

Making music — a real pain in the neck!

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“Instrumentalists’ hand problems — somewhat like social diseases — were unmentionable. Understandably so: if a performer is still performing, or hopes to get back on the road soon, he’d be crazy to advertise his disabilities. Nobody wants a wounded pianist. There is an oversupply of healthy ones. Admitting difficulties is like jumping, bleeding, into piranha-filled waters” – Gary Graffman (Sen 1991).

Introduction

Work-related musculoskeletal disorders cause pain, disability and loss of employment for workers in many professions. Evidence that musicians are also vulnerable to painful musculoskeletal conditions is increasing. Musicians have known this for centuries, but they dare not talk to anybody about this and therefore health problems of musicians remain under-recognised and under-researched.

Compounding the problem, musicians are slow in recognising and admitting injuries as they tend to believe that “more is better” as an accepted practice for mastering an instrument. Pain is further mistakenly accepted as natural in music-making leading to reluctance amongst musicians to seek timely medical help. Reluctance may be aggravated by a fear of losing their hard earned reputations, or even losing their jobs.

Playing through pain or accepting pain as a normal component of making music is a cause of grave concern and unintentionally contribute to injuries – some even severe enough to prematurely end a promising career. The economic effects of Playing Related Musculoskeletal Disorders (PRMDs) are significant, especially since most musicians are self employed and do not qualify for workers’ compensation benefits. Musicians may have to hold several jobs to make ends meet and a PRMD can affect the ability to earn a living adversely from any job, musical or otherwise.

People suffering from Repetitive Strain Injuries (RSI) in the computer workforce point out that the average typist typing at a good 60 words per minute, strikes the keys about 18,000 times per hour. This translates to five keystrokes per second or fifteen every three seconds! Wow!! To put the risks of playing a musical instrument into perspective, consider this: The size of the computer keyboard equals only about thirteen notes on a normal piano keyboard. As calculated by Dr. Frank Wilson, a prominent neurologist, many musicians are able to execute 38 notes in three seconds. That is more than twice as many keystrokes as those at a computer and amounts to about 45,600 strokes per hour!! If you are working on a computer by day and being a professional musician by night and over weekends, you may double the risk of sustaining a playing related injury.

Musicians hurt — that is a fact. But how common are RSIs amongst musicians really?

A survey in the early 1980s by the International Conference of Symphony and Opera Musicians (ICSOM) among about 4000 members [symphony and opera musicians]

from 48 American orchestras found that 76% of the musicians reported a medical problem severe enough to influence playing. Of these, 36% reported up to four serious conditions that influenced playing (Brandfonbrener 1997)!

Bejjani (1996) from the New Jersey Medical School, Newark, set the prevalence of playing-related musculoskeletal problems as high as 80%! The studies he reviewed show that alarming high numbers of musicians experience problems during their careers. In a survey amongst 117 piano students 62% complained of musculoskeletal problems in one area and 14% had pain in 3 or more areas. Another study found a 77.5% presence of upper extremity problems severe enough to significantly impair performance. A review of the literature published in the Canadian Medical Association Journal agrees that the prevalence of injuries range between 39% and 87% in adult musicians (Zaza 1998). An Irish study found that 25.8% of their music students suffered from a painful injury during an academic year (Shields 2000).

Repetitive Strain Injuries (RSI) or Playing Related Musculoskeletal Disorders (PRMD) – table 1

“Pain, weakness, numbness, tingling, or other symptoms that interfere with (their) ability to play (their) instrument at the level (they) are accustomed to.” (Zaza and Farewell 1997).

“Repetitive strain injury” is not a diagnosis. It could rather be seen as an umbrella term for a number of related upper-quadrant disorders of the hands, arms, shoulders, neck, and back (Keller 1998). These injuries can further be described as a painful condition brought about by prolonged, hard or repetitive use of a limb. Use is usually excessive for the individual affected and stresses the tissues beyond anatomical and physiological limits. An injured musician frequently complains of pain that may involve the entire upper extremity, including the neck, upper back, and shoulders (MacKinnon 1994). Musicians themselves report their loss of facility in playing in terms of loss of speed, loss of control of major motions, loss of control of fine motions, loss of power (*forte*), loss of finger span or any combination of the above (Caldron et al 1986).

Injuries do not only present as generalised complaints. Symptoms that are specific to disorders associated with RSI include tendonitis in the wrist, myositis (muscle strain) of the forearm muscles, trigger finger, tennis elbow, ganglion, shoulder tendonitis, cervical spondylosis, carpal tunnel syndrome, thoracic outlet syndrome, and other nerve entrapments syndromes (Warrington 2002).

Injury patterns are instrument specific with certain complaints more frequent among particular categories of instruments. In general terms, we find that neck and back problems are common in most string instrument players. Cellists and harpists present with the highest incidence of lower back pain, possibly due to the weight of the instrument they have to carry or move around while pianists and harpists are highest on the list for neck aches (Bejjani 1996). Among keyboard players the wrist, finger extensors and small hand muscles are the most vulnerable to injury. In a survey in eight Irish music schools, wrist and finger injuries among keyboard players were responsible for 50% of the reported injuries (Shields 2000).

<i>Synonymous terms for injuries associated with repetitive movements include:</i>	
RSI	R epetitive S train I njury. (United Kingdom, Canada)
WRULD	W ork- R elated U pper L imb D isorder (United Kingdom)
NSAP	N on- S pecific A rm P ain
RMD	R epetitive M otion D isorder
CTD	C umulative T rauma D isorder (USA)
OOS	O ccupational O veruse S yndrom (Australia, New Zealand)
OCBD	O ccupational C ervico B rachial D isorder (Japan)
PRMD	P laying- R elated M usculoskeletal D isorder (Musicians)

Table 1. Terms for injuries. PRMD is the term most commonly used for music-related injuries

Aetiology and predisposing factors

According to Shields (2000) the risk of playing a specific instrument is determined by several factors. These could be either **intrinsic** (normally referring to the genetics of the musician) or **extrinsic** factors (the environment in which training is done, and the musician's training methods). Extrinsic factors may include the number of repetitive movements required when playing the instrument, playing posture, the resistance against which force must be applied, whether the instrument must be supported while it is played and the size and weight of the instrument.

Anatomy of the hand:

This is a problem the musician may have been born with. It is an *intrinsic* factor. Descriptions of variations in muscles and tendons are often neglected in anatomical literature. As many as 50% of hands do not show the "standard" pattern that we would normally see in a textbook! This is highly significant for those who must carry out skilled movements that lie close to the limit of what is physically possible. Regardless of the degree of training, not all musicians are capable of the same finger movements!

Instrument played:

The type of instrument played may predispose the musician to developing a playing related injury. Based on careful records collected over 14 years at the University of Rochester health clinic in New York, instruments were classified as **low**, **medium** or **high** risk according to injury rates per instrument. All the brass instruments showed low injury rates, while the woodwinds fell into the high level of the low risk group and the lower levels of the medium risk group. Percussion, organ and bowed string instruments all fell in the medium risk group. Three instruments were high-risk instruments - the guitar, the harp and the piano (Cayea 1998).

Gender:

Several studies report that females are more susceptible to developing injuries than males (Zetterberg 1998; Pak 2001; Castleman 2002). Some explanations mention differences in hand size and joint laxity or hyper mobility. (Brandfonbrener 1997a)

Technique:

A musician's technique and posture are important factors in determining a tendency to injury (Brandfonbrener 1997b; Castleman, 2002). A number of playing techniques peculiar to the piano have been cited as causing pain. These include double octaves, chords, playing fortissimo, trills or arpeggios. In the Irish study 73% of their respondents reported that they experienced pain when executing at least one of these techniques, most of them while playing double octaves. Many pianists felt that the pain was due to the small size of their hands. All but one of the respondents was female (Shields 2000; Sakai 2002). This is cause for concern because experiencing pain when playing may already signify the presence of a grade I repetitive strain injury (see table 1).

Practice habits:

A direct relationship exists between the number of hours a musician plays or practices and the danger of developing an injury (O'Neill 2001; Castleman 2002). The Irish study found that 36% of the respondents who practiced seven days a week sustained a playing related injury. It was noted that 24% of those who practiced up to three hours a day had sustained a playing related injury compared with 44% of those who practiced between 3.5 and 7 hours a day (Shields 2000).

An explanation for the relationship between playing time and injury may be that the blood supply to the forearm muscles starts to slow down after around ninety minutes of continuous hand and finger movements. This is similar to a compartment syndrome (shin splints) occurring in the lower legs of athletes. With prolonged use pressure within a muscle compartment rises, leading to reduced microcirculation within the muscles and reduced nerve conduction due to nerve endings not receiving sufficient oxygen for sustained optimum nerve conduction.

Stress and anxiety:

Stress and anxiety affects our posture and muscles according to specific patterns. These patterns are fairly universal, whether it originates from performance anxiety, work pressure, the traffic, financial problems, watching television or an important audition or exam coming up. Increased muscle tension becomes a problem for musicians since optimum performance on a musical instrument requires a precise and correct balance between the degree of tension and relaxation in the muscles. Stress interferes with proper 'use'. Playing under tension — for whatever reason — involves using more muscles than is usually needed to get the job done, or using the correct muscles in a state of greater tension than is necessary. Co-contractions usually inhibit the smooth performance of rapid, repetitive motions and must be minimized or eliminated. Holding down more than one job to make ends meet causes extra stress. Very often, the second job involves computer or other repetitive work, adding to the total number of repetitions the limb has to perform during a normal day and then pushing working structures beyond its safe physiological limit for that specific person.

The role of posture:

Posture and proper body alignment is dynamic and depends upon the balance between the 206 bones of the skeletal framework and the effort of the muscles, tendons and ligaments (myofascia) to counter the pull of gravity. All the parts of this continuous structure (the body) stay in equilibrium by the way the entire structure distributes and balances mechanical stresses. The effortless balance in the distribution of mechanical forces signifies good dynamic posture. Minimal muscular effort is then needed to maintain balance. Should tension increase in one part of the body, compensatory changes in tension will result in other parts of the body.

Most people modulate between the two inefficient postural extremes of the military 'strain' and the poking chin 'slouch' in an attempt to win the fight against gravity. The former posture has too much tension and the latter not enough. Apart from day-to-day poor postural use, further sources of abnormal postures in musicians exist. These may include bad playing habits, fatigue, the position of the music stand, your position in the orchestra in relation to the conductor, being far or near sighted, seating, and how crowded the orchestra pit is. Maintaining or repeating poor postural habits over prolonged periods of time may serve as trigger for developing PRMD's.

Abnormal postures and poor postural habits may have three major consequences:

1. **Particular positions of the extremities may create direct increased pressure around peripheral nerves at various entrapment points chronic nerve compression the end result.** Examples in the forearm are: increased pressure and tension on the median nerve in the carpal tunnel when the wrist deviates from neutral. Increased and sustained elbow flexion increases the pull on the ulnar nerve. Forearm pronation compresses the radial sensory nerve between the tendons of the brachioradialis and the extensor carpi radialis longus muscles.
2. **Abnormal postures can result in a set of muscles being maintained and used in shortened positions.** Maintained tension in tight muscles may become painful. A common fault is the typical 'poking chin' posture. This posture is usually accompanied by rounding (protraction) of the shoulders, internal rotation of the arms and increased curvature of the spine. In these postures the scalene, sternocleidomastoid, pectoralis minor and the pronator teres muscles are the most vulnerable. Several instrument-specific shortening patterns of other muscles may be identified, e.g. violinists and flutists.
3. **Abnormal postures may result in some muscles being underused and subsequently weakened.** Weakness in one group of muscles will result in a compensatory overuse of a second or antagonistic group of muscles, establishing a cycle of muscle imbalance. An example of this pattern is the rounded shoulders where shortening of the serratus anterior and pectoralis minor muscle may lead to lengthening of the middle and lower trapezius muscle resulting in an abducted resting position of the shoulder blades. Working at a mechanical disadvantage, they may now become weakened. With weakness in these two muscles other scapular muscles tend to compensate and become overused. The rhomboids, upper trapezius, levator scapulae, scalene and sternocleidomastoid muscles are used as accessory muscles to elevate the shoulders and arms, resulting in their hypertrophy.

Some warning signs indicating that trouble are on its way:

Pain: Sustained or chronic pain of any kind is a sign that something is wrong. It can be burning, aching or shooting. Pain may be restricted over small sites or diffuse over a larger area, making it difficult to pin-point. *Never dismiss pain as unimportant!*

Fatigue or lack of endurance: If you find yourself getting worn-out easily, or notice that you cannot practice as long as you once could, *take it seriously.*

Stiffness: You may experience difficulty opening and closing your hands, and ascribe it to ‘early morning stiffness’. *This condition is not normal.*

Weakness in the hands and forearms: This might first be noticed in other daily activities such as hanging the washing, or carrying your shopping bags or your instrument. *Pay attention to the messages that your body is sending.*

Tingling, numbness, or loss of sensation: Your arms and/or hand may feel like they are ‘falling asleep’. *This should be investigated.*

Heavyness: Do your arms feel like a ‘dead weight’?

Clumsiness: If you have to start holding your coffee mug with two hands or have to concentrate more to grip objects, *you likely have a serious injury.*

Lack of control of co-ordination: A feeling that your fingers aren’t doing what you want them to or that you have lost control over them is unpleasant and *a signal for you to pay attention.*

Cold hands: An injury may cause limited blood flow to your hands. *Have it investigated.*

Heightened awareness: Just being vaguely aware or hyper-aware of a body part can be a clue that something is wrong. “My hands never feel normal!” *Your body may be trying to warn you that something is amiss by drawing your attention to specific limbs.*

Hypersensitivity: Pain should not come from light touch or stroking. Heightened sensitivity after minimal use of your hands or arms may indicate impending problems and *need to be tended to.*

Frequent self massage: If a pupil is constantly rubbing an area over the neck, shoulders, wrist, hand or forearm or shaking out her hands because they have gone numb, this could very well indicate a RSI.

(Modified from: Repetitive Strain Injury — A Computer User’s Guide by Emil Pascarelli and Deborah Quilter)

LAY-OUT: These separately or possibly in a side-bar

Treatment and management

There is only one effective treatment: ***do not allow the injury to happen!*** The exceptional co-ordination and skill needed to make music is almost impossible to restore after a serious injury, even if treated well by the best hand surgeons and physiotherapists in the world. When disaster strikes and you **do** develop an injury, the first and most important thing is not to accept “no pain, no gain” as an excuse to play through your pain. There are effective ways of leading the injured musician onto the road to recovery.

Evaluation

Before considering treatment options, an accurate diagnosis is paramount. A full evaluation of all the painful sites, nerve entrapment sites, posture (both passive and dynamic), range of active and passive movements, and muscle strength should always precede management and treatment.

Patient education

Without a clear understanding of the problem, the predisposing factors and habits, exacerbating and relieving factors, the injured musician may be unable to control and decrease symptoms and may not fully participate in the treatment and rehabilitation process. Education should include:

- Background on the pathophysiology of muscle overuse and nerve compression.
- The grading of overuse injuries – table 2.
- Risky playing positions and habits.
- Less efficient and more efficient postural habits and positions.
- The influence of activities of daily living at work, leisure, home and sleep on contributing to an injury.
- Lifestyle. The negative impact of obesity, smoking, breast hypertrophy, and lack of general physical conditioning (or fitness).
- Healthy lifestyle and practice habits.

<i>Grade</i>	<i>Description</i>
0	No Pain.
1	Pain while playing, or for a short period after playing.
2	Pain that persists for a longer period after playing.
3	Pain that progresses while playing and requires the practice session to be shortened, but resolves between sessions.
4	Pain that progresses while playing and does not totally resolve between sessions.
5	Continuous pain that markedly reduces or prevents playing.

Table 2. Grading System for Severity of Injury
(Hoppmann, 1998)

Treatment

Every individual injury will be different. Treatment guidelines can therefore only be suggested. The primary goal of therapy is the restoration of function through the correction of muscle imbalances. After a comprehensive evaluation, treatment starts with the control of pain. Rest and treatment modalities like warmth, ice, ultrasound and electrical stimulation may be of great help to alleviate and control the initial acutely painful areas. Local dysfunction is also addressed during this phase.

With pain and local dysfunction under control, the second treatment phase can start. This is the long, protracted process of restoring normal tissue flexibility and gliding between structures as well as addressing muscle length and strength of the upper quarter. The process of restoring muscle length and normal range of motion progresses from central to peripheral, and proximal to distal. Treatment therefore starts with the central structures in the neck and shoulders before progressing to the peripheral structures. Massage, stretching and mobilising treatment modalities are the treatments of choice. Manual treatment techniques should be augmented by a well structured home program of stretching and mobilising exercises for the head, neck, shoulder, arms, and hands.

After restoration of tissue flexibility and balance, strengthening exercises for the weakened neck, shoulder blade, arm and hand muscles are introduced. Endurance and fine coordination of movements are increased until a full practice and playing routine can be established. With the help of an experienced music teacher it is also advisable to correct any faulty or strained playing techniques that may either have led to the injury, or developed as a consequence of the injury.

Better posture

When these steps are taken, postural and positional correction will become of real value. One of the reasons for poor posture is the avoidance of pain associated with stretching of tight and tender muscle structures. Correction of faulty postures and maintenance of correct posture are essential to successful management and prevention of injuries.

Improved fitness

Following an aerobic conditioning program is important because many musicians are in a poor aerobic condition, and their postures of 'thoracic flexion' and 'head forward' contribute to further restriction of chest expansion during breathing. They should be taught improved diaphragmatic breathing and encouraged to follow some type of aerobic conditioning program. Care should be given to head and trunk positions to avoid excessive cervical extension or head-forward postures.

With mild to moderate injuries (grades 1, 2 or 3 injuries), one may be able to continue playing through recovery — provided technique is modified (if at fault), practice time reduced, posture or other unhealthy habits are modified, and treatment and physiotherapy adhered to if prescribed. Remember, severe injuries (grades 4 and 5) may take many months to recover and may require complete rest and occasionally surgery. Some injuries may prematurely end a promising career as professional musician. ***Do not let injuries go unattended.***

Finally

It may take a musician up to 20 years of diligent commitment and practice to reach a concert or soloist level of playing. After many hours of committed practice even a minor injury could have far reaching consequences for a promising career. Musicians hurt, that is a fact. Diagnosis and treatment may be a long, frustrating and protracted road to travel. For the treating therapist, knowledge of the nature of the injury, the playing of a musical instrument and the world of the professional musician is important. The road travelled with a hurting musician is one of commitment and ultimate reward.

References and further reading

- Bejjani F J, Kaye G M, Benham M. 1996. Musculoskeletal and neuromuscular conditions of instrumental musicians. *Arch Phys MedRehab*; 77:406-413
- Brandfonbrener A G. 1997a. Orchestral injury prevention intervention study. *Medical Problems of Performing Artists*;12:9-14
- Brandfonbrener A G. 1997b. Pathogenesis and prevention of problems of keyboardists. General considerations. *Medical Problems of Performing Artists*;12:45-50
- Brandfonbrener A G. 1997c. Pathogenesis and prevention of problems of keyboardists. *Medical Problems of Performing Artists*;12:57-59
- Caldron PH, Calabrese LH, Clough JD, Lederman RJ, Williams G, Leatherman J (1986). A Survey of musculoskeletal problems encountered in high-level musicians. *Medical Problems of Performing Artists*;1(4):136-139
- Castleman H. 2002. Five common causes of physical injury for violists. *Medical Problems of Performing Artists*;17:128-130
- Cayea D, Manchester R A. 1998. Instrument-specific rates of upper-extremity injuries in music students. *Medical Problems of Performing Artists*;13:19-25
- Hoppmann RA. 1998. Musculoskeletal problems in instrumental musicians. In: Sataloff RT, Brandfonbrener AG, Lederman RJ ed. *Textbook of Performing Arts Medicine*. 2nd ed. New York: Raven Press, pp.71-110.
- Keller K, Corbett J, Nichols D. 1998. Repetitive Strain Injury in computer keyboard users: Pathomechanical and treatment principles in individual and group intervention. *Journal of Hand Therapy*;11(1):9-26
- Mackinnon S E, Novak C B. 1994. Clinical commentary: Pathogenesis of cumulative trauma disorder. *Journal of Hand Surgery*;19A(5):873-83
- O’Niell L, Taunton J, MacIntyre D L. 2001. Making music: Challenging the physical limits of the human body. A survey of musicians in western Canada. *Physiotherapy Canada*; 53(2):101-108

- Pak C H, Chesky K. 2001. Prevalence of hand, finger, and wrist musculoskeletal problems in keyboard instrumentalists. *Medical Problems of Performing Artists*;16:17-23
- Pascarelli E, Quilter D. 1994. Repetitive strain Injury. A Computer User's Guide. John Wiley & Sons. New York
- Sakai N. 2002. Hand pain attributed to overuse among professional pianists. A study of 200 Cases. *Medical Problems of Performing Artists*;17:178-180
- Sen J. 1991. Playing the Piano. Playing with fire? A study of the occupation hazards of piano playing. <http://eeshop.unl.edu/text/musicmed.txt>
- Shields N, Dockrell S. 2000. The prevalence of injuries among pianists in music schools in Ireland. *Medical Problems of Performing Artists*;15:155-160
- Warrington J, Winspur I, Steinwede D. 2002. Upper-extremity problems in musicians related to age. *Medical Problems of Performing Artists*;17:131-134
- Zaza C, Farewell VT (1997). Musicians' playing-related musculoskeletal disorders: An examination of risk factors. *Am J Industrial Med*; 32:292-300
- Zaza C. 1998. Playing-related musculoskeletal disorders in musicians: a systematic review of incidence and prevalence. *Canadian Medical Association Journal*;158(8): 1019-1025
- Zetterberg C, Backlund H, Karlsson J, Werner H, Olsson L. 1998. Musculoskeletal problems among male and female music students. *Medical Problems of Performing Artists*;13:160-166
- W J Fourie. August 2010
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