Injury Prevention – What Can Music Teachers Do?

Abstract

Research in performing arts medicine has demonstrated that approximately 25% of music students experience a playing-related injury\(^1\). Since musicians’ musculoskeletal injuries are associated with several factors related to practice habits\(^2,3,4\), music teachers can and should play a vital role in injury prevention. There is evidence that music teachers who receive relevant training in music-specific physiology do make changes in their teaching, and that these changes subsequently benefit their students\(^5\).

This paper aims to provide music teachers with practical prevention strategies that can be used with all instrumentalists. Included are specific instructions regarding the nature and importance of several strategies, including: taking breaks, pacing techniques, cognitive rehearsal, ergonomics, warm-up and cool-down, preparing for performances, and the question of whether or not stretching is advisable. Emphasis will be placed on how music teachers (regardless of instrument) can incorporate prevention strategies into their lessons.
Introduction

The risk of injury in musicians has been well established over the past 25 years. Concerns regarding the risk of becoming injured have been increasingly present in the music world. In 2003, the National Association of Schools of Music (NASM), the accrediting body for degree-granting music institutions in the United States, adopted the following statement for its handbook: “Institutions should assist students to acquire knowledge from qualified professionals and authoritative medical sources regarding the maintenance of professional health and the prevention of performance injuries.” 6 Despite this statement, only a “handful” of NASM-accredited institutions have devoted resources to musicians’ health. 7 Despite these efforts, the basic question remains: What can music teachers do to prevent injuries? Although not wide-spread, prevention education programs have been developed and implemented for music teachers and students alike. For example, Spahn and her colleagues8 demonstrated that their prevention education course for Conservatory music students was effective in improving several aspects of health and musicianship. Studies show that music teachers who learn about injury prevention do pass it along to their students9. Many music teachers learn about injury prevention through contact with other teachers and musicians, attendance at workshops, and through reading articles. The purpose of this paper, then, is to present evidence-based prevention strategies for music teachers, with the intent of putting the information into the hands of a very influential group of individuals. The hope is that this paper will assist in ultimately reducing these potentially career-threatening injuries.

Prevalence and Types of Injuries Among Musicians
Injuries to the upper extremity (hand, arm and shoulder) are common in musicians\textsuperscript{10,11}. These include overuse problems, strains and sprains, inflammatory conditions (e.g., tendonitis, tenosynovitis), nerve compression problems (e.g., carpal tunnel syndrome), and other neurological conditions such as focal dystonia. Instrumentalists also experience symptoms in the back and neck\textsuperscript{12,13,14}, but these have been less well described in the performing arts medicine literature. Temperomandibular joint disorder (TMJ), which affects the joints between the jaw and skull, can be a concern for some, and others may experience skin disorders (e.g. violinists’ neck). Musicians can also experience high levels of performance anxiety\textsuperscript{15} and other mental health concerns.

Reported prevalence rates of playing-related injuries in instrumental musicians vary from 26 to 93%. It is difficult to know the true prevalence of these problems within the musician community, because processes for definitive diagnoses have not been fully established, many research papers use different definitions or fail to define playing-related injuries, and many studies are fraught with methodological problems\textsuperscript{16,17}. In addition, there are vast differences in the frequencies of certain types of injuries between different common instrument groups (piano, upper strings, guitar, flute, other woodwinds, and percussion)\textsuperscript{18}.

\textbf{Risk Factors for Playing-Related Injuries}

An important risk factor for playing-related injuries is the use of repetitive movements during extended hours of practice\textsuperscript{3}. In particular, a rapid increase in practice time appears
to predispose musicians to injury\textsuperscript{19,20}. This may occur when preparing for an important audition or performance, or when beginning professional music studies. Stress and anxiety appear to be risk factors in acquiring injuries\textsuperscript{4}. In addition, stress has been shown to impact on performance\textsuperscript{21}.

Awkward body positions mandated by the shape and weight of the instrument, the technical difficulty of the repertoire, and playing unfamiliar instruments may also contribute to injuries\textsuperscript{22}. In addition, the total number of years playing may be a risk factor for playing-related injuries. For example, Yoshimura and her colleagues\textsuperscript{23} found that an increased number of years playing the piano was a significant predictor of pain in pianists.

Perhaps most importantly in terms of the goals of this paper, it has been demonstrated that taking breaks during practice sessions and doing a physical warm-up prior to playing may be related to a decrease in playing-related injuries\textsuperscript{4}. It has also been shown that student technique can be influenced by teaching students to be more efficient in their practicing\textsuperscript{24}. The time intensity of a practice session can also be changed by students and their teachers.

Some risk factors are not modifiable. These include gender (women appear to be more at risk than men); instrument played (string players and pianists have higher rates of injury); age, and Body Mass Index (BMI) (older musicians and those with higher BMI are at an increased risk of injury)\textsuperscript{4}. In addition, hypermobility (‘double jointedness’) may be a risk
factor, although it is important to note that hypermobility appears to be more common in
the musician population than in the general population. The relationship between
hypermobility and injuries remains unclear\textsuperscript{25}.

Many of the factors that contribute to playing-related injuries are related to playing
behaviours, and these behavioral factors are modifiable. Students can be taught good
playing habits which may help prevent future injuries. Therefore, it is important that
teachers not only tell students what to practice, but show them \textit{how} to practice. In the
next section, we describe how music teachers can translate the research about suspected
risk factors for playing-related injuries into good practice habits for students.

\textbf{Prevention Strategies}

The following are modifiable risk factors for music-related injuries.

\begin{center}
\begin{tabular}{ |l| }
\hline
\textbf{Modifiable Factors Affecting Injury} \\
Warm-Up \\
Breaks \\
Posture, Playing Position \\
Technique \\
Repetition \\
Pacing \\
\hline
\end{tabular}
\end{center}
**Warm-Up**

Many teachers advocate a musical warm-up, which is important in preparing the body and mind for performance. However, this can and should be combined with a physical warm-up. Students should be advised against playing with cold hands in a cold room, for reasons of intonation and instrument care as much as for injury prevention. For wind players, deep breathing exercises, focusing on lowering the diaphragm without raising the shoulders, can assist in preparing the body for playing. Long tones in a comfortable range are advocated in order to prepare the small muscles of the face and mouth. Students can then move on to short pieces of minimal technical requirement, or moderately paced scales and arpeggios. For pianists and string players, slow, comfortable playing (e.g. scales, arpeggios or easy repertoire) is advocated during warm-up. String players may wish to use open strings where possible. Technically demanding material or techniques, such as octaves for the pianists and double stops for string players, should be avoided. For all instrument types, teachers should demonstrate an appropriate warm-up routine and advise students to follow this routine during all their practice sessions at home.

**Stretching**

The scientific literature about stretching in musicians is inconclusive. Athletic trainers in the past have claimed that stretching improves performance and reduces injuries in athletes; however, there is no conclusive evidence that stretching prevents injury in healthy individuals. It is safe to say that bouncing the limb during stretching (called ‘ballistic’ stretching) should be avoided. There is some evidence that dynamic stretching (doing a movement that takes a joint near the end range of motion) produces greater benefits for high-speed movements\(^{26,27}\), but this has not been applied to musicians. There
is also evidence that stretching may reduce the sensations of stiffness and soreness when performing new activities\textsuperscript{28}. If stretching is done, then the safest way to approach it is to go slowly and gently, and to avoid any stretching that causes pain. It is helpful to adopt postures that are different than those used in playing. For example, pianists can stand, lift the head and chin, and gently lean backwards to extend the back. They may also turn their palms upward and extend their wrists and fingers. Keep in mind that it isn’t how far you stretch a muscle that counts, it’s how long you hold it. It’s important to note that many musicians create injuries by stretching too forcefully, because they erroneously think that stretching more or stretching farther is better (e.g., “if stretching 3 times is good, then stretching 9 times is better.”)

**Breaks**

No specific research on how long and how frequently musicians should break has been found by the authors. However, studies with non-musician workers have shown some indication that taking breaks is helpful in preventing injuries\textsuperscript{29,30,31}. Students should be encouraged to incorporate two kinds of breaks into their practice routine: microbreaks, and breaks away from playing. A microbreak might consist of or stopping for 30 seconds, or counting rests when practicing a piece with accompaniment. For wind instrumentalists, counting rests can greatly increase perceived stamina for a long recital and may not only prevent injury, but may also improve students’ self-confidence.
Longer breaks away from the instrument should also be encouraged. Tubiana and Amadio\textsuperscript{32} write that “most music teachers suggest a 5-minute breaks after 30 minutes of practice”. However, clinical experience of the first author and research in occupational health suggests that this will vary significantly with the instrument, repertoire, and student familiarity with the piece\textsuperscript{29,33}. This does not mean that students need to leave the room and forget about music. They should, however, change position and do an activity that does not involve the muscles or postures that are used for playing. For example, a pianist could stand up, do some gentle stretches, and visualize performing the piece at an upcoming recital. A woodwind player who was practicing in standing could sit down and sing her part as mental rehearsal. Fingering parts while not playing is not a complete break, since the muscles of the fingers and posture of the hands, arms and body are still being used.

**Playing Position**

All instrumentalists should be aware of the natural curvatures of the spine, and maintain these normal curves when sitting or standing. (FIGURE 1; FIGURE 2) Posture should not be static, and students should be encouraged to move with the music and as required by the instrument (e.g. leaning the pelvis to the right to reach higher notes on the piano). When possible, instruments sized to the body of the student should be chosen, rather than expecting the child to ‘grow into’ the instrument. Lastly, keep in mind the relationship between the sheet music and the student’s body posture. The height of the music may
encourage poor posture if it is not level with the eyes (older students who use bifocals may need the music lower).

Parents need to be included in the education of the specifics of playing posture for children, so that this can be monitored at home. This could be done through inclusion of information about playing position in a teacher’s introductory letter, or in a course outline.
Sitting

When sitting to perform, musicians are often told to sit at the edge of their chair and some tend to overextend the lower back in an effort to ‘sit up straight’. Sitting tall (shoulders down and back, chin not jutted out, not slouching) is important. However, in addition to the common ‘slouching’ seen in many students, the first author has also observed hyperextension in the lower back of musicians who sit at the edge of their chairs. Both of these extremes can cause unnecessary tension and pain in the lower and mid-back. Whether at the edge of the chair or not, sitting posture should focus on maintaining the natural curves of the spine and ensuring that the feet are flat on the floor (except in the case of pianists and harpists, who need foot mobility for pedals). The student’s body weight should be evenly distributed through the buttocks, legs and feet. Students should learn to ‘fit’ themselves to their playing position, and to check for common problems (e.g. pianists sitting too close or too far from the piano).

Chairs should be relatively flat, not highly curved surfaces, parallel to the floor or tilted forward no more than 20 degrees (not tilted backward), and preferably lightly padded. The seat depth should stop one or two inches behind the bend of the knee. A solid back piece is preferred, so that students can use the backrest for support if needed. Pianists should use adjustable benches, and teachers should adjust the height for students to demonstrate the appropriate position. The height of the chair or bench should allow the student to sit with hips, knees and ankles bent at right angles (90 degrees), or slightly higher for use of foot pedals. Some healthcare practitioners advocate a slightly forward-tilting posture in order to promote a natural curve in the lumbar spine. In both cases,
feet and buttocks should be solidly planted in order to provide stability for the moving upper body parts. If necessary, a footrest can be used (e.g. phone book). It should be noted that the desirable characteristics of a chair are often not found in the folding chairs commonly used in school auditoriums or classrooms. Schools should consider purchasing stacking (not folding) chairs with flat seats at 2 or 3 different heights to accommodate varied and growing body sizes.

**Standing**

When standing to play, the most common postural ‘error’ is to lock the knees backward. This may cause slouching through the mid- to upper back and shoulder areas. Encouraging students to unlock their knees often corrects many postural difficulties, and can increase expression in the music if accompanied by gentle movement. Feet should be placed about shoulder width apart, with shoulders down and back, and the chin not jutted out.

Ergonomic principles teach us that neutral joint postures are desirable for optimal functioning of the muscles and minimal injury. Wherever possible, teachers should examine students for extreme postures and see if they can be corrected (e.g. bent wrists should be straight; head should not be tilted forward). The following photos illustrate some common postural concerns and corrections that may be applied by teachers in lessons.

**Repetition**
While repetition is integral to performing music, it is also a risk factor for injuries.

However, there are ways to reduce repetition, which can include practice techniques that may benefit the student in ways other than simply injury prevention.

Figure 3 & 4. Left – Woodwind player sitting at the edge of the chair and demonstrating hyperextension of the lower back. Her knees and hips are not at right angles, and the music stand is too low. Right – By moving to the back of the chair and supporting the feet, the back is in better alignment and the hips and knees are now at right angles. The music stand was also raised.

Figures 5, 6 & 7: Child at piano. Left: Child is seated too far away from the piano. Note the extended elbow and slight wrist extension. Middle: Child is seated too close, and is
compensating by bending over the piano at the neck. Note the elbows are too bent. Right: Good position. The elbows are at right angles, and the wrists are straight. The child is able to sit straight and maintain normal spine curves.

Figures 8 & 9. Small child at the piano. Left – child is seated too low due to his small stature. Note the elbows are too bent and the wrists are below the keys. Right – the adjustable bench was raised and a stool placed under the child’s feet. Note the elbows are now at right angles and the wrists are straight.

Smart Practicing

‘Smart practicing’ includes teaching students not to start at bar 1 and play through the piece, no matter what mistakes may be made, until the double bar. Students should practice short chunks of music (e.g. a few bars, a phrase) when learning a new piece. They can learn to be like ‘detectives’, and try to find where problems arise in the music (is it fingering? Bowing? Uneven rhythm?). Problem areas should be practiced slowly until accurate, and only then should the tempo be increased, without compromising
technique or sound. ‘Muscle memory’ is involved performing music, and it is important that the correct movements be learned, so that they can be relied upon at higher speeds.

**Cognitive Rehearsal and Imagery**

Mental (cognitive) practicing (i.e., practicing away from the instrument) can help reduce repetition, and can benefit the learning process. For example, learning the fingering of a scale on a table top first, then going to the piano; or listening to recordings of the piece and studying the chord structure before playing it, or visualizing oneself practicing arpeggios or scales, or a piece. Research shows that visualizing a successful performance improves perceived self-efficacy, and this in turn is likely to improve performance. We also know that people who first visualize themselves performing have better performances than those who do not.

Guided imagery (imagining oneself go through all the steps in a performance, right through to a successful result) is an effective strategy for reducing performance anxiety and increasing confidence. Guided imagery can therefore be a powerful tool in students’ preparation for performances.

**Pacing**

As mentioned previously, it is important that students not ‘crash practice’ before lessons, recitals, exams, etc. The best strategy, as teachers know, is daily or almost daily practicing. Strategies such as keeping a practice chart or log can assist students with learning to practice. When an increase in practice time is needed, teachers can compare it
to a crescendo (not subito), and encourage students to gradually increase the time in increments of 10-20 minutes\textsuperscript{32}.

Some busy students who are involved in several extra-curricular activities find it impossible to find a 30-minute block of time to practice each day. Teachers can encourage these students to divide up their music ‘homework’ into manageable small chunks of 5 or 10 minutes (e.g., 5 minutes for scales here, 10 minutes on a piece there, etc.)

**Tension and Technique**

Many musicians are aware that undue tension can cause long-term pain and injury. Although position is important in preventing undue tension, technique is also important. A student who is comfortable with scale patterns will approach scalic passages with less tension and therefore reduce the risk of injury in the long term. As teachers know, good technique also reduces the amount of repetition and time required to learn new repertoire. Teachers should work with students to develop technique at a pace that is achievable for the student and without over-practicing, while being alert to unnecessary tension. Regularly scheduled breaks and micro-pauses can assist students in returning to a relaxed, basic position for playing. Students should be encouraged to be aware of common areas of tension – for e.g., hiking the shoulders towards the neck, clenching the jaw – and focus on relaxing these areas whenever they are taking breaks or micro-pauses. This is particularly important when preparing for recitals and other potentially stressful
circumstances. Diligent attention to these practices over time will pay off when relaxation becomes an unconscious part of the student’s routine.

**Cool-down**

Although no research can be found to support the use of cool-down as a preventive measure, given the athletic performance of playing a musical instrument, it seems prudent to recommend a cool-down. Both musical and physical cool-down activities are important. As recommended for warm-up, long, slow tones in an easy range are recommended for winds, and slow movements are recommended for all players of all instruments. If stretching is done, students can also stretch after a practice or performance session.

**What to Do if an Injury Occurs**

Music teachers do not need to become experts in performing arts medicine to provide sound advice to their students to help prevent the all-too-common injuries that many will face throughout their careers. The strategies presented in this article are simple to incorporate into lessons or classroom instruction, and are unlikely to do any harm. However, teachers may sometimes be approached by students in need of help with an injury. Teachers should not diagnose their students’ injuries, but may find it helpful to inform themselves about local services and qualified healthcare practitioners that can help students recover.
There are four basic symptoms of playing-related injuries that should be investigated by a healthcare professional. Pain should be avoided during playing at all costs. Although some pain may resolve without complications, it is an indication that the player has pushed the body too far, and changes need to be made. Numbness, tingling, or ‘pins and needles’ may be an indication of nerve involvement. Persistent lack of control of a finger, hand or arm may be an indication of a condition known as focal dystonia. The appearance of an unexplained bump might be related to a ganglion cyst (a benign outgrowth of the joint lining). All of these symptoms should be investigated and professional treatment sought in order to prevent the issue from becoming chronic and therefore, more difficult to diagnose and treat.

**Conclusion**

This article has provided guidance for music teachers on measures that can be taken to help prevent students from sustaining playing-related injuries. Teachers can be instrumental in instilling the practice habits, postures and techniques that can help to sustain students through a lifetime of music enjoyment. We also hope that this article will help to increase the awareness of the risk of injury within the music education community and thereby promote wellness for generations of musicians to come.

**Further Reading**


NOTES


