IFSSH Scientific Committee on Musician's Hand

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Musculoskeletal conditions affecting the musician

Introduction

Since the dawn of mankind, music has been an integral part of human culture. Music has been used for various purposes, such as pleasure, entertainment, worship and communication.

Two important factors have influenced these purposes of music making. Firstly, the discovery that music has a definite enhancing influence on the mental and cognitive development of children, which takes place even in utero. Secondly, competition has become an integral part of social activities, education and training in the modern word. This is transferred to young children who grow up with the constant pressure to perform. One may add that regular practising cultivates a healthy self-discipline.

If the budding musician loses the enjoyment of music making, it eventually may become a burden. When the eff ort to achieve becomes greater than the reward of having achieved, loss of interest is almost guaranteed and a basis for ailments could become a reality. Once pressures, demands and stresses become the overriding driving force behind the child's playing of music, psychosomatic symptoms and signs may develop.

Musicians could be compared to athletes. Although athletes may start at an early age, their full potential is only known once they reach puberty. The next stage is extensive training under scientific supervision with the necessary backup from teachers, trainers, and a range of health professionals. This period usually lasts about 10 to 15 years.

Musicians on the other hand, usually start even before school age. Their talent is recognised very early on and is gradually promoted through training and encouragement. It is expected of them to perform at each concert without any mistakes. Musicians are also expected to adapt to their instruments (which may be ergonomically not suited for the particular individual), as well as their surroundings. Often they live a lonely life because of long hours of practising, and their support system may consist only of close relatives and friends. Even from their colleagues one may find severe criticism, jealousy and even outright negative feelings. Furthermore, the musician practises many more hours than the average athlete, often does not take a break over weekends or holidays and may perform right up into old age. Also, with the 'normal' handicaps of everyday living such as arthritis, injuries and other ailments, the musician often battles to adapt or tolerate these handicaps without seeking medical help.

The incidence of medical conditions in musicians is unclear but some reports claim that up to 90% of musicians may suffer some ailment during their career. The aim of this report is to review the medical and surgical conditions affecting the musician, and to provide a practical approach for their management (1-5).

Preventative approach

1. Lifestyle and diet

The old dictum 'practise makes perfect' is very applicable to the musician, and long lonely hours are spent to master pieces. These music students often miss out on normal child's play, sport, socials and other activities. Parents and teachers should understand that a balanced lifestyle will ensure a balanced and healthy child. Some foods are heavy on the stomach and may interfere with the student's concentration. Drinks with gas and stimulants like caffeine should best be avoided. It is important to re-hydrate the musician before any performance just as an athlete rehydrates before an event. This keeps the tissues soft, pliable and promotes lubrication between tissue planes and structures. The level of dexterity required from top musicians can only be achieved if the tissues are well lubricated to allow gliding, and the muscles, which move these tissues, have enough energy (carbohydrates and lipids) and building blocks (proteins).

2. Musculoskeletal system

The best performance can be achieved from the mid-position of a muscle, i.e. the resting or balanced position of the muscle. This will allow excursion of the muscle, either side of this resting position, and also enhances the amount of muscle power generated. Athletes are well aware of this important physiological principle, and use stretching exercises to improve the excursion on either side of the mid-point. This should also apply to musicians (6).

Another indispensable preparation for any performance is warm-up exercises. This will prevent micro- and macro injuries to the muscle fibres, tendons, ligaments, sliding tissue planes, and all the various receptors and nerve endings responsible for sensory input (such as two-point discrimination, proprioception, vibration sense, temperature changes, light and deep pressure and stereognosis).

A further aspect is the clear understanding that peak performance and endurance of fingers and the hand can only be achieved if the supporting foundation also has the necessary strength and endurance. These foundations include the elbow, shoulder, neck, back and the whole torso. Most musicians severely neglect this aspect of their training. They should get into a habit of regularly engaging in physical exercises, such as non-contact sport or workout at home or in a gym.

3. Posture

Musicians and their teachers often underestimate the importance of a balanced posture. Many musical instruments are of a poor ergonomic design. Teachers should also be sensitive to normal anatomical variations in people. Some students have difficulty in full pronation of their forearms which make piano playing rather difficult. Others may have connections between their tendons, which would make individual finger playing difficult or impossible (e.g. Linburg-Comstock connection between Flexor policis longus and Flexor digitorum profundus of the index finger), or a non-functioning Flexor digitorum superficialis to the small finger. Many other examples exist. It is of no use to force the child to do certain movements, if it is physically not possible or very difficult. A full neurovascular examination could exclude anatomical variations, which in some cases could easily be rectified.

Musical instruments are not holy and should be considered for adaptation or change if musicians have difficulty in reaching certain keys. Extensions and modifications could easily be fitted to instruments to allow for a more balanced hand and relaxed posture. For example, a violin may be too short or too long, twisting the upper part of the body into an awkward position, which will eventually lead to muscle spasms and pain. Professional help in this regard could be gained from trained occupational therapists, who are knowledgeable about the physical and psychological demands of the performing arts.

4. Exercise and training

John Williams, the guitar player, is quoted saying that for every half hour he practises he would rest for one half-hour. During the half-hour rest, he would do stretching exercises as well as moving exercises. This is a very important physiological concept, which needs to be understood by all musicians. Movement encourages blood flow and therefore function. Function refers not only to muscle power; but also to all the various sensory modalities referred to earlier. These exercises could be either isometric or isotonic muscle contractions.

Isometric muscle contraction is responsible for stable fixed joint positions, i.e. no movement takes place, but the muscles stabilising the joints are co-contracted, whereas isotonic muscle contraction is responsible for active movement of joints. This contraction shortens and lengthens the muscle with resultant movements, such as the fingers. Stretching of muscles and nerves is an integral part of exercise, which 'resets' the full excursion of muscle and nerve movement. All soft tissue structures need to glide, to prevent stiffness. This is particularly true for nerves as well. Nerves need to glide and be stretched. However, prolonged continuous stretching and compression, for example, around corners at joints such as the ulnar nerve at the elbow, causes ischaemia because of reduced blood flow. Short-term ischaemia causes 'pins and needles' (paraesthesias), numbness and a burning pain, whereas longer term ischaemia causes external and internal scar tissue formation and fibrosis with permanent symptoms and signs of nerve compression. It is therefore important to any performer that whenever he or she has a chance to relax between performances or pieces, soft tissues should be relaxed, stretched and exercised to stimulate blood flow(6). Active relaxation is a technique which physiotherapists could teach musicians to reduce muscle spasms, fatigue and improve blood flow. Relaxation exercises can be attained by a number of methods, which include the Alexander technique(7), the Feldenkrais method(8) and yoga. All stretching and active exercises must be done without pain. Pain is the signal that tissues have been damaged (torn), which leads to inflammation and swelling, and eventually to scar (fibrosis) formation. This fibrosis will reduce the amount of gliding of tissue planes (because of adhesions) and reduce the amount of muscle excursion (because of restricted elasticity).

Approach to specific problems

One should emphasise a holistic team approach to the management of health problems in musicians (9). Those most intimately involved with the musician, such as parents and teachers, should be sensitive to pick up any ailments and concerns (10). The musician should have the courage to approach the teacher and the parents with any problems that she or he may face before serious conditions could evolve. A case in point was a young, very talented musician, complaining of severe aches, pains and spasms in both her arms, which would only improve on rest. Physical examination did not reveal any abnormalities. However, her history indicated that she would develop these symptoms only after two hours of uninterrupted high performance playing. This was demanded by her teacher to 'improve muscle power and endurance'. This kind of illogical approach, unsympathetic behaviour with an unfounded scientific basis should be strongly discouraged. It is important to explain to musician patients the basic anatomy and workings of their bodies, and how things could go wrong. This will diminish fear, uncertainty and anxiousness. It will also help to improve communication and co-operation.

The musculoskeletal conditions affecting musicians can be grouped into three sections:

1. Common, everyday life ailments such as injuries, arthritis, rheumatic conditions and nerve compressions.

2. Overuse (too much of a normal activity), abuse (willfully causing damage) or disuse (incorrect activity or position). These are seen with poor posture, imbalances, and over training.

3. Stress related ailments such as musicians' cramps, spasms, and dystonia.

In order to arrive at a diagnosis and a plan of management, a thorough history and examination is mandatory. Table I lists some of the pertinent points that need to be clarified in order to put the patient and his/her problem into proper perspective.

Table I: History

Gender
Age
Musical history
Symptoms – cramps/pain/ weakness/sensory deficit (pins & needles, dead feeling, burning sensation)/subjective perception of difficulty in coordination and/or stiffness
Signs – sweating/heart rate increase/dry mouth/palpitations
Cognitive signs – forgetting/fright/fear
Behavioural signs – drugs/medicine/tablets/pills/alcohol/cancelling performances
Social activities – friends/parents/teachers
Sporting activities – regular exercises/relaxation exercises
Hobbies
Financial
Career stresses – competition/job security/conductor/fellow musicians/parents
Triggering factors – overuse/type of instrument (musician-instrument interface)

Examination

Apart from the points summarised in Table II, the following should also be considered:

● The general clinical examination which includes sensory, motor and vascular examination, should always compare with the contra-lateral normal side.

● Demonstration with the instrument is often essential to highlight the problem.

● Specific examination of the involved part should be done systematically, gently and meticulously.

● Specialised investigations may be needed to confirm and complement the clinical examination, e.g. sonar, nerve conduction, x-rays, technetium MDP bone scans, blood tests (to exclude conditions such as gout, rheumatoid arthritis, diabetes), biopsies from nerve, muscle or synovium .

● Diagnostic therapy, e.g. local anaesthetic with or without steroid injections may be indicated to exclude or confirm certain painful conditions.

● Consultations with the other team members or experts for second opinions are often helpful before a final diagnosis is made.

Table II : Examination

General medical examination
Neurological examination – motor/sensation
Vascular examination – swelling/blood supply/sweating/temperature
Physical examination – pinpoint tenderness/posture/muscle co-ordination/power
Perform with instrument/simulate
Specific examination of affected part
Special investigations – sonar/x-rays/bone scans/nerve conduction/MRI
Blood test (RA, DM, Gout, Muscle enzymes, FBC, ESR, LFT, CRP)
Diagnostic measures – local anaesthesia + steroids
Consultations

Diagnosis

It may not always be easy to arrive at a diagnosis. Table IIIa indicates the interrelationship between physical and psychological conditions; e.g. a tennis elbow could lead to poor posture which in turn presents as a dystonia. Cautionary note: NEVER label a patient with an 'arbitrary' diagnosis, when the clinician is uncertain about the diagnosis.

Management

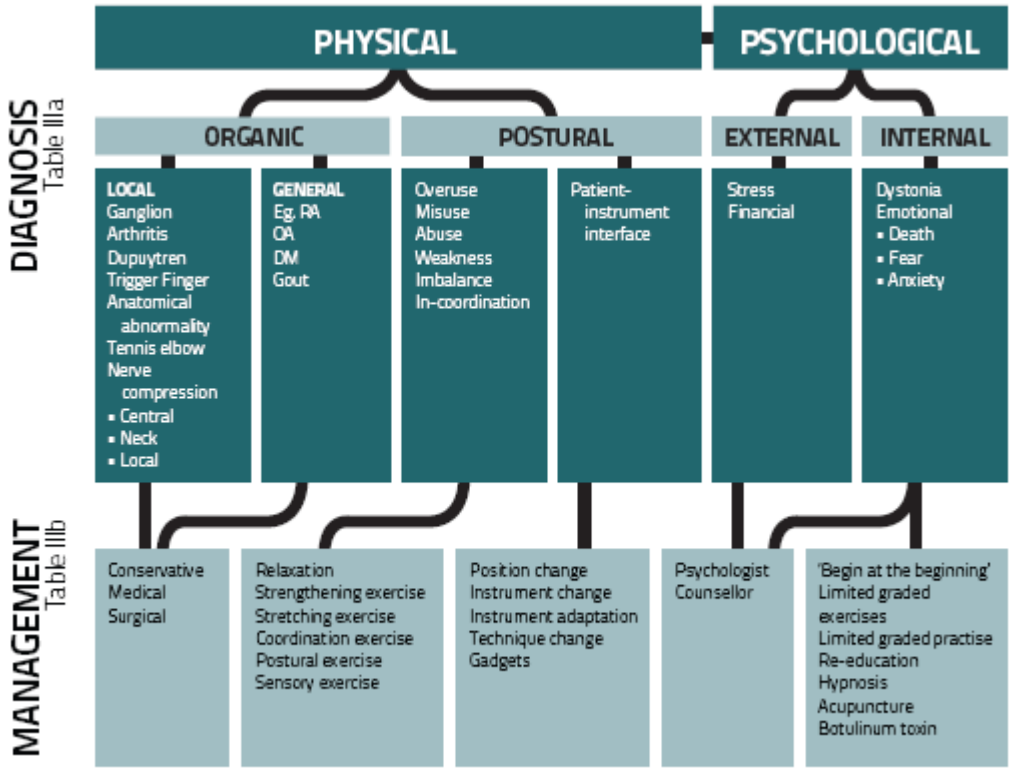
This depends on the diagnosis and may be multipronged as depicted in Table IIIb. Once a diagnosis is made the management from the hand surgeon's point of view is relatively straightforward. An anatomical variation may be corrected, a tumour may be removed, a web space may be deepened or widened and arthritic joints may be dealt with in various ways. Special consideration should of course be given when dealing with the musician's hand, such as placing the surgical scar in a position which would not interfere with the performance of the musician's hands and fingers. An arthroplasty for an arthritic proximal interphalangeal joint may be more appropriate than an arthrodesis in certain instrument players, whereas the reverse may be true in others. The range of excursion (arc of movement) of finger joints need to be considered when reconstructive surgery is done and may differ depending on the type of instrument played.

During the medical examination the emphasis should be on evaluating balance and coordination, and not only strength and endurance. Sometimes one sees an unbalanced posture of non-physiological position, which distorts the whole body resulting in a strained back, twisted neck, elevated shoulders, bent elbows and flexed wrists. Aches, pains and spasms will surely follow; and need to be addressed by restoring balance, prescribing appropriate exercises and attending to the musician-instrument interface.

Hyperlaxity of ligaments and therefore of the joints, may be a severe handicap to musicians. This laxity may be generalised, involving joints and/or tendons and ligaments; or localised, involving sets of joints, ligaments or tendons or only one joint, ligament or a tendon. Surgical plication, shortening or tightening of these structures may be needed.

Repetitive strain injuries (RSI), sometimes referred to as 'cumulative trauma disorders', is a very controversial topic. It would be prudent to either make a definite diagnosis or regard the problem as disuse, overuse or abuse rather than label the patient with RSI. Under normal circumstances, tissues can handle extensive exposure to repetitive movements over long periods without tissue damage, provided the general precautions have been taken, e.g. warming up, stretching and strengthening exercises, hydration, posture, etc. RSI is an artificial diagnosis seeking to place blame on some 'other cause' and therefore compensation may be claimed. To label a condition as RSI is dangerous

and often unsupportable. Mostly one would find an underlying condition (eg De Quervain stenosingtenosynovitis) which is being aggravated by the playing of an instrument. This needs to be treated. It is not the instrument playing which caused the condition in the first instance (11), (12), (13).



Other indications

Compartment syndrome of certain muscles or muscle groups, eg hypothenar muscles and more specific the Abductor digiti minimi, can develop in piano players with relatively small hands who have to over-stretch to reach all the keys.

Certain demanding pieces, and having practised with great effort, may cause hypertrophy of the muscle (with some swelling) ending in a painful compartment syndrome. Conservative management may include an antiinflammatory drug, ice, and pressure garment. If this proves to be unsuccessful, a surgical decompression (fasciotomy) may be indicated.

The gliding of tissues can be curtailed severely by swelling. The synovium, is an anatomical structure to enhance gliding. Once this gliding layer which is responsible for lubrication is inflicted by disease and swelling, movement will be severely affected.

Stiff joints and fingers can often be treated with an anti-inflammatory drug to reduce the swelling and increase movement. Swollen fingers can benefit greatly by wearing elastic gloves.

Sensory education and development has never been stressed when training musicians. One modality of sensation, namely proprioception, is such a fundamental function of all the joints of the body that without this modality no musical instrument can be played. Therapists should concentrate on proprioceptive acuity after an injury, surgery or in patients with hyperlaxity.

During the rehabilitation phase, the measurement of improvement helps as a psychological boost, however it is important to set limited, graded goals for a slow build-up especially if the original problem was due to overuse, misuse or disuse.

Occupational cramps, or to be more specific, musicians' cramps, are also referred to as focal dystonia. Provided physical conditions, postural imbalances and overuse injuries have been eliminated, one may consider a diagnosis of dystonia. The cause of dystonia is still poorly understood. It is suggested that the 'strain is in the brain', i.e. that the normal intricate interaction between the many parts in the brain which work together during music playing, becomes somehow disorganised. The delicate and complex integration between sensory input, interpretation, and motor execution becomes scrambled. It may be triggered by many factors. It may occur with one instrument, but not with another. Only one finger may be involved, or more than one including other parts of the arm. Only certain music pieces may elicit the spasms. The management thereof should be very sensitive and with a great deal of empathy, understanding and patience. Stressful situations such as overbearing parents or unreasonable teachers should be identified and dealt with circumspection. Assessments by occupational, physical and hand therapists as well as the psychologist could prove helpful.

Once the problem is unraveled, analysed and understood it is advisable to start right at the beginning and slowly build up to a level of performance, which would match the ability of the musician. Again, slow, graded, and attainable goals should be set. The brain therefore needs to be 'reset' (14), (15), (16).

Long-term strategies

Since many conditions may be interrelated and may have an emotional or a psychological overlay, a combination of treatment options need to be considered. This includes drug therapy for stage fright, anxiety, excessive sweating and tremors. Musicians should not use sedative drugs such as the benzodiazepines, since they cloud judgment, cause sleepiness and depression and lead to addiction. Alcohol may 'calm the nerves' and boost one's confidence, but also may cloud the judgment and suppresses reflex time. It may be wise to follow the general rule: Don't drink and play. Caffeine, which is contained in coffee, tea and cola, may cause tremour, anxiety and insomnia. Other drugs, such as beta-adrenergic receptor antagonists (e.g. propranolol) block the physical effects of adrenaline such as anxiety, tremour, sweating and reduce the heartbeat. Generally, they are safe in healthy people, but should not be used in patients with asthma, heart problems and pulmonary obstructive disease. Side effects may however include slowing of fi nger movement and insomnia. These drugs do not enhance performance, but will allow a more optimal performance. When these are prescribed for the first time, the dose and timing should be tried during a non-important event. However, on a cautionary note, one should emphasise that these medicines should only be used as single doses for the exceptional occasion. If a drug is used regularly the musician may become psychologically dependent on this 'crutch', so that performance without these drugs may become difficult or even impossible.

Conclusion

Very often factors such as job security and pressure from peer and support groups prevent the musician from making an issue of his or her specific ailment. Musicians should develop the confidence to approach their teachers, conductors, parents and peers when they have a problem. It is better to solve the problem earlier rather than later, as it will make rehabilitation and the earlier achievement of peak performance much easier. Musicians should also have the right to have 'off days', make mistakes and be 'out of synch' with their biological clockwork. Often insurmountable problems, as seen from the musician's perspective, may indeed be a simple medical problem that could easily be solved.

References

1. Winspur I, and Wynn Parry CB. The Musician's Hand. J Hand Surg 1997;22B(4):433-40

2. Winspur I. The professional musician and the hand surgeon. In: Vastamaki M et al (Eds): Proceedings of the 6th Congress of IFSSH. Helsinki, Bologna, Monduzi Editori, 1995:1207-11.

3. Wynn Parry CB. Musicians suffer a variety of problems. J Hand Surg 1994; 19B (Supplement):11-12.

4. Amadio PC, Russotti GN. Evaluation and treatment of hand and wrist disorders in musicians. Hand Clinics 1990; 6:405-162.

5. Brockman R, Chamagne P,Tubiana R. The upper extremity in musicians. In:Tubiana R (Ed.): The Hand, Philadelphia, W B Saunders 1990 4:873-85

6. Eins M, Dedekind K, Mennen U. Mobilization of the Nervous System of the Upper Limb; SA Bone & Joint Surgery 1966;6(3):110-23

7. Rosenthal E. The Alexander Technique, what it is and how it works. Medical Problems of performing Artists, (Journal) 1987; 2:53-57

8. Spire M. The Feldenkreis Method. An interview with Anat Baniel. Medical Problems of Performing Artists 1989; 4:159-62.

9. Rietveld B. Performing arts clinics – a Dutch approach. Performing Arts medical News, 1995; 3:12-18.

10. Graff man G. Doctor; can you lend an ear? Medical Problems of Performing Artists, (Journal) 1986; 1:3-4.

11. Vender MI, Kasdan ML, Truppa KL. Upper extremity disorders. A literature review to determine work-relatedness. J Hand Surg 1995; 20A:534-41.

12. Barton NJ, Hooper G, Noble J, Steel WM. Occupational causes of disorders in the upper limb. BMJ 1992; 304:309-11.

13. Hadler NM, Hill C. Repetitive Upper Extremity Motions in the Workplace Are Not Hazardous. J Hand Surg: 1997,22A(l):19-29.

14. Critchley N. Occupational palsies in musical performs. In: Critchley N, Henson R (Eds): Music and the brain. London,Heinemann,1977:365.

15. Lederman R. Neuromuscular problems in the performing arts. Muscle and Nerve 1994, 17:569-577.

16. Altenmüller E. Focal dystonia: advances in brain imaging and understanding of fi ne motor control in musicians. Hand Clinics 2003:19; 523-538