Playing related injuries in elite young instrumental musicians: A physiotherapist’s perspective  – Sarah Upjohn

This is a presentation of the results of an audit of playing related musculoskeletal injuries sustained by pupils in a specialist music school. It shows which part of the body sustained most frequent injuries, and which instruments generated the most injuries. Risk factors for playing related injury are clearly identified. The implications for instrumental teachers are discussed, and suggestions for targeted injury prevention strategies are made.

Introduction
I am the physiotherapist at a specialist school for elite young musicians. This article is based on the result of an audit of playing related musculoskeletal injuries sustained by pupils between October 2008 and December 2011. In addition to detailing injuries related to different instruments, it clearly revealed risk factors for playing related injuries. This has enabled targeted injury prevention advice to be developed.

The school has about 170 pupils aged between nine and 18. Most pupils board at the school and many are international, coming from South East Asia, Europe and Eastern Europe. The majority of them progress to continue studying instrumental playing at conservatoires in the UK and overseas. The school curriculum and timetable are designed so that each pupil has an individually tailored programme of study. This includes instrumental lessons, practice time and performance opportunities as well as academic education. Instrumental practice sessions are timetabled throughout each day in order to enable the pupils to put in the many hours of practice required to develop expertise in instrumental playing. My role was established in response to the Health Promotion in Schools of Music Project, which was set up in 2004 and which, in September 2006, published a number of declarations and recommendations for action (Chesky, Dawson & Manchester 2006). Amongst these was the statement that ‘performance injuries are preventable’ and it recommended that a health promotion framework be adopted by educational establishments that are training musicians. This idea reinforces work by Spahn et al. (2002), who identify a strong indicator for the need for health promotion courses to be taught to music students. This is supported by work in 2004 which identified a higher prevalence of health problems in music students compared with other students, and suggested that prevention and health promotion measures, specifically tailored for music students, should be used (Spahn et al. 2004). Zander et al. (2010) found that playing related symptoms are already found in between 25% and 79% of university level student musicians. These were found to be predominantly caused by overuse endured by certain body parts. This highlights the need for injury prevention programmes aimed at pre-conservatoire level students. I began working in the school in October 2008. My role as physiotherapist at the school is to advise on the management of, and to treat, a variety of playing-related musculoskeletal injuries. These are injuries to soft tissue structures (muscles, tendons, ligaments and nerves) sustained as a direct result of instrumental playing.

Emergent findings from an audit of physiotherapy treatment records between October 2008 and December 2011
In accordance with guidelines set out by the Chartered Society of Physiotherapy (the professional body for physiotherapists working within the UK) and regulations set out by the Health and Care Professions Council (the UK registration body for professions allied to medicine), full and comprehensive notes were written about each pupil seen for physiotherapy. These notes contain an initial assessment of the problem, including details of the onset, and then include details of treatment, progress and outcome. An audit of these records has revealed details about the incidence of injuries for each instrument (see Fig. 1); about which parts of the body became injured most frequently (Fig. 2); and about whether the injuries were chronic, acute or recurrent (Fig. 3). The emergent findings also clearly identify five risk factors for playing-related injury, and this allows us to consider implementation of targeted injury prevention strategies (Fig. 4).

![Incidence of playing related injuries out of total number of players per instrument](image)

**Fig.1 Incidence of playing related injuries out of total number of players per instrument**

The figures do not represent the number of players injured per instrument (Fig. 1), as some pupils had more than one injury, or a recurrence of the same injury, but they provide a useful illustration of the level of incidence of injury per instrument.
For the purpose of this audit, the spine describes the area from the base of the skull to the base of the pelvis, the upper limb describes those structures situated between the shoulder joint at the top of the arm, and the ends of the thumb and fingers, and the shoulder girdle describes the area between the neck and the top of the arm (see Fig. 2).

Acute injuries (Fig. 3) are characterised by a rapid onset after a specific incident. They have every chance of healing given the right circumstances. If an acute injury is not given the opportunity to heal, it can become a chronic injury. These are usually low grade injuries that ‘grumble on’, causing persistent pain and dysfunction. These are much more resistant to treatment. Recurrent injuries are repeated episodes of an acute injury.

The pie chart (Fig. 4) shows that the majority (82%) of the injuries were either postural in origin (46%) or were caused by overuse (36%). This finding is echoed by Kreutz et al. (2008) who reported from two UK conservatoires that playing related musculoskeletal pain was common, and that significant proportions of health problems among music performance students emerge from such factors as posture and fatigue, rather than being specific to the instrument played.

The 18% of injuries not related to posture or overuse originated from a variety of factors including stress, change in biomechanics due to a rapid growth spurt, carrying percussion instruments, hypermobility syndrome or pre-existing pathology.

It is clear that the playing related injuries at the school are predominantly caused either by overuse of soft tissue structures (simply put, playing too much without sufficient opportunity to rest and for recovery to take place) or by playing with posture that places adverse biomechanical loading on soft tissue structures and joints, inevitably causing eventual dysfunction and usually resulting in pain (Culf 1998). The severity of the injuries seen at the school ranged from inconvenient to career ending.
typically, we often have no idea of our posture, nor of the positions or movement patterns that we are using. Many instruments place us in positions of asymmetry, increasing the risk of eventual postural pain.

Both overuse injuries and postural dysfunction are, by definition, preventable (see Fig. 5).

Major risk factors for injury
Five risk factors for the onset of playing related injuries clearly emerged from the audit (see Table 1).

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| Table 1 |

1. Sudden increase in playing time
Our pupils reported sudden increase in playing time in response to preparing for exams, competitions, auditions, concerts and assessments, and also during orchestral courses, when not only do they play for longer periods of time each day in a highly organised way, but players who usually stand to practise (for example, violinists, viola players, and woodwind players) sit to play. This places unfamiliar demands on the body. The body of knowledge from sports science about the way the body adapts in response to training is useful here. The SAID principle (Specific Adaptation to Imposed Demands) asserts that the human body adapts specifically in response to demands imposed on it. For adaptation (or change) to occur, the body requires a stimulus (or a demand or a stress).

In response, specific biological changes occur in bone, tendons, muscles and ligaments, and also in the central nervous system. However, if the demand is too high, or recovery time is insufficient, then adaptation can be inhibited, there can be a decrease in the capacity of the physiological systems, and a condition of ‘over-training’ arises. In athletes acute overtraining occurs when muscles are worked to exhaustion, while chronic overtraining can result in muscles becoming weaker. This adaptation to imposed demands and the subsequent risk of ‘overtraining’ applies whether we are talking about what a pupil can play, how they play it, and how long they can play for.

2. Introduction of new repertoire
While the introduction of new repertoire is frequent and necessary, practising new pieces that have new or unfamiliar technical demands can result in pain until adaptation to the new demand occurs.

Posture
Habitual posture that takes a person out of anatomical neutral (symmetry, head balanced above pelvis, and spine lengthened) places stress and strain on soft tissues and joints, and can result in pain.

Growth spurt
Our pupils are growing. This sets them apart from adult instrumental players. Some children and teens seem to grow slowly and steadily, and others have periods of rapid growth (growth spurts). When children grow rapidly, first the long bones grow, and then the soft tissues (muscles, tendons, and ligaments) accommodate to the new frame. Immediately after a growth spurt, muscles are relatively weaker, as they operate across a longer lever, soft tissues are less flexible, as they are stretched over a larger frame, and the child or teen may be less coordinated as their body map (the internal representation of themselves in their own sensory cortex) adapts to their new dimensions and new shape. Soft tissues are particularly vulnerable to injury immediately following a growth spurt, and this is not the ideal time to change to a larger or heavier instrument, nor to dramatically increase the amount of time spent practising, nor to introduce new technically demanding repertoire.

Stress
Our pupils become stressed for a variety of reasons. A few examples of common sources of stress are: concerns about family life, about friendships at school, about academic work, about musical progress, and about up-coming performances. Stress can increase tension in muscles and can change posture. This can increase vulnerability to injury. Stress can also interfere with sleep and lack of sleep can make students more vulnerable to injury for two reasons: 1) Sleep is restorative for the body, and inadequate sleep interferes with physical recovery; 2) Fatigue interferes with ability to concentrate, and technique can deteriorate.

Injury prevention in elite young instrumental musicians: Implications for instrumental teachers and parents
Having established that most playing related injuries are preventable, and having identified five specific risk factors for injury, we are now in a strong position to help our students to remain injury free.

Each one of us has a duty of care towards our pupils. The special relationship that can develop between a pupil and their instrumental teacher places the teacher in a position of particular power and responsibility. Part of this must include taking steps to minimise pupils’ risk for injury. This can be done if the teacher has a working knowledge and awareness of individual risk factors and an appreciation of how risk increases if more than one risk factor is present (Table 2).
It is useful to be mindful of these five major risk factors. In the following section I have provided more information about injury prevention relating directly to these five risk factors.

1. Sudden increase in playing time
   Pupils often increase the amount of time spent practising when preparing for exams, auditions, competitions, assessments and concerts. This is wonderful, but sudden, large increases in amount of time spent playing can result in overuse injury, as muscles and tendons are not ‘conditioned’ to the increase in workload. A better approach is to gradually increase playing time, to allow soft tissues to accommodate to increase in demands. Increasing by 10% each week is generally safe, unless other risk factors for injury are present. Be mindful of the following questions:

   Q: How much playing is the pupil doing?
   Q: Has this increased suddenly?
   Q: Are they taking frequent breaks during practice sessions?

2. Introduction of new repertoire
   The SAID (Specific Accommodation to Imposed Demands) principle applies here too. Any new physical demand requires time for the body to accommodate.

   Be aware of the technical demands of new pieces. If it is completely different from current pieces, then start slowly, limiting time spent on the new piece initially, and thoughtfully organising practice so that the new piece is played in the middle of a practice session, once the player is warmed up, and before they become fatigued.

   Augment learning of a new piece by listening to recordings, and by sitting down with the music without the instrument, and thinking it through.

3. Posture
   Q: Do your pupils play the violin, the piano, the cello or the flute?

   These instruments produce the highest incidence of posture related injuries, and are worthy of special consideration:

   **Violin**: Ensure that the shoulder rest and chin rest are adjusted as the child grows, to keep the head supported with the neck in a neutral position, and to prevent excessive shoulder girdle elevation.
Piano: Encourage the pupils to sit heavily on their ‘sitting bones’ rather than to sit ‘up and off’ their sitting bones. If your body weight is being supported by your spine, muscle tension is reduced as muscles are required to do less work to hold you up.

Cello: Ensure that the spike is adjusted as the child grows.

Flute: Pay particular attention to whether or not the pupil is excessively rotating the spine or shoulder girdle to position the flute.

Whatever the instrument, be aware of your pupils’ posture as they play, and aim for them to be standing or sitting with their weight evenly distributed, and with their spine lengthened.

Alexander Technique lessons can be wonderful for increasing body awareness and changing posture.

4. Growth spurt

Q: Are your pupils growing rapidly?

Be aware that they may be less well coordinated (like a clumsy puppy), and their soft tissues will be particularly vulnerable to injury while they are relatively weaker, and relatively less flexible. This is not the right time to introduce complicated new repertoire, with new technical demands, or to change to a larger or heavier instrument.

Advice for everybody

Pain: Pain is the body’s way of alerting us that something is wrong: if something hurts STOP PLAYING. Apply an ice pack for 20 minutes as soon as it is convenient, and rest the affected area for 48 hours. Continue to apply ice for up to 20 minutes per hour for the first 48 hours. If the pain returns once the pupil resumes playing, or persists despite stopping playing and applying ice, stop playing and SEEK MEDICAL ADVICE.

Fitness: Regular exercise can help reduce stress, and increase concentration. In addition to these benefits, improved strength, flexibility, cardiovascular and respiratory endurance will all help with the significant physical demands of instrumental playing. Yoga, pilates, swimming, walking, jogging, running, are all safe, fun and hugely beneficial.

Conclusion

Playing related injuries are predominantly preventable. With understanding of the mechanisms of injury and with insight and overview of the physical and emotional demands placed on our pupils, in and outside the lesson and practice room, changes can be made when risk factors are present. We are in a position to enable our pupils to develop as musicians while remaining injury free.

References


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