

REVIEW ARTICLE

HAND DISORDERS AMONG MUSICIANS – REVIEW ARTICLE

**PROBLEMY ZDROWOTNE W OBRĘBIE KOŃCZYN GÓRNYCH U ZAWODOWYCH MUZYKÓW –
ARTYKUŁ PRZEGLĄDOWY**

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ABSTRACT

Overloads within the musculoskeletal and nervous systems are common in instrumental musicians. In their exceptional work, they are exposed to a number of physical and mental overloads associated with the stress accompanying the profession. It is estimated that 32%–86% of professional musicians during their careers experience various types of pain. Characteristic health problems in this professional group include overuse syndromes, focal dystonia, osteoarthritis of the hands, joint laxity and nerve entrapment syndromes.

Key words: musicians, overuse syndrome, osteoarthritis, entrapment neuropathies

STRESZCZENIE

Przeciążenia w obrębie układu mięśniowego, szkieletowego oraz nerwowego są częste u muzyków instrumentalnych. W swojej wyjątkowej pracy są oni narażeni na szereg przeciążeń fizycznych jak i psychicznych związanych ze stresem towarzyszącym profesji. Szacuje się, że od 32%–86% zawodowych muzyków w czasie trwania kariery zawodowej doświadcza różnego rodzaju dolegliwości bólowych. Do charakterystycznych problemów mięśniowo - szkieletowych w tej grupie zawodowej zaliczamy zespoły przeciążeniowe, dystonię ogniskową, chorobę zwyrodnieniową stawów dłoni, uogólnioną lub lokalną wiotkość stawową oraz zespoły uwięźnięcia nerwów.

Słowa kluczowe: muzycy, zespół przeciążeniowy, dystonia ogniskowa, wiotkość stawowa, choroba zwyrodnieniowa, zespoły uwięźnięcia nerwów

Introduction

Instrumental musicians are professional group that is significantly exposed to overload in the musculoskeletal system. Immense group of musicians have health problems that are directly related to their profession. Playing the instrument in a non-ergonomic posture, often forced by demanding long-lasting isometric muscle tension, repeated movements and lack of rest can be one of the main causes of health problems within the musculoskeletal system. Injuries and overloads lead to chronic pain states, which to a large extent may limit the possibilities of playing the instrument, which in turn may lead to end of the career. The daily work of the music consists of many hours of individual rehearsals and together with the orchestra or band. Additional time should be spent on performances. According to researchers, between 30% and 90% of professional musicians are exposed to the development of musculoskeletal disorders (Zaza, 1998). One of the first, wide-ranging, epidemiological studies of instrumental musicians showed that 82% of the 2212 tested, felt at least one painful area in the upper limb. 76% of respondents reported that the pain they felt was so intense that it affected their ability to play (Fishbein *et al.*, 1988). Higher risk of injuries, ailments, musculoskeletal overloads is in the group of musicians playing string and keyboard instruments. Playing on instruments from these two groups requires many fast movements, often lasting for a very long time, which, combined with insufficient rest may limit the regenerative abilities of the body. Symptoms of the musculoskeletal system may increase gradually or occur suddenly in the least expected moment. The most frequently reported complaints include pain, decreased muscle endurance, reduced range of motion, tingling sensation and feeling of tense muscles. Pain significantly contributes to the decline in speed, endurance and muscular control, causing playing on the instrument very difficult. Symptoms associated with playing in the early stages are often neglected. Appropriate steps taken to cure are often implemented in situations when playing on instrument is no longer possible. Proceeding to cure at such

a moment is much more complicated and the probability of obtaining results at a satisfactory level decreases.

The term playing related musculoskeletal disorders (PRMD) has been introduced to describe a series of disorders in the group of instrumental musicians (Zaza, 1998). The most common health problems among professional musicians are overuse syndromes (fatigue), focal dystonia, degenerative disease, joint laxity (local or general) and nerve entrapment syndromes. This article presents an overview of the most frequent health problems in professional instrumental musicians in the upper limbs.

Overuse syndrome

The overuse syndrome results from the profession and occupation is described in not obvious way. This term is often used to describe a set of symptoms, usually pain, associated with professional activity without specific diagnosis. The dominant symptom in this syndrome is pain and it is believed to be the most wide spread problem among a group of professional musicians. It is becoming known that the overuse syndrome affects more than half of the musicians playing in professional orchestras (Fry, 1986), 50–80% reported to physician for this reason (Dawson, 1988). Characteristics for the overuse syndrome are muscle weakness and reduced motor control. The sensory complaints are not present. Symptoms usually occur during playing the instrument or immediately after stopping. The occurrence of ailments is often associated with a change in the instrument or game technique. Factors that may increase the risk of overuse are the extended time for rehearsals associated with learning to play more difficult music sequences, the concert tour and the inadequate time spent resting between performances and rehearsals. Exacerbation of symptoms may also be associated with incorrect posture (Figure 1), frequent finger movements in extreme ranges of motion, as well as the disproportion between the size of the instrument and the musician (Wilson, 1991). The pathophysiology of the overuse syndrome is still the topic of discussion among many researchers. A frequently cited hypothesis of the

occurrence of ailments is tissue fatigue being the effect of using them above the physiological limit of endurance. Some researchers believe that the cause of the ailments are tissue changes. It is certainly necessary to unificate the concept of overuse to avoid unnecessary discrepancies. In many cases, this syndrome is confused with bursitis or tendinitis and other inflammatory conditions. However, the studies did not show any histopathological changes characteristic of inflammation (White, 2003).

The treatment of the overuse syndrome consists mainly in the application of an appropriate rest. Factors such as fear of losing a job, a large amount of time dedicate to the game in order to achieve perfection, pressure from the environment cause that breaks and rest from the game meet with a great reluctance in this specific professional group. Adequate setting of the day plan by teachers, orchestral directors, consultation with a doctor, meetings with trainers and physiotherapists can be very useful in reducing the risk of ailments that can significantly affect the career of a professional musician. Researchers have shown that an appropriate day plan including rest and properly conducted rehabilitation brings about a very large improvement in regressed ailments and the ability to return to the game (White, 2003).

incidentally and appears after years playing the instrument. It is characterized by painless muscle cramp of affected limb (Lockwood, 1989). The occurrence of uncontrolled muscle contractions commonly occurs while playing on instrument, being provoked by conscious movements. It is observed that focal dystonia occurs mainly when performing complex fast movements in a small space while playing on instrument. On the otherhand, performing normal movements, by limb in which the symptoms of dystonia occurred, do not cause similar symptoms (Abruzzies, 2001; Jankovic and Ashoori, 2008). Among the group of professional instrumental musicians, the most exposed to the occurrence of symptoms are pianists, guitarists and musicians playing on string instruments (Zeuner and Molloy, 2008). Newmark and Hochberg (1987) described the occurrence of uncontrolled contractions on a group of 57 professional musicians. Their research also confirm that the most exposed to uncontrolled spasms are pianists (n = 35), guitarists (n = 13) and string instrumentalists (n = 9). Results also showed that unconscious spasms occurred in the fourth and fifth fingers, mainly in the right upper limb. The pathophysiology of focal dystonia is still unclear (Konczak, 2013). Authors consider the sources of this disorder in the central nervous system, insufficient work of the motor



Figure 1. Unnatural posture during playing on instrument.

Focal dystonia

One of the rarest debilitating health problem for professional musicians is focal dystonia. It is estimated that this problem affects 0.6–1% of musicians (Altenmuller 2003, 2013). Occurs

cortex, weak stimuli from the basal ganglia (Lederman, 2003). On the other hand some researchers claim that the reason of this condition is in earlier limb injury (Newmark and Hochberg, 1987; Lederman, 1988; Lockwood, 1989).

Treatment of focal dystonia is difficult and there is lack of spectacular effects. Injection or oral steroid use, physiotherapy, rest, botulinum toxin, localized immobilization, antidepressants, eventually surgery are the most commonly used methods of treatment (Marsden, 1991; Toledo, 2004).

Osteoarthritis

Osteoarthritis affects the general population, with greater prevalence among women compared to men (Srikanth, 2005; Hoxha, 2015). The musician begins his professional career at an early age, around the age of six and lasts around the age of seventy. Due to the fact that the degenerative disease progresses with age, it seems that the probability of this disease is quite high (Lambert, 1992). However, there is no direct correlation between longtime playing the instrument and degeneration of the hands joints. Overlook genetic predisposition or injury, osteoarthritis is a disease rather common in this group. The main symptom of this condition is pain, stiffness and reduction in the range of motion that accompanies this disease have the greatest impact on the quality of playing the instrument. Carpo–metacarpal

joint of the thumb, the scapho-trapeziotrapezoid joint, interphalangeal and metacarpo-phalangeal joints are the most vulnerable places for the occurrence of ailments (Sheibani-Rad, 2013). The connection between playing the instrument and degenerative disease in 1984 was described by Bard, Sylvestre and Dussalu. The same researchers showed on a group of 20 pianists degenerative changes in the carpo – metacarpal and metcarpo-phalangeal joints on radiographs. Schwartz and Peimer (1998) in their study described the case of a 70-year-old violinist with degenerative joint disease in distal interphalangeal joint index finger of the left hand. Applied surgical treatment (Swanson's plastic surgery) brought positive effects and the possibility of returning to the playing without any limitations. Treatment of osteoarthritis mainly focus on reducing pain, restoring the range of motion and protection of the affected joint. The biomechanics of playing on the instrument should be improved to avoid the intensification of symptoms. Steroid injection, hyaluronic acid or platelet-rich plasma is also used. In some cases arthroscopy treatment is need (Figure 2).

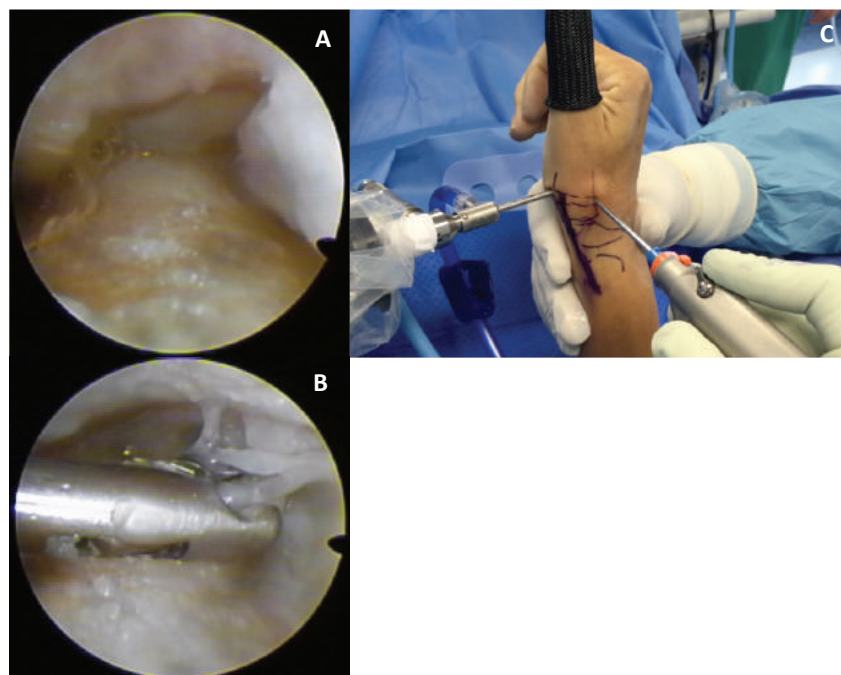


Figure 2. Degenerative changes in 1 metacarpophalangeal joint; view from arthroscopy of damaged cartilage (A), view from arthroscopy (B ,C).

Joint laxity (joint hypermobility)

Generalized joint laxity is characterized by an increased movement in the joints, beyond the normal range. It is estimated that in the group of professional musicians 5 to 25% had generalized or local joint laxity and occurs more often than in the general population (Graham, 1993; Larsson, 1993). Professional musicians often experience hypermobility in one or several joints, which may manifest themselves in pain and a sense of instability. Arthritis or neuropathy are other ailments that may be a consequence of hypermobility (Hansen, 2006; Bird, 2008). Possibly it is a necessary condition for easier getting some extreme hand positions while playing the instrument (Figure 3). Larsson and colleagues (1993) in their research considers joint laxity as a disadvantage and on the other hand as an advantage. In the group of 660 examined musicians, pain in the elbow, wrist and fingers was more frequent in people without joint laxity. On the other hand, Brandfonbrener (1990) in a study conducted among 396 musicians showed that the higher probability of injury, overload occurs in people with with joint laxity. Treatment of joint laxity should primarily be based on stabilizing exercises aimed at increasing strength and muscle endurance. In case of very high instability and lack of improvement after the use of conservative treatment, temporary immobilization, and finally surgery is considered.

nervous system occurring among professional musicians (Wilson, 2014). Diagnosing neuropathy in musicians can be quite difficult due to the presence of complaints only when playing the instrument (Charness, 1985). Diagnostics is based on a thorough clinical assessment. Electromyography, ultrasounds and magnetic resonance also can be helpful. Carpal tunnel syndrome is the most common disease among professional musicians (Wilson, 2014; Lederman, 1986) like general population. Shaffer *et al.*, (2013) in their research showed that 27% of examined persons had incorrect signal from medial nerve in electromyography. Hochberg (1983) also described 9 musicians with medial nerve entrapment. Numbness and pain are dominant are dominant symptoms in this neuropathy. Pain also can occur during night. In severe condition medial nerve entrapment can lead to sensory disorder in the finger tips. Second most frequent neuropathy among musicians is ulnar nerve neuropathy (Lederman, 1986; Wilson, 2014). The main clinical problem in this condition is impairment of the muscles innervated by ulnar nerve. That lead to the reduction of muscles endurance and deteriorate control of precise movements (Nakano, 1990). Bilateral ulnar nerve neuropathy in group of pianists was observed by Charness *et al.* (1985). Repeated flexion and extension of the elbow by string players can also lead to ulnar nerve neuropathy (Lambert, 1992).

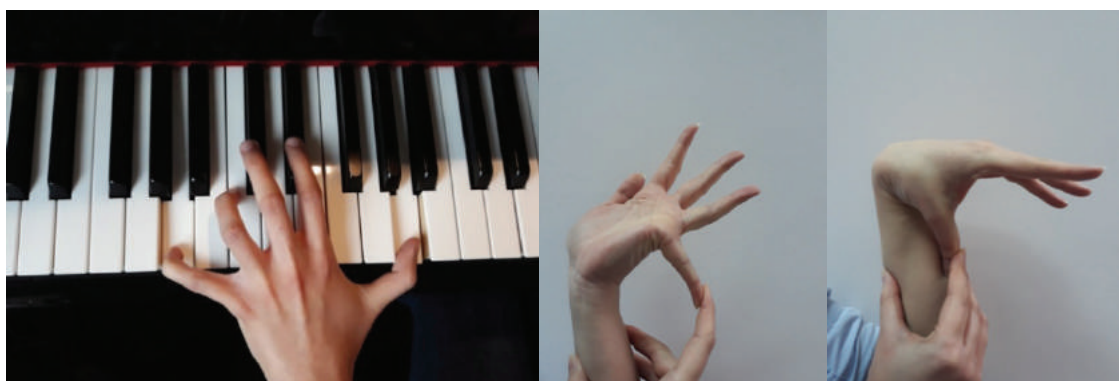


Figure 3. Photos of pianists hand with joint laxity.

Entrapment neuropathies

Thoracic outlet syndrome (TOS), carpal tunnel syndrome or ulnar neuropathy (elbow joint) are quite frequent disorders of the peripheral

Thoracic outlet syndrome (TOS) is caused by nerve and blood vessels compression between collar bone and first rib. Lederman *et al.* in his research described group of 17 musicians

with TOS. Characteristic complaints for TOS occurred only during playing the instrument. Garret *et al.*, (2018) also showed that group of professional musicians are more exposed for TOS. Conservative treatment consist of rehabilitation, rest, immobilization and steroid injection. Lack of improvement can be indication for surgical treatment (Lambert, 1992). Prevention in neuropathy seems to be crucial. Rehabilitation, autostretching and correct posture during playing on instrument are significant factors.

Conclusions

Overload syndromes, focal dystonia, nerve entrapment syndromes, joint laxity and in consequent osteoarthritis can significantly affect the career of a professional musician. Due to the high risk of various types of ailments among professional musicians, there is a need for education about treatment and prevention. Conservative treatment should be considered first. Lack of effects of non-invasive treatment may be an indication for surgery.

REFERENCES

- Abbruzzese, G., Marchese, R., Buccolieri, A., Gasparetto, B., and Trompetto, C.** (2001) 'Abnormalities of sensori motor integration in focal dystonia: a transcranial magnetic stimulation study.' *Brain*, 124, pp. 537–545.
- Altenmüller, E.** (2003) 'Focal dystonia: advances in brain imaging and understanding of fine motor control in musicians.' *Hand Clin.*, 19, pp. 523–538.
- Altenmüller, E., Baur, V., Hofmann, A., Lim, V.K., Jabusch, H.C.** (2012) 'Musician's cramp as manifestation of maladaptive brain plasticity: arguments from instrumental differences.' *Ann N.Y. Acad. Sci.*, 1252, pp. 259–265.
- Bard, C.C., Sylvestre, J.J., Dussalut, R.G.** (1984) 'Hand osteoarthropathy in pianists.' *J Can Assoc Radiol.*, 35, pp. 154–158.
- Bird, H.A., Wright, V.** (1981) 'Traumatic synovitis in a classical guitarist: the study of joint laxity.' *Ann Rheum Dis.*, pp. 40–161.
- Brandfonbrener, A.G.** (1990) 'Joint laxity in instrumental musicians.' *Med Probl Perform Art.*, 5, pp. 117–119.
- Charness, M.E., Parry, G.J., Markison, R.E.**, (1985) 'Entrapment neuropathies in musicians.' *Neurology*, 35(suppl 1), p. 74.
- Dawson, H.J.** (1988) 'Hand and upper extremity problems in musicians; epidemiology and diagnosis.' *Med Probl Perform Art.*, 3, pp. 19–22.
- Demaree, C.J., Wang, K., Lin, P.H.** (2017) 'Thoracic outlet syndrome affecting high-performance musicians playing bowed string instruments.' *Vascular*, 25, pp. 329–332.
- Hoxha, F., Tafaj, A., Roshi, E., Burazeri G.** (2015) 'Distribution of risk factors in male and female primary health care patients with osteoarthritis in Albania.' *Med Arch.*, 69(3), pp. 145–148.
- Fishbein, M., Middlestadt, S.E., Ottati, V., Straus, S., Ellis, A.** (1988) 'Medical problems among ICSOM musicians: overview of a national survey.' *MPPA.*, 3(1), pp. 1–8.
- Fry H.J.H.** (1986) 'Incidence of overuse syndrome in the symphony orchestra.' *Med Probl Perform Art.*, 1, pp. 51–55.
- Garret Adam, Kevin Wang, Christopher J Demaree, Jenny S. Jiang, Mathew Cheung, Carlos F. Bechara, Peter H. Lin.** (2018) 'A Prospective Evaluation of Duplex Ultrasound for Thoracic Outlet Syndrome in High-Performance Musicians Playing Bowed String Instruments.' *Diagnostic (Basel)* 8(1): 11 Published online 2018 Jan 25.
- Grahame, R.** (1993) 'Joint hypermobility and the performing musician.' *N Eng J Med.*, 329, pp. 1120–1121.
- Hansen, P.A., Reed, K.** (2006) 'Common musculoskeletal problems in the performing artist.' *Phys Med Rehabil Clin N Am.*, 17, pp. 789–801.
- Hochberg, F.H., Leffert, R.D., Heller, M.D., Merriman, L.** (1983) 'Hand difficulties among musicians.' *JAMA.*, 249(14), 1869–1872.
- Hoppmann, R.A., Ekman, E.** (1999) 'Arthritis in the aging musician.' *Med Probl Perform Art.*, 14, pp. 80–84.
- Jankovic, J., Ashoori, A.** (2008) 'Movement disorders in musicians.' *Mov. Disord.*, 23, pp. 1957–1965.
- Knishkowsky, B., Lederman, R.J.** (1986) 'Instrumental musicians with upper extremity disorders: a follow up study.' *Med Probl Perform Art.*, 1, pp. 85–89.

- Konczak, J., Abbruzzese, G.** (2013) *Focal dystonia in musicians: linking motor symptoms to somatosensory dysfunction.* *Frontiers in Human Neuroscience*, 2013; 7: 297. Published online 2013 Jun 25. Prepublished online 2013 Mar 27. Doi. 10.3389/fnhum.2013.00297.
- Lambert, C.M.** (1992) *Hand and upper limb problems of instrumental musicians.* *Br J Rheumatol.*, 31, pp. 265–271.
- Larsson, L.G., Baum, J., Mudholkar, G.S., Kollia, G.D.** (1993) *Benefits and disadvantages of joint hypermobility among musicians.* *N Eng J Med.*, 329, pp. 1079–1082.
- Lederman, R.J.** (1986) *Nerve entrapment syndromes in instrumental musicians.* *Med Probl Perform Art.*, June 1986, Vol. 1, No 2, pp. 45–48.
- Lederman, R.J.** (2003) *Neuromuscular and musculoskeletal problems in instrumental musicians.* *Muscle Nerve*, 27, pp. 549–561.
- Lederman, R.J.** (1988) *Occupational cramp in instrumental musicians.* *Med Probl Perform Art.*, 3, pp. 45–51.
- Lederman, R.J.** (2002) *Neuromuscular problems in musicians.* *Neurologist*, 8, pp. 163–174.
- Lockwood, A.H.** (1989) *Medical problems of musicians.* *N Engl J Med.*, 320, pp. 221–227.
- Lockwood, A.H., Lindsay, M.L.** (1989) *Reflex sympathetic dystrophy after overuse: the possible relationship to focal dystonia.* *Med Probl Perform Art.*, 4, pp. 114–117.
- Marsden, C.D.** (1991) *Investigation and treatment of dystonia.* *Med Probl Perform Art.*, 6, pp. 116–121.
- Nakano, K.K.** (1990) *Peripheral nerve entrapments, repetitive strain disorder and occupation related syndromes.* *Curr Opin Rheumatol.*, 2, pp. 253–269.
- Newmark, J., Hochberg, F.H.** (1987) *Isolated painless manual incoordination in 57 musicians.* *J Neuro Neurosurg Psychiatry*, 50, pp. 291–295.
- Shaffer, S.W., Koreerat, N.R., Gordon, L.B., Santillo, D.R., Moore, J.H., Greathouse, D.G.** (2013) *Median and ulnar neuropathies in U.S. Army Medical Command Band members.* *Med Probl Perform Art.*, 2013 Dec; 28(4): pp. 188–194.
- Schwartz, D.A., Peimer, C.A.** (1998) *Distal interphalangeal joint implant arthroplasty in a musician.* *J Hand Ther.*, 11, pp. 49–52.
- Sheibani-Rad, S., Wolfe, S., Jupiter, J.** (2013) *Hand disorders in musicians.* *Bone Joint J.*, 2013 Feb; 95-B(2): pp. 146–150.
- Srikanth, V.K., Fryer, J.L., Zhai, G., Winzenberg, T.M., Hosmer, D., Jones, G.** (2005) *A meta-analysis of sex differences prevalence, incidence and severity of osteoarthritis.* *Osteoarthritis Cartilage.*, 13(9), pp. 769–781.
- Toledo, S.D., Nadler, S.F., Norris, R.N.** (2004) *Sports and performing arts medicine. Issues relating to musicians.* *Arch Phys Med Rehabil.*, 85(3, suppl. 1), pp. S72–S74.
- White, J.W., Hayes, M.G., Jamieson, C.G.** (2003) *A search for the pathophysiology of the nonspecific “occupational overuse syndrome” in musicians.* *Hand Clin.*, 19(2), pp. 331–341.
- Wilson, F., Wagner, C., Homberg, V.** (1991) *Interaction of biomechanical and training factors in musicians with occupational cramp/focal dystonia.* *Neurology*, 4(suppl 1), pp. 291–292.
- Wilson, R.J., Watson, J.T., Lee, D.H.** (2014) *Nerve entrapment syndromes in musicians.* *Clinical Anatomy*, 2014 Sep; 27(6): 861–5. doi: 10.1002/ca.22377. Epub 2014 Mar 18.
- Zaza Ch.** (1998) *Playing-related musculoskeletal disorders in musicians: a systematic review of incidence and prevalence.* *Canadian Medical Association Journal*, 1998 Apr 21; 158(8): pp. 1019–1025.
- Zeuner, K. E., Molloy, F.M.** (2008) *Abnormal reorganization in focal hand dystonia—sensory and motor training programs to retrain cortical function.* *Neuro Rehabilitation*, 23, pp. 43–53.