeling faint and/or nauseous. Marching band members reported feeling frequently tired and 38% of them stated they had suffered an injury as a direct result of participating in marching band. Marching bands have relied on sports research to deal with their injuries. Due to the number of performances, physical activity, competitions, and injuries, marching band should be treated as a sport, because like other sports, marching band requires physical exertion and team work. Marching band students rehearse anywhere between four to five days a week from an hour to two hours per day (Aho, as cited in Gonzalez, 2012). Marching and playing simultaneously is a highly aerobic activity because a large percentage of students use air to play their instrument. The tempo of the music determines how fast one marches from point A to point B on a field, which involves the an increase in blood circulation, causing the heart to work harder. Many students will already have pre-existing injuries and continue to play. Since a large percentage of practices occurs outdoors, students who do not drink plenty of fluids can risk being dehydrated. Vepraskas, (as cited in Gonzalez, 2012), "Marching band students are athletes who practice outdoors under conditions that expose them to dehydration, heat exhaustion, and sunstroke." High school directors do not allow for continuous breaks

during practice due to amount of time required to establish different formations. Some members of marching band are not music majors.

Psychological Impacts

Musicians who acquire a playing-related injury are also affected psychologically. McCready and Reid (2007) state "that when playing one's instrument is disrupted by a physical playing-related injury, student musicians experience not only physical changes, but psychosocial ones as well" (p. 140), which include frustration, stress, depression, isolation, decreased perception in self-worth, and more. Stress can cause muscular tension (Tubiana, 2003) which can lead to injury while playing music. Injuries, learning music, music competitions, and competition within a music program, are examples when student musicians experience an increase in their stress levels. Musicians, such as violinists and pianists, can also have the added stress of having to memorize their music. Musculoskeletal disorders have been compared with psychological stress due to work environment (Sandell, Fryman, Chesky, & Fjellman-Wiklund, 2009), and therefore the causes of PRMDs cannot be attributed solely to repetitive practice. Musicians who get injured can experience depression which should also be treated (Heinan, 2008).

Student musicians who get injured often experience occupational disruption. McCready and Reid (2007) reported detailed accounts of injured student musicians' experience with occupational disruption. The authors define occupational disruption as the period of time that musicians take a break in practicing due to some playing-related injury that has forced them to stop playing their instruments. Sandell et al. (2009) compare music to an occupation where work-related injuries are likely to occur. Heinan (2008) states these injuries can cause financial burden with the cancelation of

performances due to their inability to play. Zaza, as cited in Heinan (2008), stated that, "in a national study of orchestral musicians, 76% of respondents had to take off from performing because they developed a serious injury during their career" (p. 45). Other psychological factors such as eagerness to practice and nervousness were positively correlated to incidence of injury in a study by Furuya et al. (2006). These authors believe eager and nervous pianists are likely to significantly increase their practice load prior to a performance, performance evaluation, and playing tests. Furuya et al. (2006) recommend that future studies need to be conducted on how psychological or personal traits correlate with PRMDs. The data compiled by Brandfonbrener (2009) did not show a relationship between playing-related pain and Music Performance Anxiety (MPA). On the other hand, Furuya et al. (2006) found that musicians who reported experiencing a high level of MPA also showed a higher incidence of PRMDs.

Medical Treatment for the Injured Student Musician

Although medical treatment is important to any injured population, there are numerous reasons why student musicians with playing-related injuries fail to receive medical attention. Shafner-Crane (2006) states that the injured musician may be unwilling to seek medical attention early, because he or she may be concerned that the physician will require the limitation of practice or performance times, or even instruct the musician to stop playing all together. Blackie et al. (1999) state that even with an increase of number of student musicians getting injured, ISMs fail to seek medical attention because they do not believe physicians are sufficiently trained to treat musicians. The inability to treat this population is due in part to ISMs being vague when describing their symptoms to their physicians (Wood, 2014). Injured student musicians

can assist their physicians if the ISM were more aware of the nature of PRMDs. An increased awareness of injuries among musicians would allow the ISM to describe the problem, and facilitate the process of diagnoses and treatment by their physician.

Injured student musicians had an array of negative and positive experiences when seeking medical attention. From the 157 individuals who reported sustaining a PRMD, 69% received medical attention (Furuya et al., 2006). From this group, 30% sought medical treatment from acupuncturists. In a study by Wood (2014), 47% of the respondents were treated and diagnosed by a health professional. The respondents listed having the most dissatisfaction with general practitioners while having their highest satisfaction with physiotherapists. Wood (2014) found that, "65% of the participants sought alternative forms of treatment for their PRMDs" (p. 41). A 20% level of satisfaction was perceived of acupuncturists and occupational therapists. Preferred alternative forms of treatment were Alexander Technique (66%), meditation (63%), and general exercise (50%). These studies did not state the reason why ISMs were dissatisfied with their medical attention. Sakai (2002) believes that physicians need to understand the way musicians play in order to make better diagnoses and treatments. Hand pain experienced by musicians is specific to how they use their hands to play their instrument (Sakai, 2002). Some injuries, for example, are specific to the instrument played and for this reason require different treatment options (McCreedy & Reid, 2007).

Heinan conducted a review of injuries that are unique to musicians. Heinan (2008) believes that all physicians should be knowledgeable in the injuries that are common among musicians. This information is useful for treating professional musicians and for the growing population of people who play music as a leisure activity, because

this population also experiences PRMDs. Musicians are in need of quality care that addresses their physical needs as well as their psychological. Heinan (2008) has designed a procedure for physicians to use when treating injured musicians. Physicians should start with a standard medical history followed by testing for other related conditions as a result of their injury, such as depression. Heinan (2008) recommends that before examining the affected area the physician should first evaluate the student in their performance posture (while holding their instrument and/or playing). The physician should also examine posture away from the instrument to make sure there are not any transferred posture modifications. When examining the affected areas, doctors should look for lesions, swelling, skin color, asymmetry, deformity, and signs of atrophy. Heinan (2008) believes that physicians should document the extent of exposure of risks in the patient's history. Redmond and Tiernan (2001) found that the most prescribed remedies among physicians were gradual increases in practice loads followed by varying the material practiced. Other effective ways to temporarily treat musicians are through the use of rest, icing, compression, and elevation of the impacted area (Heinan, 2008). Wood (2014), noted that although many of the injured student musicians experienced psychological problems, none of them reported seeking treatment from a psychologist or counselor. The income of an average student musician is low, meaning that a large percentage of student musicians did not have the benefit of having health insurance prior to the American Healthcare Act of 2010. None of the research showed nor negated that fact that many of the participants may not have received medical attention due to lack of insurance.

Among treatments options for injured musicians, rest was the most recommended option followed by the adjustment or modification of one's technique (Furuya et al., 2006). Bruno et al. (2008) reported that only 26% of the population never rested during daily practice, while 53.8% of the remaining respondents took breaks only after periods of at least 60 minutes or more of continuous practice. Furuya et al. (2006) found that 66% of respondents took regular periods of rest during practice sessions. No differences in PRMDs were apparent between the groups that took frequent breaks and those who did not. Some injured musicians continue to play through pain until they can no longer perform. (Hansen & Reed, 2006). Wood (2014) conducted a study of PRMDs among jazz pianist in Australia and in the United States. Out of the 106 surveyed, 74 reported continuing to play the piano even while they were experiencing pain. Prevalence of pain was found highest in pianists who were between the ages of 26-30 followed by the group who was between the ages of 21-25. Wood believes that the older age groups (30+) may have had a lower incidence of injury partly due to a larger awareness of PRMDs and the use of coping strategies such as frequent breaks. Brandfonbrener (2009) found that, "most pain experienced by instrumentalists was musculoskeletal in nature" (p. 34).

Yoshimura, Fjellman-Wiklund, Paul, Aerts, and Chesky (2008) conducted a study among piano teachers to determine the risk for injury. The authors found that some subjects always experienced pain during and after playing the piano and that, "more than 90% of the respondents reported experiencing a PRMD's in one or more areas of their upper body" (p. 108). For the majority of respondents, left hand span was greater than that of the right hand. The authors did not state why this was the case, whether or not injuries were more common in the RH of pianists and therefore LH span was greater. In

some cases, the PRMDs experienced by a musician were not localized (Furuya et al. 2006). More than 60% reported experiencing PRMDs on both sides of their body. Symptoms of PRMDs are pain in the affected area, with other side effects such as weakness, stiffness, and cramping (Heinan, 2008). Pain can be located in different areas depending on the instrument played. If left untreated or ignored, the injured student musician can develop playing-related injuries, such as Carpel Tunnel Syndrome (CTS), causing muscle atrophy and motor control problems (Heinan, 2008). Symptoms of Carpel Tunnel Syndrome include discomfort, pain, and paresthesia. Neck and back pain can be caused by poor posture of by the body trying to support the weight of the instrument. Symptoms common among injured student musician include, "pain, weakness, reduced range of motion, numbness, tingling, or loss of motor control, which interferes with their ability to play" (Hansen & Reed, 2006, p. 790).

There are many symptoms as result of playing-related injury. Zaza (1998) stated that, "39% of professional and university student instrumentalists reported pain, weakness, numbness, tingling, or other symptoms that interfere with the ability to play their instrument at the level to which they are accustomed" (p.1022). Larson et al., as cited in Zaza (1998), found that 67% of the respondents, which included university students and faculty, experienced symptoms during performance or practice of music. Bruno et al. (2008) state that 64% of the students considered that "a certain amount of pain is acceptable when attempting to overcome technical difficulties." In some cases pain is not present when playing. Convincing musicians to adopt new practice habits is difficult when they are not experiencing any symptoms of pain (Hansen & Reed, 2006). The United States has the highest cost of health care in the world (Manchester, 2009).

Those whom are interested in the life of student musician should be concerned with this issue. Young male adults are the most likely to be uninsured. There is a need for musicians to be medically insured in order to perform. Countries such as Germany and the Netherlands have health care programs and clinics for performing artists. Universal coverage would be a great advantage in the lives of performing musicians.

CHAPTER 2 - DISCUSSION

Introduction

It is very common for a student musician at the university level to overplay to the point where they injure themselves. These injuries debilitate the performer and impacts the student musician in a variety ways. The purpose of this document is to collect information on how student musicians are impacted by playing-related injuries. The goal of the author is to provide this information in one document where injured student musicians can be informed about injuries that are common among student musicians, understand the causes of injury, use this information to make better choices about the way to practice, see what they could have done differently to prevent injury, know what questions they should ask their medical professional, and realize how other musicians have returned to performing. This document can also be helpful for college professors to understand and relate with their injured student musicians while knowing how to guide their students who deal with an injury. Bragge, Bialocerkowski, and McMeeken (2006), believe that understanding the issues encountered by injured students can inform effective prevention and management strategies for playing-related injuries. The few qualitative studies available at this time focused on Alexander technique, anxiety, and form analysis. Brandfronbrener (as cited in McCready et al. 2007, p. 140), states, "that depending on the instrument being played, an individual may experience different types of pain and injuries may require different therapeutic interventions."

Students who pursue a university degree in music often dedicate a large part of their lives to their instrument. Perhaps the most vigorous transition student musicians encounter is the one that occurs when entering college. In most situations, college

musicians are not prepared for the transition from a private studio or high school music department to the studio in a collegiate setting. Students at this stage are competing with other students of various levels. These can often be much more advanced students at junior, senior, or even graduate levels. Often competing with individuals with these skill-sets places strenuous demands on students to match these students playing ability or become even better than their peers. Competing at this level places huge physical and psychological strains on the body because the student is often not ready for these new performance requirements. As a result of rushing to increase practicing abilities and muscle/joint overuse, many student musicians encounter some type of injury during their undergraduate or graduate studies.

Dealing with a playing-related injury, particularly while in college, can be devastating for the injured student musician (ISM). Practice routines are personal in nature, allowing each person to develop and implement their own unique practicing schedules and procedures. Practicing often leads to higher self-esteem, thus gaining a sense of fulfillment or sense of pride in the aspiring musician's playing/music abilities. Important aspects of practicing are often overlooked by the student musician, such as warming up, stretching, and studying the piece that is being practiced. Student musicians do not understand how important these procedures are to prevent injury, but without proper practicing procedures, student musicians are at risk of becoming injured. Injured student musicians are often required to make many changes to their practice routines and the length of time they can physically practice. When these practice sessions are no longer available to the student musician, the ISM may feel there is something important missing in their life. What makes this more difficult is that the student musician has

developed a dependence on playing music over several years of their life. Music is a lifetime investment and student musicians enter school with that understanding and commitment. Music is part of daily life that is truly enjoyed by the individual. For some, making music is considered an outlet for fun, sociability, or even their way of coping with stress, while for others, music is the driving force in their lives. At any rate, there are several risk factors presented to aspiring musicians and despite these warnings, they choose to perform every day. Being injured can pose an array of physical, social, and psychological problems that need to be explored, discussed, and considered.

Physical, Psychological, and Social Concerns

While improvements have been made to the design of instruments such as the piano, not many changes have been modified to the way musicians play. Although student musicians may have great technique, Smith (2009) argues "rethinking playing technique should be an ongoing process," (p. 34). He goes on to say "our lifestyle and particularly the way we use our bodies has changed a lot in the last 100 years." There are many differences we made as a society that indirectly affects student musicians

A large percentage of university musicians will experience a playing-related injuries at some time during their careers (Park et. al, 2007). Examining current research, one must wonder why music majors pursue music despite the risk of playing-related injuries. Several qualitative studies were conducted and synthesized to determine why musicians still choose music as a career and whether they are willing to choose to play through pain. After careful research amongst their study sample, Park et al. (2007) suggest students decide to continue pursuing music as a career due to personal and environment influences. Contrary to the research presented by Maslow and his theory on

human needs, most musicians are willing to perform even when they are experiencing pain or discomfort. All things considered, 87.7% of college students have experienced some type of injury during their lives, specifically musculoskeletal disorders (Park et. al, 2007).

A playing-related injury (PRI) can be defined as an injury that prevents a musician from playing or an injury that causes pain to the performer when he or she is playing. While the prevalence of acquiring an injury at some point in life as a result of playing is quite high for musicians, there are new measures for PRI prevention. Though medicine has continued to make advancements for the injured musician, one must assess why musicians take the risk of encountering a PRI during their career and thus, what music means to them on an individual level. Park et al. (2007) suggests there are risk factors to assess when entering the music profession, however there are several benefits as well. He looks at music as having different meanings for individuals and exists as a part of academic life, social life, career aspirations, and part of an individual's identity.

In the study conducted by Park et al. (2007), participants had various meanings of music and the impact it had on their life. Participating in music is vigorous and requires much time. As a result, particularly at secondary and post-secondary levels, music becomes a part of the student musicians' daily routine. Student musicians find competition in their departments and this competition often drives them to do their best and excel above other musicians. As these student musicians struggle to meet the demands amongst this population of people, they may discover new talents (Yoshimura et. al, 2006). While competition flourishes in the music department, "musicians were positively described as being cliques, family, and even cult-like due to shared feelings of

compatibility, support, belongingness, and acceptance” (Park et. al, 2007, p. 91). Being involved in music at these levels often fosters a desire to enter music as a career through performing, teaching, or further ambitions.

As musicians continue to pursue music as a career plan, they are reminded of the risk of experiencing a PRI. Examining the perspectives on PRIs, some of the most common peer complaints deal with tendinitis and pain (Shields & Dockrell, 2000). As previously mentioned, it is common for college musicians to experience some form of injury during their college career. When experiencing these PRIs students encounter several obstacles or shortcomings such as requiring musicians to step away from playing music long enough to heal. These musicians often feel their injury will delay academic progress and/or do not have suitable healthcare, finances, and time to manage the injury (Parks et. al, 2007). Considering the emphasis placed on performance in post-secondary schooling, encountering a PRI can be detrimental to a musician’s placement and/or status in the music department. One can understand the challenges that may be presented to the injured student musician as a result of an injury. Taking into account the prevalence of injuries amongst college musicians, specifically the pianist, an assessment of risk-factors and rationale for continuing to pursue a career in music should be obtained.

While there are risks for any student musician, Yoshimura et al. (2006,) suggest “research in performing arts medicine suggests that musicians experience pain and upper extremity musculoskeletal problems from playing the piano” (p. 118). Several studies have been conducted examining factors that may contribute to PRIs. What are these factors and how do they affect the college pianist? Yoshimura (2006) found that factors of injury include age, gender, hand size, technical requirements, biomechanical forces,

and posture". Typical onset of pain is around the traditional college years ranging from eighteen years of age to the age of twenty-four. However, age is not the important concern. Instead of focusing on the age of the pianists (or musician), what should be assessed is their exposure to playing or how long they have been playing the instrument. There is a positive correlation between playing duration and injury. Research studies conclude females generally experience greater pain and more fluently than do males (Yoshimura et al., 2006). For the piano player, anthropometric measurements were taken into account. Arm, forearm, and hand length, in addition to wrist circumference were measured and analyzed. Size is an important aspect to consider as it affects the strength and speed of the performer where negative correlations exist between performers with smaller hands and acquiring a piano related injury (Yoshimura et. al, 2006). More often than not, pianists have greater ranges of stretches with their left hand than they do with their right hand. For pianists, this is largely due to the fact that melody is generally played with the right hand while harmonic support is played with the left hand meaning, the speed of the right hand and use of joints is greater than that of the left hand.

The purposed of research on injuries among musicians is to determine and examine risk factors associated with pain related to playing a musical instrument. An understanding and study of these risk factors should be examined by college musicians in the beginning of the undergraduate career. In order to understand why pain is reported by student musicians, these factors were studied. Applying this information from the beginning "can be applied toward the development of effective preventative strategies and clinical responses to pain" (Yoshimura et. al, 2006, p. 123). Joint mobility is of great concern to the aspiring pianist. Results indicate "finger joint mobility, particularly right

3-4 span, is a risk factor for piano related injury" (Yoshimura et. al, 2006, p. 123). It is important to consider non-musculoskeletal problems as they will be a determinant in how often and to what extent a student musician may practice or perform. For example, a person battling cancer may not have the energy to practice as often as he/she would prior to experiencing the symptoms of the disease. Another, more realistic example is a student musician with poor sleeping and nutritious habits. As a result of the SM's eating habits and sleeping schedule, performing and playing puts increased strain on the body and joints. Contrasting musculoskeletal versus non-musculoskeletal problems is important because overall of the health of a student musician affects the possibility of acquiring an injury. A variety of musculoskeletal and non-musculoskeletal problems should be examined as concerned with the ISM.

Causes

There are many benefits to understanding the causes of injury among student musicians. Technique and practice routines can be tweaked and altered to allow musicians to return to performing, while prevention strategies can be developed for long lasting careers. Keeping the ISM informed about injuries and advices can help ISMs make healthier choices about their practice habits. Pak & Chesky (2001) categorize the causes of injury into two groups known as intrinsic and extrinsic factors. Hansen & Reed (2006) further expand these causes or risk factors into three main groups and label them differently. Extrinsic factors are called environmental factors and intrinsic factors become personal characteristics. The third group is labeled as physical demands. Environmental factors include the instrument, the action or resistance of the keys to be pressed, evenness of the keys, spread of keys (especially on woodwinds), the temperature

of practice room, height of the piano bench, and others. Personal characteristics consist of practice routines preferences, such as duration of practice routines, the desire to make music, and ambition to excel and succeed as a musician. Physical demands are the different types of techniques that include stretches, chords, scales, repeated notes, and other techniques that are required to execute each piece.

Environmental Factors

In order to understand the cause of injury in the environmental factors or instrument type in the area of ISMs one must consider the tendencies of the instrument, how they function and how they differ. Every instrument has their own idiosyncrasies that even instruments from the same maker made in the same year can have various differences in sound, weight in the keys or pistons, and facility of dynamic range. Because of these differences, SMs adjust their technique while practicing in order to emulate or produce the sound that hear in their minds. Pianists and non-pianists alike have to play/perform on different pianos based on availability of practice rooms. Different pianos may require different intensities to produce the same sound. Two different pianos may require a passage to be played with different amounts of energy to get the same desired effect such as a crescendo. There will also be times when ISM will have to use a substitute instrument due to maintenance or forgetting it at home. These instruments may require immediate changes in technique to produce the same sound. No research was found that considered the different brands of instrument that may have been associated with injury. Most studies included questionnaires that asked about things such practice session length and resting periods.

Technique is an environmental factor, but can also be considered a personal characteristic depending on how one views it. Musicians develop their own technique over years of playing. Technique can be considered as an external or environmental factor when a professor teaches a new technique to their student. For pianists, a student's technique is influenced by their teachers and by centuries of keyboard technique provided in standard exercises such as Hanon and *Études*. From this perspective, it is easily understood that why a sudden change in technique is associated with injury, especially when there is not sufficient time for the student musicians' hand to adapt to any new type of playing. One of the environmental factors is the hand-size ratio to the keyboard. Hand size is considered a personal characteristic while the size of the keys is an environmental factor. Most of the keyboard music composed prior to the Romantic period was written for instruments that had keys that were smaller in width. It is also important to understand that the change of width is a minute difference although Sakai (2008) asserts the modern piano has a greater width of the keys that requires the performer to extend the hand in various and repetitive ways that are potential to harm or injury. Furthermore the expansion of the repertoire places more demands on college students. More repertoire means there are more pieces from which a teacher or student can choose. Keyboard players from the classical period only had music from their current period and before. Today's pianists have music from multiple periods from which to learn. Even the music from the Romantic period places great physical challenges for all pianists, since only a handful of musicians from that period were able to execute those pieces. Most student musicians are required to take piano as part of their music studies at the university level. Student musicians such as brass players may not have the dexterity to play with their left

hand due to their nature of only using one hand to play their instrument. Pianistic injuries among brass player is an area that should be explored. Student musicians also take pedagogic classes in different instrument families which require them to play in postures that are not accustomed to and use their hands and bodies in new ways which can also lead to injury. Size of instrument is another instrumental factor. Instruments such as violas are made in various sizes. Larger string instruments, such as a 16 inch versus a 15 inch viola, are typically preferred because of the instruments ability to resonate more and thus produce a better sound. These larger string instruments require the performer to stretch more to reach certain intervals.

Practice rooms are also fall under the category of environmental factors. Temperatures for college buildings are usually regulated by a source other than the current building. Practice room temperatures affect how long it takes for a SM to warm up. Colder practice rooms require students to initially play pieces at slower tempi. In colder environments the muscles tend to contract meaning that the muscles are not as flexible. In hotter practice room environments, students can become dehydrated due to the dry air.

In some cases one environmental factor can effect another. Pianos are finicky instruments since a large percentage of the instrument is made from wood, therefore unregulated temperatures in practice rooms can change the quality and even the shape of the instrument known as warping. Pianos that are not regulated can possibility develop a stiffer and uneven action in the instrument which require the SM to exert more unnecessary or unhealthy force or energy to strike the keys. In order to overcome the problem of having outdated pianos, some colleges have a yearly piano sale where the use

the money from this sale to purchase new and more up to date instruments. Other colleges have contracts with local piano stores where they switch out the pianos every year or semester.

Student musicians are also affected by their class schedules. Maintaining a consistent practice schedule is often difficult due to meeting deadlines for papers, projects, both solo and group, exams, and learning and performing music for other ensembles and concerts. These factors just listed may not be the cause of injury, but can inversely impact a SM, because they may not have the time available or may not choose to warm-up, or practice enough to maintain technique for learning a piece. The positive impact that may be considered is that these extra obligations allow the student to get more resting time than usual.

When looking at environmental factors as external or extrinsic factors, other concepts such as the amount of time required to learn a piece can be included. The amount of time it takes for one to learn music correlates with the SM personal characteristics which include the different types of memory, the way they learn, the facility or difficulty of the piece to be learned, and others. More experienced SMs learn how long it generally takes them to learn a piece to the point where they feel prepared. An experienced musician may choose to talk with their applied professor and choose the repertoire for the next semester immediately after juries. Getting this music in advance is effective for the ISM because of the one month break between the end of the fall semester leading into the spring semester and the three month break between the spring and the fall semester. Therefore assigning repertoire early allows the muscles more time to gradually

get accustomed to new motions of the music without the pressures of mandatory performances such as in juries and recitals.

Intrinsic Factors

According to Pak & Chesky (2001), "intrinsic risk factors include, but are not limited to, size, strength and tone of the muscles in the hand and wrist, flexibility of the joints and fingers, and presence of any underlying musculoskeletal disease" (p. 17). Personal characteristics are generally determined by genetics. Hands that are smaller in size have to further extend than a larger hand for chords, and for large or compound intervals. Even the hand span of an octave on the piano is much of a stretch for many musicians. Some stretches in the piano repertoire are uncomfortable even for the large handed pianists. Student musicians with small hands are accustomed to rolling chords or large intervals that exceed their hand span. For smaller handed musicians, this often becomes an advantage because they do not try to attempt awkward or big stretches that are even difficult for the large handed pianist to achieve. On the contrary, small handed musicians that roll chords all of the time do not develop larger stretches due to relying on rolling chords. Oftentimes the average or larger handed pianist tries to grasp for intervallic chords that are way beyond the normal hand span, making them susceptible to injury because they often resort to over stretching. Some of these awkward or larger stretches can be developed with time as the healthy hand develops flexibility. Having a large hand can also be an issue for student musicians because they have to crunch or compress their hand span for music that uses successive major and minor 2nds. This is found in piano music of Mozart and Haydn, which was written of smaller keyboard instruments of that era. Strength and tone of the muscles also take time to develop and is

usually one of the areas students are impacted when one gets injured. The strength and tone a SM develops is essential for maintaining stamina during practice sessions and performance. The amount of time one can practice is correlated with their stamina. Technique is a process that is developed over years through hours upon hours of practice. Technique is an external factor when it is first influenced by the teacher. After one's body has adapted to this technique, technique becomes an intrinsic factor because it becomes automatic, engrained in the SM's muscle memory. Therefore when the SM executes a particular passage or technique they often do not think about it because it is automatic. These techniques facilitate the learning of new music.

In regards to gender, women are more likely to get hurt than men (Zaza & Farewell, 1997). Researchers that stated this do not supply the information of what percentage of men play piano versus the number of women who play piano. The author found that the studies that did included the gender of the participants, typically had more women than men. Age also plays an important factor where younger people, generally heal faster, whereas they can make more incorrect mistakes and typically use technique that is not biomechanically the most efficient. When compared to younger musicians, older, more seasoned musicians have experience with how to practice more effectively and efficiently. Since seasoned musicians generally have more experience, they tend to make better choices about their practice regimen, time allotted for rest, and balance their choices of repertoire on which they are working.

The factors mentioned by Pak & Chesky only focus on the physical makeup of a person. Using the different labeling of intrinsic factors to personal characteristics opens up new perspectives for this area. Personal characteristics are not limited to the genetics

of the person, but also include their psychological make-up. This includes their practice routines they have developed, their desire or need to practice, their eagerness to excel as a musician, and others. Because practice routines are unique to each individual, it is often difficult to identify causes injury. Every SM has their own preference on how they practice and some of these ways can include practicing in lengthy sessions while others can include multiple smaller segments or sessions. Some choose to practice their difficult pieces first, while others may choose to sight-read. A practice routine that is efficient for one person may not work for another even though that practiced routine may contradict some of the underlying causes of injury.

Musicians have an innate desire to practice. For many, playing an instrument started as a hobby and turned into a passion. Practicing no longer becomes something that a musicians have to do, but something they want to do. There is a sense of intrinsic gratification when they accomplish their musical goals and they see their growth as musicians. As a musician's confidence builds up, so does their passion for music. As their passion increases so does the desire to practice. As their practice routines increase, so does their passion for music. The SM's desire to practice is accompanied by their passion to excel as a musician. This desire can mean that SMs are sometimes going to continue to practice even if they're experiencing pain. Their lack of education on injury, or their perception that they will not get injured can in turn lead them into an array of immediate problems. These problems interfere with their passion of making music and ISM starts to experience negative feelings such as depression and helplessness.

Physical Demands

Each piece in the musical repertoire has its own unique technical demands that are required in order to learn and execute that piece successfully. Some examples of these physical demands are octaves, arpeggios, chords, and stretches. Each SM's prior playing experience prepares them as their technique grows. Students who are working on more pieces with many physical demands are more likely to get hurt compared to a musician who is working on multiple pieces with less physical demands. The insights of the lesson teacher is useful, because their experiences make it possible to make healthy choices in assigning repertoire to their students.

One issue that today's musicians encounter is that the repertoire is constantly growing. As the standard repertoire expands, the technical demands that are imposed on the SM also increase. Student musicians learn music through physical repetition. A student who is accustomed to practicing everything ten times might incur an injury because that is their goal – ten repetitions and therefore they may not stop playing if they start to experience pain. The student musician may not be aware that some techniques require more time and less repetitions, at least in the beginning of the learning phase. In order to decrease incidence of injury when learning new technical demands, students should be in tune to their body and know when to stop practicing. When the goal is to execute a set number of repetitions, one can divide the number of repetitions throughout the day. Using this method allows for the body to get several breaks which allows for resting time.

Society has become much more technologically driven and, as a result, allows people to sit for several hours at a time partaking in such activities as social networking,

browsing, online shopping, and video games. Considering the length of time people sit in today's society, "learning the principles of pain-free, efficient movement is essential" (Smith, 2009, p. 34). Overtraining, fatigue, and performance increase the likelihood of acquiring a playing-related injury that has caused physical, psychological, and social concerns since the first performers (Manchester, 2010). Looking back in history, there is not much documented evidence of playing-related injuries. In the sections to come, the physical, social, and psychological concerns of the injured student musician will be discussed.

Physical Impacts

When playing any instrument, there will be certain physical strain placed on the body. Manchester (2010) suggests "almost by definition, the performance of dance, music, or any other performing art involves physical exertion of some type and some degree" (p. 47). The purpose of this work however, is to discuss the physical effects of the injured student musician and how one acquired those injuries. According to Shields and Dockrell (2000), "it is believed that the instrument played may act as a predisposing factor to sustaining an injury and that it also has a bearing on the type and location of the injury sustained" (p. 155). Among these predisposing factors is the intensity and time applied to practicing one's instrument. A common ailment of student musicians is fatigue brought on by overtraining and performance. Fatigue involves tiring and occurs after approximately 30 minutes of playing, and when fatigue begins to set in, error rates increase (Manchester, 2009). Practice schedules greatly impact the amount of physical exertion put on the body because the majority of a performer's time is spent practicing their art as opposed to performing. Manchester (2009) also points out "It is not

uncommon for instrumentalists, especially pianists and string players, to state that they practice for two hours before taking a break" (p. 47). Considering practice sessions generally last much longer than 30 minutes, interventions should be designed to improve the overall quality of practicing and performance alike.

Gradual conditioning should guide practice schedules. Instead, many musicians choose to play daily and for extended durations of time. "Practicing every day of the week may be a predisposing factor to injury and...even one day's rest will significantly reduce the rate of injury" (Shields & Dockrell, 2000, p. 158). The practice regiment of the performer greatly affects their likelihood to encounter injury and their recovery time especially when practicing certain skills. For example, playing trills and octaves cause greater strain on the hand than playing scales. Technique, therefore impacts the possibility of injury. Several factors including "the number of repetitive movements required when playing the instrument, the required playing posture, the resistance against which force must be applied, and whether the instrument must be supported while it is played" should be considered when describing and examining pain (Shields & Dockrell, 2000, p. 155).

Among pianists, the most common source of pain is between the fingers and the hand however, pain is recorded in several areas including the neck, wrists, arms, and back (Sakai, 2002). One must wonder how so many areas of the body can be impacted due to playing the piano. "This may be due to successive periods where the hands must be supported in a position of mechanical disadvantage," leading to pain in the hand, arm, shoulder, and even back region (Shields & Dockrell, 2000, p. 155). Among symptoms reported, right sided injuries are most common amongst pianist but, as time goes on,

more and more left sided injuries are being treated (Sakai, 2002). Much of this pain can be attributed to overuse/overtraining and poor conditioning. Overtraining generally is used to describe the work of athletes, however practicing and especially performing can be just as physically strenuous as physical exercise. Much like athletes acquire muscle and muscle memory when playing a sport, musicians acquire similar traits.

After playing for years and practicing in the same way, the body develops muscle memory which assists the performer. When student musicians sustain an injury, it is difficult for the musician to return to performing because music is predominately a muscle memory activity. Once something is retained in muscle memory, the performer no longer has to think about what to do because their muscles remember what needs to happen. Musicians repeat passages over and over to master them and therefore engrains them to their muscle memory. Other activities such as analysis, memorization, listening, and others are important and do a great deal to help master a piece, even if only recalling how the piece is supposed to sound. Memorization is a widely used performance tactic which, for violinist and pianists, requires muscle memory (Brandfonbrener, 2009). The process of mastering a piece is impossible without the use of muscle memory. For the advanced musician these motions and flexibility take years of practicing to develop. Yet, ISMs want to return to performing like they were before they were injured, but they do not consider the fact that these physical abilities take time to redevelop. Musicians are essentially athletes even if musicians do not view this idea. There is plenty of insights on information of athletes that is beneficial to musicians such as muscles getting tired and the need for frequent breaks. Also, athletes drink larger amounts of water to help flush out toxins and to cushion their joints.

Injured student musicians often resort to muscle memory when playing. The fact they do not think about what they are doing when playing can pose many problems. Although some techniques have proven to work for them in the past that does not mean that these techniques will work for the ISM, and some of these techniques will take time to reacquire. These injured student musicians need to rethink how they play and what they are playing so that their muscles do not return to automatic mode and have a reoccurrence of injury. This type of training is essential for a long lasting potential career of any musician. If this approach is adopted early, the incidence of injury can be minimized. This type of practice is new for the ISM and takes time to train and to adjust. Injured student musicians can modify their practice routine by minimizing the amount of repetitions needed by the use of other learning and practice strategies. Amongst these strategies are listening to the pieces being studied with the use of anticipating the next sections such as memory switches, score review and analysis, visualizing fingerings for playing passages and others.

Injured student musicians are affected physically by their injuries. Pain affects the continuity required for sleep cycles, which slows down the healing process (Adam & Oswald, 1984). Injured student musicians who are not resting well may not be able to focus or to keep up with a schedule of a variety of classes in which they are enrolled. This means IMs who are not getting adequate sleep have to study harder and longer, which in turn takes away time from other activities such as practicing. Due to their lack of sleep, injured student musicians may not have the mental stamina to do vigorous activities that require high levels of concentration such as writing.

Musicians who are injured practice less due to their pain. Injured student musicians either stop practicing because it hurts too much to practice or because they are afraid of being reinjured. Injured student musicians may not take the physical risks required to learn new repertoire because they are afraid these new motions may cause their injury to reoccur or worsen. Also, ISMs may not be able to distinguish between pain and soreness. Soreness is a part of regular practicing and is normal for newly learned motions which often take time for the body to adapt. Some ISMs may discontinue practicing due to this soreness they experience not realizing it is a part of the growing process (Sakai, 2002). Pain experienced by an ISM impacts their playing ability and non-music related areas. This pain distracts musicians even in non-musical settings. While other students are focusing on the lesson being taught by their professors, ISMs are focused on the pain, swelling, and other negative effects these will have on their potential career. The different types of pain experienced by the ISM are swelling, tightness or stiffness, sweaty or very warm hands, lack of flexibility, throbbing, and others.

Psychological

There are several reasons to explore how an injured student musician is impacted psychologically. First, an injury does not just affect musicians physically. Injured student musicians experience many emotions when affected by their injury. Second, treatment options that focus solely on the physical are not necessarily the most effective especially when these treatments options do not address the psychological problems attributed to dealing with injury. Qaurrier (as cited in Blackie et. al, 1999) "found that treatments focusing only on physical dysfunction of injured musicians brought low percentages of success while treatment addressing all aspects of the individual presented

higher degrees of efficacy” (p. 141). Treating the problem alone does not mean complete healing of the ISM. By addressing the multiple areas that impact an ISM, a holistic approach, healing can be more successful and meet more of the needs of the injured musician who is trying to return to performing. One way to address these issues is to compile the information that is available on how an ISM is affected psychologically. This information can further help counselors, therapists, and physicians understand what problems need to be addressed among ISMs. This information can be utilized by lesson teachers to help their students and can also be beneficial for the teacher to understand their students especially if they have never experienced a playing-related injury. Even though one may understand some of the ways an ISM is affected psychologically, there may be other aspects they may have not considered. By compiling this section of this document, the general population can have access to many ways SM are psychologically impacted by injury.

Student musicians who get injured experience psychosocial and physical problems (McCreedy & Reid, 2007). These problems affect the ISM in many ways. Student musicians who get injured due to a playing-related injury experience frustration (Sakai, 2002). This frustration is associated with their inability to play, to contribute as a part of an ensemble, to compete, and to grow as a musician. When comparing themselves with their colleagues, ISMs feel that they are falling behind while others are moving forward. Injured student musicians also feel frustrated because a passage that would normally be quite simple for them can become an unbearable or unachievable challenge. Their lack of facility leaves the ISM feeling discouraged because they are not making sufficient progress. Even if some progress is attained ISM feel their progress is

not enough to keep up with their peers, the music department's expectations, and their own desire to excel. What makes these feeling worse is that they are followed by other negative emotions.

Student musicians who are affected by a playing-related injury may experience music performance anxiety (MPA). Since music is a physically produced art, musicians may feel that their injury limits the amount of repetitions they can do, and may not feel adequately prepared for performance. This is true for pianists and violinists since performing by memory has been considered the norm. Performing from memory may also put musicians at added risk for injury. An injured student musician may not feel that they have executed enough repetitions to securely memorize their music. This feeling of not practicing enough may cause ISM to accumulate unnecessary tension during a memorized performance and put them at risk for injury. Having this fear can also limit the "free-ness" needed for a spectacular performance.

Blackie et al. (1999), state, "many musicians alter their technique to adapt to pain, while others attempt to play through it" (p. 112). Since musicians, injured and un-injured alike, often decide to play through pain it is important to have an awareness of the consequences associated with not adjusting one's practice routine or technique in order to create a long lasting career. When hand pain goes untreated, the end result can be quite severe resulting in the loss of one's career in music performance. Student musicians have a choice whether or not to play through pain. The choice to play through pain is associated with the fact that making music is more important than the pain they are experiencing while playing. There are several reasons musician chose to play through pain including, passion for this art form, a lack of awareness of how to treat these

injuries, and/or lack of insurance (Sakai, 2002). Student musicians may not understand why they are experiencing this pain especially if playing-related pain is unfamiliar to them. Since pain is felt even when they are not playing, the ISM may think this pain is a result of some other cause and thus choose to continue playing. Injured student musicians are reluctant to seek medical attention. Investigating what fuels these fears may help to uncover strategies that make seeking rehabilitation less threatening. McCready and Reid (2007) suggest investigating these fears may provide helpful information to ISM where they are less hesitant to seek medical help. This also suggests that people are afraid of rehabilitation or the diagnosis/prognosis of the doctor regarding their playing abilities.

Injured student musicians do not want to refer to themselves as injured (McCready & Reid, 2007). Being injured can be associated with the feelings that they are not good enough to be a true musician. The music performance track is also a very competitive area of study. Although this area may have the highest incidence of injury, other tracks of music study also have musicians who are getting injured such as music educators, since performing is typically a requirement for the non-performance music majors. Musicians compare themselves to their musical peers. Musicians that become injured experience psychosocial problems (Blackie et al. 1999). Injured student musicians may feel that that they no longer belong to their group of peers. This is attributed to the fact that ISMs feel they cannot connect with their peers, contribute to their ensemble(s), and perform within their peer group. Musicians who had to stop playing due to a playing-related injuries describe themselves as being disconnected from their group of musical peers (McCready & Reid, 2007).

Musicians often play through pain out of reluctance to take a break from the occupation that is central to their lives (Furuya et. al, 2006). Musicians choose to do this because they have a psychological need to play music. Often this desire overrides their sense of feeling of pain, where the need to make music matters more to them the pain they are experiencing. According to Park et al. (2007), "Abraham Maslow's humanistic hierarchy of needs was used to frame an investigation of the motivation of student musicians to continuing to play music despite the risk of a playing-related injury" (p. 89). It is a basic need to be free from pain, yet musicians constantly play through the pain they are experiencing. Maslow would consider music a higher level need and therefore expects the musician to want to play, even if it is through pain.

Dealing with a PRMD (playing-related musculoskeletal disorder) can even leave an ISM's with alterations to their personality or psyche. Suffering from chronic pain may lead to such intense discomfort and functional limitation that is can change an individual's personality (Zaza, 1998). These changes in personality may affect their relationships with their significant other, their peers, the quality of their school work, and overall self-worth/self-esteem. Lederman, Jourbel, & Smith et al. (as cited in McCready & Reid, 2007, p. 141) state student musicians are reluctant to refer to themselves as injured, because they do not want to be compelled to rest or change their routine or technique. Musicians by nature want to play and for this reason student musicians may fail inform their colleagues, or professors that they are experiencing any pain. Usually the student musician tells their teacher about their pain when it is too late to make minor modifications, such as taking frequent breaks in between practice routines, or decreasing practicing intensity. By bringing about this awareness and communication between

student and teacher, ISMs can avoid aggravating the problem even more which may lead to a speedier recovery by adjusting technique. Also, it is psychologically difficult for a person who is used to practicing a certain number of hours, to adjust their practice routine to be significantly less in quantity. People who are injured for the first time may not know how to cope with these injuries, and this can be detrimental to one's psyche or musical identity. Furthermore, the professors at the university level may not know how to deal with these problems, and may just state that pain is part of the game. Student musicians' motivation to achieve often makes them unwilling to sacrifice practice time in order to recover (Zaza, 1998). This is a psychological issue that needs to be examined and explored.

Social Concerns: Fears

Sociological concerns are often overlooked when dealing with any type of playing-related injury. As Parks et al. (2007) point out "playing an instrument is not always a solo event, and musicians are often involved in groups or ensembles" (p. 93). There is a sense of accomplishment that ISMs lose when they can no longer contribute to the ensemble. Even typical solo instruments, such as the piano, are widely used today as an ensemble instrument in band, piano ensembles, and others. When student musicians are dealing with an injury, not only are they let down themselves, but they feel in debt to their musical peers. In an ensemble each person plays a vital contributing role. When one person is missing or when one part is missing, the overall quality of sound can be impacted. While peers are considered a huge social support most ISMs do not talk with their peers about their injuries fearful they will lose respect of their peers (Parks et al, 2007). Another problem that ISMs encounter is that when they cannot perform due to an

injury, another musician has to deal with the psychological and physical stress of learning the music that was originally the responsibility of another performer. This typically means the substitute musician has to learn new music in a short time frame, which possible makes them susceptible to injury. Putting someone else in that position can add stress and self-blame to the ISM.

While trying to return to performing, ISMs experience some form of fear. This fear can be attributed to the fact that the ISM does not want to experience the multiple feelings associated with an injury, many of which have already been discussed in this document. Because of this fear, students are afraid to increase tempi. For example, when a non-injured student musician is learning a piece, the SM plays around with different tempo ranges. Injured student musicians may stay at a consistent tempo for a longer period of time that renders their growth as stunted or delayed. This fear can leave an ISM far behind in making progress even if their muscles or hands are ready for a tempo increase.

Prevention

According to Redmond and Tiernan (2001), "it is generally agreed that prevention should be taught to musicians before the injury occurs." They go on to say "there is a lack of clarity as to when and how prevention education should be taught and who is responsible for teaching it" (p. 33). After the mid-twenties, it is difficult to change playing habits making it harder to cope with shift in practice schedules and technique in general. Several key elements of technique should be closely monitored and control to prevent injury. Among these techniques are chords, arpeggios, octaves, playing

fortissimo, staccato, and the wide range of notes being played (Redmond & Tiernan, 2001). Exploring how musicians prevent injury can be helpful.

There are several precautions that can be examined and explored. First and foremost, shifting or transitioning to proper technique and posture will limit much pain that is acquired. Musicians, though they learned proper technique and seating styles, they often adjust technique to meet their individual needs. Sometimes, these shifts in technique work for the student, while at other times, it can be the cause of future injury. Mastering proper technique during the college years is the best way to insure a performer has the least likelihood of encountering a playing-related injury. Another element of practice that is often overlooked is warming up and stretching. Much like athletes, musicians need to warm-up, loosen up, and stretch their muscles and joints. According to Bragge et al. (2006), stretching and warming up for ten minutes for every one hour of practice, musicians reduce their chances of experiencing a musculoskeletal disorder by almost one-third. Without proper warming up and stretching, the performer is forcing joint and muscles to move faster than they are ready to move which often triggers inflammation and swelling. While the effects are not felt immediately, continuing this of practicing over several sessions may result in permanent damage. A systematic practice schedule, which focuses on prevention, should be addressed and taught by private teachers in a complete university program.

Additional prevention strategies include educating oneself on the types of injuries that are common for the instrument the performer plays. Having a strong knowledge base helps student musicians understand when to stop playing due to pain. Perhaps if student musicians were more educated on the long term effects of continued strain, they

would be more willing to seek assistance from a health care professional. Redmond & Tiernan (2001) report that most college students do not seek medical attention when encountering an injury because college students go to the doctor less frequently than any other age range of people. This may be due to the fact that medical problems are more experienced in the later 20's than they are in the early 20's when the majority of people attend college.

Rehabilitation

A large majority of college students will encounter some form of performance related injury during their career, if not before they complete their degree of study. When onset of the symptoms occur, like most illnesses, early treatment leads to increased success in rehabilitation. Several items should be considered ranging from how to shift/alter practice schedules to how well someone sleeps and eats (Lee, Hanks, & Schwartz, 2005). Rehabilitation must start from a desire to get better and make the necessary changes to make that happen. One of the elements to a speedy rehabilitation process is having a sympathetic and knowledgeable doctor. Having a doctor who understands the pain the performer is dealing with and one that is willing to offer ISMs strategies is difficult to find in most areas (Lee et. al, 2005). Most performers find coping mechanisms from their private instructors and take on several rehabilitation programs with an aim to one day play "normally" again. A central element of rehabilitation involves getting adequate sleep. Without sleep, the body takes longer to heal and the performer feels more tired and is more aware of the pain he/she is experiencing. In order for the healing process to go as quickly as possible, maintaining a healthy sleeping schedule is of the utmost importance. According to Lee et al. (2005), "ultimately, well-

coordinated playing that combines refined posture, strong fingers, and arm relaxation techniques is an important part of any rehabilitation strategy” (p. 39). Pedagogues can be used during rehabilitation to teach proper techniques and to assist the student musician in finding ways to play that are not harmful to the body. As professional musicians themselves, teachers are going to be more passionate and empathetic with their students than the doctor himself.

By combining medical and other therapeutic approaches, most ISMs are able to complete the rehabilitation process. In some cases, however, the injury is permanent and the performer has to make permanent accommodations or quit playing entirely. When injuries are this severe, it is important to remind these musicians that they do not have to be play in order to continue a career in music. Music education, private lessons, and composing are all ways for musicians to stay connected with their art form. Even if rehabilitation is not an option for the ISM, he/she should be made aware that their condition may impair their playing ability but does not prevent their ability to contribute to a musical world around them.

CHAPTER 3 – CONCLUSION AND RECOMMENDATIONS

Introduction

Injuries debilitate student musicians in many ways. Knowing the causes of injury is essential in developing prevention procedures for musicians (Hansen & Reed, 2006) because university musicians may not be receiving the proper injury prevention training essential to a long lasting musical career (Blackie et al., 1999). Even some musicians who have knowledge in playing-related injuries have expressed a desire to know more about injury prevention (Redmond et al., 2001), with the areas of most interest being specific playing techniques, guidelines for safe practice habits, and strengthening and conditioning. Those who were knowledgeable stated they received information on injury prevention from their teachers, colleagues and workshops which suggests that most information on prevention is obtained from other musicians. Among the different types of prevention techniques taught in lessons are proper body mechanics and posture playing, specific playing techniques, importance of warm-up, and awareness of physical limitations when choosing repertoire.

Prevention

Since playing-related problems can have repercussions that can last anywhere between two to five years, prevention procedures are warranted. Applying some modifications to the way SMs practice can reduce several potential playing-related problems. Student musicians are likely to tell someone about their injury when it is already too late to correct these problems. Student musicians should feel comfortable enough to inform someone about their playing-related injuries. Counselors may be good listeners, but ISMs prefer to talk to some who understands the process of their art form

and someone who can sympathize with their issue. For this reason, lesson teachers and musical peers make perfect candidates for SMs dealing with a playing-related injury. Musicians offer experience and insight, because they thoroughly know the mechanics used to play an instrument even if they do not play that instrument themselves. Typically, this population knows of other injured student musicians with whom they have connected. These connections may be able to direct the ISM to specialists who have dealt with injury who may have treated them or their musical peers.

Paying attention to posture provides several insights for the SM since injuries, such as overuse syndrome, often occur when the fatigued SM continues to play (Blackie et al., 1999). One way to recognize when the SM's is physically tired is when their posture starts to wane. Having a good core would allow for the SM to have stronger muscles to support their body while playing their instrument. This is especially true of marching band students who have to carry large instruments on the field. Another option for the SM is to take a break from playing when they become tired.

Being prepared as far as working on music consistently is a way to avoid last minute practicing, which is also a helpful way of preventing injury. Being prepared is beneficial for the ISM because they are not practicing or cramming large quantities of music, which is often associated with a sudden increase in practice time. Student musicians are likely to practice significantly the day before their lesson, recital, and/or jury. Music can take substantial time to learn, and therefore planning out musical goals as far as what to learn and how long it will take to learn it is an efficient way to avoid injury. The SM's body needs ample time to learn and get acquainted with new motions. Increasing practice loads gradually allows for a healthier approach for building physical

and mental endurance. Memorizing music is beneficial to ISMs because they can focus more of their attention to their movements or motions while playing. Rigid and jerky movements in music that is not memorized and in sight-reading, due to unfamiliarity of the music, are highly associated with injury among musicians. Sight-reading and playing at slow tempi decreases the possibility of non-fluid movements and are some ways the SM can decrease the incidence of injury.

There are several ways to practice that are effective for prevention. Playing at higher intensities, such as *fortissimo*, were positively correlated with injury. Student musicians can avoid injury by practicing music at lower intensities and use intensities such as *forte* and *fortissimo* during lessons and performances. When one has to play at a dynamic intensity of *fortissimo*, the SM can use his or her whole body to produce that sound. Student musicians can use devices such as a microphone and/or amplifiers, to help hear themselves and thus allowing them the opportunity to use a less dynamic intensity to play their instrument.

Practicing certain musical techniques were associated with injury (Redmond and Tiernan, 2001). Some advices are to gradually increase technical practice and the number of repetitions of a passage. Having an awareness of how their bodies feel allows SMs to make smarter choices about the way they practice. Musicians should be in tuned with their bodies to recognize when a motion is not comfortable. Student musicians need to also be aware of the causes of injury that are common to their instrument type. For pianists this could meaning knowing that carpel tunnel syndrome is an injury many pianists can encounter. Often the cause of injury can be they instrument on which the student musician plays. Student musicians should make sure that their instruments are

maintained in working condition. Stiff keys require the musician to use more unnecessary and unhealthy force to play their instrument. Most musicians are required to take piano as part of their college curriculum. Pianos at universities are not always maintained, and musicians should avoid these instruments. Student musicians can also indirectly help other SMs by informing their department chair about these out of date pianos. University music departments should provide piano benches that are adjustable, especially for the practice rooms that have pianos mounted on piano trucks.

Having a balanced repertoire per semester and per recital is beneficial to the SM. The SM's repertoire can have a variety of pieces that include both fast and slow tempi, high and low intensities, and others. In order to avoid injury SMs should make sure not to over practice and to stop practicing if they are experiencing pain. Student musicians should include researching injuries and injury prevention as part of their routine. Student Musicians, as athletes, should drink plenty of fluids and get adequate rest.

Recommendations for the Injured Student Musician

Many musicians' lives revolve around music. This in part has to do with the many hours they have grown accustomed to practicing and playing. Whenever possible, the injured student musician should maintain musical activity (Tubiana, 2003). Since injuries can hinder student musicians' ability to play, ISMs can resort to other types of musical activity which can include composing, listening, analyzing, studying, and teaching music which allows them stay connected to the musical world. Musicians stated feeling frustrated seeking help for their playing-related injuries (Wood, 2014). Universities can help decrease the frustration experienced by injured student musicians by providing resources to them such as who they should talk to if the start having

playing-related problems. Teachers can have a list or directory of physicians to whom they can refer their students. This directory can list physicians by area and by what type of instrumentalists and injuries they treat.

Injured student musicians can facilitate and expedite the diagnoses and treatment process by being prepared before seeing their physician. This includes reviewing and bringing a practice/pain journal to their appointment that has a record of the things they practiced, number of repetitions, tempo, and when in their practice routine they started to experience pain. This form of documentation would allow for injured student musicians to answer their physician more accurately. If ISMs are unaware about any information, or if there was something they could not remember, they might be able to refer to their practice/pain journal. Musicians, who have an instrument that is mobile, can bring their instrument to their appointment. Ideally, a physician who is accustomed to treating musicians would have a piano/digital keyboard for pianists.

One thing that is consistent with music education is that warming up is important. Warming up allows the body to get ready for the vigorous motions involved in making music. However, just like practice routines, warm-up routines are also unique to each student. Some musicians may start their warm-up routine with technical exercises, while for others choose to play through a series of small pieces. In some cases SM may not warm-up maybe in part to lack of time between classes due to a busy schedule. Although a sudden increase of practice time or change of technique is associated with incidence of injury, no the information was found on increasing warm-up time or adding new technical exercises. The recommendation for the student musician is for them to continue to warming up the way in which they were accustomed unless it causes them pain. The

ISM who cannot complete their warm-up routine should create a new warm-up routine that contains a small percentage of their original. Injured student musicians then can implement other aspects of their original warm-up routine. These additions and changes should be accomplished gradually, with new warm-up activities done at slower tempi.

Physically, there are different levels of injury and how it affects the ISM. When the injury is not the hand of the dominance the ISM is more capable of dealing with their injury when it comes completing school work. When the injury sustained is in the hand of dominance, many subsequent problems are encountered. For example, it is difficult to write or take notes in a class. The pain experienced from writing, makes it difficult for the ISM to return to performing when they should be in a period of physical rest. Injured student musicians encounter other problems with their academia. Since pain typically manifests itself at night, ISMs can have trouble sleeping, which makes it difficult to focus and take accurate notes in class. One solution to compensate for this is for the ISM to ask permission to tape record the class in that way they can take post notes and have the class information available to them in a format that is more accessible to the ISM.

One of the strategies associated with the injured pianist is for the college professor to assign one-handed repertoire for the non-injured hand. This strategy is effective because it allows the injured college pianist to maintain musical activity. Although this strategy is effective there are some problems that need to be considered. One-handed repertoire often requires that one single hand do the job of two hands. Therefore, the use of that one hand is increased significantly. The injured college pianists who is not aware of the causes of injury may drastically increase their practice for that

one hand and sustain an injury in that hand. When a pianist experiences an injury in both hands they become severely debilitated since they find themselves unable to play at all.

Practicing certain techniques were harmful and can put musicians at risk for injury (Redmond and Tiernan, 2001). Some types of injuries are specific to the instrument played while other principles can apply to multiple instruments and instrument families. Knowing what causes of injuries are particular to each instrument means ISMs can reduce or completely avoid or reduce these playing-related motions so that they can still play and maintain musical activity. Gradually implementing these techniques allows the body to adjust. Learning these techniques at slow tempi is beneficial for the goal is to get the muscles moving in that direction.

Injured student musicians have to change the way they think. From a psychological perspective, ISMs need to learn that healing from a playing-related injury takes time. For example, a person who hurts their leg, does not attempt to run. Instead they have to walk until they develop the strength and endurance to run. Injured student musicians also need to understand that generally it will take them longer to learn music because they will not be able to practice as many repetitions nor will they be able to practice as long as they are accustomed to before they were injured. Musicians should gauge the length of their practice durations. Musicians tend to increase the amount of time they practice the day before their lesson (Wood, 2014). Scheduling practice times can reduce last minute practicing and lower fluctuations in practice durations. This is not always achievable for the ISM due to the pain they often experience and their school schedule. Shorter practice durations are effective for the ISM because it allows for maintain musical activity, while limiting overuse and can limit the reoccurrence of injury.

Taking frequent breaks allows the muscles to relax and can be helpful for maintaining a good posture. When student musicians are injured they need to re-learn how to balance their practice routine. This includes varying what they practice routine according to how they feel. This can mean practicing a variety of things in a random order.

Changing practices habits such as decreasing tempo and dynamic intensities are recommended. Furuya (2006) found that practicing chords at the dynamic level of *fortissimo* lead to injury. As a guide, teachers can instruct ISM to play passages at lower intensities to avoid re-injury. In this way the ISM conserves energy that can be used to play and learn more music. The ISM should also limit the number of repetitions they play a passage in order to lower the incidence of repetitive strain injuries (RSI). Injured student musicians can also play music at slower tempi allowing for the body to gradually get used to the motions of the music. Slow practice allows for the ISM to be more aware of their motions, correcting rigid or jerky motions that are not biomechanically efficient. Sight-reading is musical activity that can be a series of erratic movements, and therefore should also be done at slow tempi.

Juries are a requirement for most music programs. Notifying the jury panel about the ISM's injury in advance will allow them to understand why pieces may be learned incompletely or significantly under tempo. Since juries are a requirement, playing at slower tempi is a more effective long term goal than trying to play music a tempo and risk re-injuring themselves. Teachers can have a repertoire list for that caters to injured musicians. These lists can challenge the ISM musically while keeping their physical playing down to a minimum. Teachers should also develop strategies for musicians who get injured at various times during the semester such as change of repertoire.

Assignments in applied lesson usually include research papers about composers and information about their instrument. Injury prevention and research on injuries should also be included as part of the university students' lessons. Musicians have a love for music and in some cases they decide to be involved in multiple ensembles. Limiting the number of ensembles the ISM is in would be a benefit for the ISM because it lowers the amount of their playing time.

Teachers should be more knowledgeable in injuries among musicians. Knowledge of these injuries can be used to help inform the ISM and to develop solutions that would cater to the problems they experience. Injured student musicians can ask their lesson teacher to watch their posture during their lesson. Musicians who start to experience injury should inform lessons teacher if they are experiencing pain. Lesson teachers usually have experience with students who have acquired an injury. That teacher may be able to recommend some strategies that have worked for other ISMs. By doing this, the teacher may be able to recommend solutions for the playing-related injury such as changing or reducing repertoire of study, limiting technical exercises, and others. Student musicians should also seek medical attention early as early as possible. Due to the Affordable Health Care Act, students are required to have insurance to attend college.

Injured student musicians need to have someone they can talk to about their inability to play due to their playing-related problems. Injured student musicians can consider forming a support group where they can discuss their feelings and what options they chose. This way they form a network with people who have been injured. Injured musicians can seek out other ISMs to see what solutions may have worked for them. Injured student musicians should limit practicing while on medication because

medication may mask pain, which in turn can cause more problems. There are other medical reasons to avoid prolonged use of NSAIDs and ISMs should be aware of the complications. As a general rule, both the injured and non-injured student musician should stop practicing when experiencing pain.

Implications for future research

Underuse among injured student musicians needs to also be explored with overuse (Yoshimura, 2008). Physicians usually recommend that injured musicians stop playing anywhere from two to seven days (Heinan, 2008). Although rest is warranted and important, finding the minimum resting time to allow the music to return to playing is important. Students who are injured might try to practice like they are accustomed to and therefore are at risk re-injuring themselves. Practice routines or ways to practice should be developed for ISMs.

There are a few recommendations for Research. Pat and Chesky (2001) states they research studies among injured musicians need to have larger samples. Research on men versus women getting injured needs to be explored more. Research needs to be conducted on sight-reading and improvisation with the possible use of rigid motions used to play improvised music and sight-reading and its implications on injuries among musicians. Another area can be the possible effects of playing-related injuries found in student musicians that play more than one instrument. Interviews with damaged artists may provide other insights and perspective to injury.

The use of recording technology for practice routines is both helpful and beneficial to the ISM and the SM alike. This technique allows for musicians to get instant feedback while providing them a brief period of resting time while they are

listening. The way this works is that for every passage that is required to play, the listening/resting time is at least the same amount of time if not slightly longer if the ISM were to listen to the recording in multiple successions. By incorporating listening into this type of practice session, injured student musicians can hear what parts of their playing might be harsh sounding, thus allowing them to re-evaluate their hand usage of that passage. This type of practice gives ISM practice routine purpose while incorporating critical listening, which is another way of maintaining musical activity. Injured student musicians can also take this time to think about ergonomic decisions in their playing by identifying musical passages that cause pain or discomfort.

Directions for the Practice/Pain Journal

The Pain/Practice Journal is an efficient way for the injured student musician to document practice habits and injuries. The purpose of this journal is for allow for the ISM and teacher to see patterns that may be conducive to injury and therefore correct these problems before they cause long-term effects. This document is designed to be completed in just a few seconds making it more feasible for ISM to document their injuries. Most items are already listed and can just be circled. By reviewing and analyzing their practice/pain journal, the ISM can find the routines that works best for them.

Conclusion

It is common for student musicians to acquire a playing-related injury while majoring in music at the university level. A sudden increase was found to be one of the main causes of injury among student musicians. Student musicians tend to increase their practice and playing time in order to compete with other musicians in their program. Playing at high intensities, such as *fortissimo*, were also positively correlated with injury.

These injuries debilitate the performer's ability to play while also impacting their academic studies. Musicians who sustain a playing-related injury are impacted physically, psychologically, and medically. Students who are injured fail to seek medical attention due to their negative experiences with physicians. This in part has to do with the physicians' unfamiliarity with injuries among musicians and their diagnoses which typically require to stop playing their instrument for lengthy periods of time. Prevention was the most effective way to ways to help injured and uninjured student musicians alike followed by a gradual change in practice routine such as duration, intensity, and the inclusion of frequent breaks.

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