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Occupational Musculoskeletal Diseases

Multimedia Guide for the English Programme Students

OCCUPATIONAL MUSCULOSKELETAL DISEASES

MULTIMEDIA GUIDE FOR THE ENGLISH PROGRAMME STUDENTS

"Pleasure in the job puts perfection in the work."

Aristotle (384 BC - 322 BC)

PREFACE

"Pleasure in the job puts perfection in the work."

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"Occupational Musculoskeletal Diseases – Multimedia Guide for the English Programme Students" freely develops the multimedia tutorial program "Occupational Upper Extremity Diseases" from year 2009.

The program "Occupational Musculoskeletal Diseases – Multimedia Guide for the English Programme Students" is especially meant for teaching Occupational Medicine in the master degree programme General Medicine in the English language. An illustrative and comprehensive processing of the theme of occupational musculoskeletal diseases is aimed at a more detailed introduction into these up-to-date problems.

Except for the most frequent upper extremity diseases caused by the exposure to hand-transmitted vibration and overload of upper extremities, disorders of the vertebral column and lower extremities are discussed. Furthermore, occupational diseases assessment systems of other countries, especially of those from which the foreign students come from, are mentioned. Case-reports, an English-Czech dictionary of occupations and a test of knowledge are included in the multimedia program. Short-form videos directly from the workplaces such as stone quarries, foundries, assembly lines, medical or artistic working environments show operations which can lead to health disturbances. We hope that the users will welcome the opportunity of comfortable studying in the pleasant environment of the FlipViewer program.

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PART I: INTRODUCTION

"Health is not valued till sickness comes."

DEFINITIONS: MUSCULOSKELETAL DISEASES AND DISORDERS, OCCUPATIONAL DISEASES IN THE CZECH REPUBLIC

The term musculoskeletal diseases or disorders denotes diseases or disorders of various parts of the locomotor apparatus: muscles, tendons, tendon sheaths, ligaments, skeleton, cartilage or nerves.

Work-related diseases represent occupational diseases and occupational traumas.

FIG. 1 - CONSTRUCTION WORKER
Source:
http://www.wallpapermaven.com/cat/industry/Construction-Worker-18.html
(cited 28. 9. 2012)

In the Czech system the Order of the Government No. 114/2011 (Digest) defines occupational diseases as diseases caused by adverse chemical, physical, biological and other agents, developing under the specific conditions mentioned in the valid list of the occupational diseases, which is the supplement of the order of the government No. 114/2011 (Fig. 1).

Occupational traumas are defined as disorders of physical and mental health, eventually death, as a result of a short-time, accidental and forceful exposure during performing the working duties. Occupational traumas are not assessed by occupational physicians in the Czech Republic. The assessment is completed by the employer. Therefore occupational traumas will not be discussed here.

ASSESSMENT OF OCCUPATIONAL DISEASES IN THE CZECH REPUBLIC

In connection to the assessment and confirmation of occupational diseases, irrespective of their nature, only occupational physicians from the so called **occupational diseases centres (departments)** are allowed to provide and complete this whole process. Each of those several centres in the Czech Republic has its own particular region and importantly, there is no free choice of a centre for a potential patient. All these above mentioned properties and procedures are based on legal norms.

The diagnosis of an occupational disease can be confirmed if there is an objective and well-documented evidence of exact clinical diagnosis and hazardous occupational environment at the same time.

The course of this precise assessment of an occupational disease generally follows these stages:

1. The first step is the **completion of clinical diagnosis.** The documentation held by the general practitioner is a very worth source of information in connection to the health status before the suspicion of an occupational disease. Regarding the differential diagnosis of the particular disease, all the other probable aetiologies have to be excluded – with the help of specialized clinical, laboratory and additional investigations. The completion of the clinical diagnosis in occupational medicine also means that other factors have to be taken into account – the **severity** (certain stage) of a suspicious occupational disease or its **chronicity** plays an important role, too. All these facts have to be confronted with the standards, guidelines and legal norms, especially with **the valid list of occupational diseases**.
2. After the completion and confirmation of clinical diagnosis, the second step follows. **An objective evidence of a hazardous or safe workplace** has to be provided. This, in many cases difficult, scientific and time-consuming assessment of the workplace is completed by the public health physicians (occupational hygienists) and other industrial hygiene specialists.
3. Based on the results of the assessment mentioned in the second step, the **final conclusion** follows.

In the case of a positive result of the hygienic assessment of the workplace (☞ **the evidence of particular hazardous working conditions in accordance with the performed work pattern and working operations**) the disease becomes a **confirmed (acknowledged) occupational** disease. An official and legally binding document is issued by the regional centre of occupational diseases and its copy is sent to the patient and employer, company doctor, general practitioner, public health organ and Health Insurance Company. The occupational disease is also announced to the National Registry of Occupational Diseases. In the case of a negative result of the hygienic assessment of the workplace (particular working conditions are not hazardous), the disease cannot be assessed,

confirmed or acknowledged as an occupational disease and an official document regarding these facts is issued.

There is a legal possibility of making a proposal by the patient or the employer to reevaluate the medical assessment.

COMPENSATION FOR OCCUPATIONAL DISEASES

According to the Czech judicial system, the last employer for whom the patient worked under the risky conditions is liable for the development of an occupational disease (Fig. 2). This employer is obligated to cover the compensations for:

a) loss of the income (in the time of the work disability)
b) decrease in the income
c) pain and aggravation of the social state
d) costs for treatment
e) damage to property.

FIG. 2 - COMPENSATION
Source:
http://wigginspayroll.com.p11.hostingprod.com/small_business_solutions/workers_comp_plans
(cited 22. 9. 2012)

In the case of death caused by an acknowledged occupational disease the employer has to cover the costs for:

a) treatment
b) funeral
c) support of surviving relatives
d) one-shot compensation of surviving relatives
e) damage to property.

Every employer must be insured for the case of occupational disease development.

THE LIST OF OCCUPATIONAL DISEASES

Every state has its own list of occupational diseases. The list of occupational diseases that was issued by the International Labour Organization in Geneva serves as a fundamental

(☞ visit the ILO´s official websites: **http://www.ilo.org/wcmsp5/groups/public/---**

dgreports/---dcomm/---publ/documents/publication/wcms_150323.pdf). The existence of such a list is necessary tool for the unification of interpretation of relationships between occupations and diseases, which is also very important because of the financial and legal impacts of occupational diseases.

The Czech List of Occupational diseases (the supplement of the order of the government) was revised last in year 2011. It consists of six chapters. Each of the chapters deals with particular groups of occupational diseases. **Only diseases and disorders mentioned in this list can be assessed and acknowledged as occupational diseases.** Also particular exposures and workplace conditions leading to these disorders are mentioned and defined here.

TAB. 1 - STRUCTURE OF THE LIST OF OCCUPATIONAL DISEASES: CHAPTERS AND EXAMPLES OF DISEASES

Chapter I	**Occupational diseases caused by chemicals** • poisonings, damage caused by gases, carcinogens, industrial intoxications...
Chapter II	**Occupational diseases caused by physical factors** • vibration, overload, radiation, noise... • carpal tunnel syndrome, occupational Raynaud's syndrome...
Chapter III	**Occupational airway diseases, pleural and peritoneal diseases** • occupational asthma, pneumoconiosis, mesothelioma, extrinsic allergic alveolitis...
Chapter IV	**Occupational skin diseases** • contact allergic eczema, irritation dermatitis...
Chapter V	**Occupational communicable and parasitic diseases** • health care professionals – tubercolosis..., farmers – tularemia, borreliosis...
Chapter VI	**Occupational diseases caused by other factors and agents** • voice overload...

Assessment and Classification of Occupational Risks

Various occupational risks are classified into four categories and express the probability and relevance of the related health impacts. Also the main risk factors, in reference to musculoskeletal disorders that will be discussed here – **vibration and overload,** are classified similarly.

- **1st category** – there is no noxious factor present at the workplace or its relevance is so insignificant that any health disorders are not supposed.
- **2nd category** – probability of health impacts is almost excluded but health disorders can develop in especially susceptible individuals. Sometimes, a special risk category (2R) can also be classified – as a transition to the clear 3rd category.
- **3rd category** – the risk of health disorders development is significant for all the exposed individuals. The exposures exceed limits for particular factors. Exposure can be effectively influenced by the use of protective equipment, which is necessary, and adopting preventive measures. **Occupational diseases occur repeatedly**.
- **4th category** – this category means a very high risk that cannot be fully modified by the use of protective equipment and adopting preventive measures. Limits are substantially exceeded. It should be excusable only in extraordinary circumstances.

Depending on the category of the risk, relevant medical surveillance for particular occupations has to be established: **frequency and contents of preventive examinations** in terms of preventive company care.

Main risk factors causing musculoskeletal diseases can be basically (for the use in this text) summarized as follows:

- **vibration**
    - hand-transmitted vibration to the upper limb (use of vibrating tools)
    - whole body vibration (vibrating vehicles, platforms)
    - specifically transmitted vibration (e. g. from a scrub-cutter through upper extremity to the cervical spine and head)

FIG. 3 - EXAMPLES OF VIBRATING TOOLS I.
Source:
http://professional-power-tool/guide.com/manufacturers/bosch-power-tool-ompany/bosch-grinders/
(cited 22. 9. 2012)

FIG. 4 - EXAMPLES OF VIBRATING TOOLS II.

FIG. 5 - EXAMPLE OF OPERATION WITH HAND-TRANSMITTED VIBRATION TO THE UPPER EXTREMITIES – STONE QUARRY

- **overload**
    - frequently repeated manipulation of objects – with the use of low-intensity forces (monotonous repetitive manipulations)
    - exertion of high-intensity forces (e. g. carrying, lifting, pushing, pulling heavy objects)
    - handling heavy loads over long periods of time (e. g. manual transporting)
    - total physical load
- working in unfavourable posture
    - working with bent or twisted trunk (e. g. also handling of patients), hands and arms above shoulders
    - working in kneeling, crouching or squatting position
- static muscular load
- additional risks
    - physical environmental factors
        - low or high temperatures of environment
    - psychosocial factors
        - time pressure, low job decision latitude
        - insufficient social support

FIG. 6 - EXAMPLES OF OPERATIONS WITH OVERLOAD OF THE UPPER EXTREMITIES – ASSEMBLY LINE I.

FIG. 7 - EXAMPLES OF OPERATIONS WITH OVERLOAD OF THE UPPER EXTREMITIES – ASSEMBLY LINE II.

FIG. 8 - EXAMPLES OF OPERATIONS WITH OVERLOAD OF THE UPPER EXTREMITIES – ASSEMBLY LINE III.

Rules of occupational safety and health as well as the hygienic limits of workplace risk factors are regulated by the Order of Government No. 361/2007 (Digest) in the Czech legislation.

Occupational Diseases Assessment Systems in Canada, Malaysia, Portugal, Taiwan, the United Kingdom of Great Britain and Northern Ireland (UK) and the United States of America (USA)

Canada

Law, Government Officials and Occupational Medicine in Canada

In Canada there are 10 provinces and 3 territories. Each province has its own **Occupational Health and Safety Act**. The basic idea of the law is similar but the provinces

and territories may differ in the regulations for certain exposures or procedures. Due to this decentralization, Canada does not have a large organization as Health and Safety Exclusive (HSE) in the United Kingdom or National Institute of Occupational Safety and Health (**NIOSH**), Occupational Safety and Health Administration (**OSHA**) in the USA. The organizations which regulate the working safety and have the power to inspect the workplace are the Workers' Compensation Boards. They have different names in different provinces.

Assessment and Compensation for Occupational Diseases in Canada

In Canada, physicians who would like to be specialists in the field of occupational medicine can be certificated by either the **Royal College of Physicians and Surgeons of Canada** or the **Canadian Board of Occupational Medicine**. Canada has population of 33 million but there are **only around 60 occupational specialists** who have completed the training and certificated by the Royal College of Physicians and Surgeons of Canada. Nowadays patients in Canada are managed by both general practitioners and occupational specialists.

Workers' Compensation is a legislation of Canada to provide benefits, medical care and rehabilitation services to employees who suffer from occupational diseases. It was firstly introduced to Ontario in 1915 then to other provinces. The idea of this legislation is also to avoid lawsuits. It works as workers were to be compensated for occupational diseases but must give up their right to sue the employers. The details in different provinces vary from each other. Workers' Compensation Boards are also the insurer for employees and funded by employers.

Malaysia

The major law according to the occupational diseases assessment in Malaysia is the **Occupational Safety and Health Act 514**, which was gazetted on 25 February 1994 by the Malaysian Parliament. Under this Act, there are more regulations and schedules for notification of occupational diseases, duties of employers, duties of employees and handling of potential dangerous operations. According to this Act, it is the duty of employers to insure their employees.

Pertubuhan Keselamatan Sosial (PERKESO) (or Social Security Organization – SOCSO)

This is a government managed organization, set up to administer, enforce and implement the **Employees' Social Security Act** (from 1969) and the **Employees' Social Security (General) Regulations** (from 1971). It basically operates as a social insurance programme to provide financial assistance to employees and their families in the event of accidents, resulting in death, disablement or affliction with occupational diseases.

Assessment of Occupational Diseases in Malaysia

An occupational medicine clinic is a referral clinic, which means that patients are referred to the clinic by their general practitioners. Once the existence of an occupational disease is confirmed then the occupational health physician has the responsibilities for notification of occupational diseases to the Director General of the **Department of Occupational Safety and Health** and also cooperates with the employer and workers to improve the working environment. The notifiable occupational diseases are listed in the **Third Schedule of the Regulation** (from 2004).

Malaysia adapts the concepts of impairment from WHO definition, "any loss or abnormality of psychological, physiological or anatomical structure". Physicians must consider both structural and functional loss and report in accordance with the **"Guidelines on Impairment and Disability Assessment of Traumatic Injuries, Occupational Diseases and Invalidity**" (☞ prepared by the Medical and Rehabilitation Division of the **SOCSO**). The impairment assessment in Malaysia is usually conducted after treatment or when the occupational illness has reached Maximal Medical Improvement.

Compensation for Occupational Diseases in Malaysia

The Employee's Social Security Act from 1969 (**ESSA**) provides the protection for employees who earn less than RM 3000 a month by two insurance schemes: **Employees' Injury Scheme** and **Invalidity Pension Scheme**.

The Employees' Injury Scheme states the employees must have been injured while commuting to and from work, commuting in the course of work, and while working. Fifth Schedule is under this scheme and the compassable occupational diseases are listed here.

The Injury Scheme and Invalidity Pension Scheme covers employees who are not able to earn more than 1/3 of his/hers usual wages due to chronic occupational diseases but only covers them up to 55 years old.

The medical treatment of an occupational disease will be paid by the Social Security Organization (**SOCSO**). The insurer must apply on their entitlements. The amount to be paid for impairment due to occupational diseases depends on the degree of the illness itself. There are independent medical assessors appointed under the **ESSA** to make the assessment.

Portugal

Autoridade para as Condições do Trabalho (ACT) and Centro Nacional de Protecção contra os Riscos Profissionais (CNPRP)

The **Portuguese Labour Code** defines the workplace rules in many aspects including Occupational Health and Safety. **ACT** is the official organization which regulates the occupational health and safety. It has the power to inspect and monitor the workplace and also enforce the law concerning working condition and safety. **CNPRP** belongs to social safety and it handles the documentation of occupational diseases.

Assessment and Compensation for Occupational Diseases in Portugal

In Portugal, severe occupational hazards which cause deaths or vast effect on public health should be reported by the employer within 24 hours when it happened. Generally it is the job of occupational specialists and any other physicians to report the occupational diseases to **CNPRP**. However, the cases they report serve only as working diagnosis. The confirmed diagnoses in cases to the court depend on the specialists from the side of the government.

It is obligatory for employers to insure their employees in Portugal. The compensation for the occupational diseases may vary a little by different contracts signed by both sides. The compensation for occupational diseases in Portugal covers the medical treatment and surgical treatment. Further more severe cases like permanent functional damage or death will be paid according to the regulation of the Autoridade para as Condições do Trabalho (**ACT**).

Taiwan

The Working environment, Government Officials and Laws in Taiwan

The **Labor Safety and Health Law** was enacted to prevent occupational hazards, ensure workers' safety and health in 1974. According to the law, the employers are responsible for preventing occupational hazards and establishing adequate work and welfare facility for their employees. There must be a full-time physician for a workplace with 1000 employees by the Labor Health Protection Act. Smaller workplace with 300 employees requires at least 1 nurse and a part-time physician.

There are two major government organizations in Taiwan responsible for occupational safety and health. They are the **Council for Labor Affairs (CLA)** and the **Department of**

Health (DOH). Their goals are to create an equal, dignified, secure and humane work environment in Taiwan from the perspective of career development for laborers. The **CLA** has the institutions and departments to perform the occupational safety and health education, workplace inspection, labor inspection, establishment of surveillance systems for occupational diseases and etc.

Labor Insurance, National Health Insurance and CLA

The **Bureau of Labor Insurance of CLA** is responsible for organizing the details of labor insurance in Taiwan. Labor Insurance can be either obligatory or voluntary. For a company has more than 5 employees, it is obligatory that the employer must insure its employees. For the one with fewer than 5 employees, it depends on the employer him or herself to voluntarily insure its employees.

There is National Health Insurance obligatory for every citizen in Taiwan. The insurance premium for policyholder is roughly calculated according to one's monthly income. It covers medical treatments of common diseases and most of surgical procedures but patients also need to pay partial fees.

Assessment of Occupational Diseases in Taiwan

Similar to the procedure in Czech Republic, the confirmation of the occupational disease must be made by an occupational doctor in the occupational medicine department or centre. The difference is that patients in Taiwan can freely choose any occupational medicine centre as they see fit.

The investigation process usually is like this:

a) Confirmation of the diagnosis of the disease.
b) Collection of the evidence of the exposure to risk factors. In Taiwan, according to the **Taiwan Environmental and Occupational Medicine Association (TEOMA)** risk factors are divided into 3 categories: chemical risk factors, physical risk factors and biological risk factors.
c) Assessment of the history of the illness. It must happen after participating in the work.
d) Confirmation of the consistence between the illness and its risk factor.
e) Excluding other possible aetiologies of the illness.

The severity of an occupational disease or handicapped situation is also divided into several classes and levels for reference of compensation. The list of Occupational diseases in Taiwan is built by the Taiwan Environmental and Occupational Medicine Association (**TEOMA**).

Compensation for Occupational Diseases in Taiwan

According to the **Labor Insurance Act Chapter 4**, the labor who cannot work and lose income due to occupational disease can receive 70% salary from the Labor Insurance after the 4th day of discontinuing working. The total fee of medical treatment will be covered by National Health Insurance and Labor Insurance together. Death or handicapped due to occupational hazard will be compensated accordingly. Patients or their family members can choose to receive the total payment at once or partial payment on each month.

UK

Law, Health and Safety Exclusive and Incident Contact Centre

The law which regulates the occupational diseases is the **Reporting of Injuries, Diseases and Dangerous Occurrences Regulations** from 1995 (**RIDDOR**). It places legal duties on employers and self-employed person and people on the control of the premises as duty-holders. All occupational diseases including death and permanent health impairment must be reported by those duty-holders. They must report to the **Health and Safety Exclusive (HSE)** and the easiest way to do it is by calling the **Incident Contact Centre (ICC)** on 0845 300 99 23 (local rate). The **ICC** can make the form for the duty-holders and send one copy back to them and one to **HSE**. **HSE** and local authorities can identify where and how risks arise, and to investigate serious accidents. Also it will be the official record legally used in the court or send to insurer for compensation later.

Assessment of Occupational Diseases in the UK

The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (**RIDDOR** from 1995) gives a list of all conditions which are reportable on the schedule 3 of the regulation. The doctor's role here is to make precise description of the disease listed, so that the employer will be able to identify immediately whether the case of disease is reportable. Doctors are encouraged to consider the possibility of links between the ailments presented by patients and the health risks associated with the types of work they do. There are occupational doctors in the UK and provide the occupational health service for companies but the report with diagnosis sent to the **HSE** does not need to be made by the occupational physicians.

Compensation for Occupational Diseases in the UK

The employers or self-employed person must insure their employees according to the **Employers' Liability (Compulsory Insurance) Act** (from 1969). When the reportable occupational disease is confirmed and registered in **HSE**, then the insurer will pay the

compensation. Employees can also make an occupational disease claim to the court if the insurers hold different opinions with them.

USA

Law, Government Officials and Occupational Medicine in the USA

The **Occupational Safety and Health Act**, which was signed by President Nixon in 1970 is the primary federal law to regulate the occupational health and safety. By passing this Act, two government agencies were born respectively, the **Occupational Safety and Health Administration (OSHA)**, an agency of the **Department of Labor and the National Institute of Occupational Safety and Health (NIOSH)**, and an independent research institute **Centers for Disease Control (CDC)**.

The role of the **OSHA** is to set and enforce workplace safety regulations. It sets the regulations such as limits on chemical exposure, requirement of using personal protective device and procedures of occupational safety. As the part of enforcement, it can send its inspectors (Compliance Safety and Health Officers) to workplace to check the working environment. Not like **OSHA**, the **NIOSH** is responsible for research and prevention activities with regards to workers' health but it is not a regulatory agency.

Assessment of Occupational Diseases in the USA

The patients are firstly treated by family physicians in the USA. If the family physician suspects the existence of an occupational disease then the patient can be transferred to an occupational specialist who has the resource to conduct the management and environmental evaluation. The occupational physicians in the USA can communicate with company officials, insurance companies, report to **OSHA** and judicial system.

Compensation for Occupational Diseases in the USA

The law demands the employers must insure their employees in the USA. But the compensation for occupational disease is administered on a state-by-state basis. There are both private insurance companies and state fund insurance (public system). Once the occupational disease is confirmed, the compensation will be paid by the insurance company. Employees can also sue their employers for a negligent act or omission.

PART II: OCCUPATIONAL UPPER EXTREMITY DISEASES

"Many hands make light work."

Note: *In accordance with work-related musculoskeletal diseases of the upper extremities, the term "cumulative trauma disorders" (**CTDs**) is used in the English-speaking literature. There are many synonyms used for these disorders: e. g. repetitive strain injuries (RSIs), repetitive motion disorders (**RMDs**) or overuse syndromes. Cumulative trauma disorders are defined as injuries of the musculoskeletal system resulting from repetitive monotonous manipulations, forceful exertions, compression, due to working in unfavourable positions and also exposure to vibration. Regarding the system of classification and terminology used in the Czech Republic, the description of occupational extremity diseases in following chapters will be based on the etiologic platform of the two above mentioned risks, vibration and overload, and particular symptoms will be described separately without using the term of cumulative trauma disorders.*

SUMMARY OF OCCUPATIONAL UPPER EXTREMITY DISEASES (FROM THE LIST OF OCCUPATIONAL DISEASES)

CHAPTER II – OCCUPATIONAL DISEASES CAUSED BY PHYSICAL FACTORS

- ***hand vascular disorders*** – caused by the work with vibrating tools and devices
- ***peripheral nerve disorders of the upper extremities*** – entrapment neuropathies caused by the work with vibrating tools and devices or caused by overload of the upper extremities
- ***disorders of bones and joints*** of hands, wrists and elbows caused by the work with vibrating tools and devices

- aseptic necrosis, isolated arthrosis

- ***disorders of ligaments, tendon sheaths, muscle insertions, joints*** caused by the exposure to overload of the upper extremities
  - **enthesopathies** – epicondylitis (radial, ulnar)
  - **tendovaginitis** – stenosing, crepitizing
  - **impingement syndrome**
  - **upper extremities arthrosis**

- ***bursitis***
  - acromial

RISK FACTOR: HAND-TRANSMITTED VIBRATION TO THE UPPER EXTREMITIES

☞ See also the chapter "**Assessment and Classification of Occupational Risks.**"

Vibration is defined as mechanic oscillation of a solid environment.

The exposure to the **hand-transmitted vibration which exceeds hygienic limits** (excessive vibration) that are defined for the vibration exposure, has unambiguously detrimental effects on the musculoskeletal system. The acceleration of vibration, which is measured in decibels, is an important parameter for the evaluation of the risk of exposure. The exact limits for the vibration exposure are stated in the Order of Government No. 272/2011 (Digest).

The risk of **excessive** hand-transmitted vibration to the upper extremity is typically present in these occupations: forestry workers using power saws (☞Video No. **4**), foundry workers (☞**Videos No. 11, 12, 13, 14**) – work with pneumatic hammers and other tools, grinders; miners, quarrymen (☞**Videos No. 1, 2, 3**), drillers, construction workers – e. g. work with jack hammers, pneumatic drillers, workers with scrub-cutters (☞**Video No. 5**). Sometimes also drivers of lorries, tractors, construction and agricultural vehicles – especially older and damaged devices and driving in rough terrain. Risk of vibration often combines with the risk of overload of upper extremities. Also health care

professionals such as dentists (☞Videos No. **23**, **24**, **25**, **26**) and dental technicians (☞ Videos No. **19**, **20**. **21**, **22**) can be exposed to the hand-transmitted vibration.

☞ See **the English-Czech Dictionary of in the Text Mentioned Occupations** .

RISK FACTOR: OVERLOAD, PRESSURE, TORSION

☞ See also the chapter "**Assessment and Classification of Occupational Risks.**"

The risk factor is a long-term, monotonous overload of particular muscle groups causing diseases of nerves, ligaments, insertions, muscles, joints, bones and bursas. All these diseases are included in the valid list of occupational diseases. Repetitive movements or use of excessive muscle strength in limiting or unusual working postures are typical components of those risk occupations. Typical occupations with the risk of overload of the upper extremities are as follows: miners, forestry workers (☞Video No. **4**), metal processors (☞Videos No. **7**, **8**, **9**, **10**, **13**), locksmiths, welders, coil winders (☞Videos No. **15**, **16**, **17**, **18**) or glass cutters, butchers, confectioners, sewers, milkers, administrative assistants, waiters, furniture upholsterers, construction workers. Dentists (☞Videos No. **23**, **24**, **25**, **26**) and dental technicians (☞Videos No. **19**, **20**, **21**, **22**) are subjected to overload of upper extremities as well. A known risk of overload of upper extremities is also present in artistic occupations such as musicians, especially violinists (☞Videos No. **30**, **31**).

According to the classification and quantification of the risk for the needs of the hygienic assessment at the workplace, there are accurately defined numbers of repetitions of movements in relationship to the exerted muscle forces and considering the time factor – stated in Order of Government No. 361/2007 (Digest). Individual muscle forces which are exerted by relevant muscle groups, and the precise numbers of movements repetitions, are detected by the help of integrated electromyography.

TAB. 2 - EXAMPLES OF OCCUPATIONS WITH POTENTIAL RISK OF OVERLOAD OF THE UPPER LIMBS

Category of Occupations	*Occupation/ Working Activity*	*The Predominant Risk Factor*
Agricultural workers	Milker	Overload
Forestry workers	Forestry worker, logger	Overload, potentiation due to hand- transmitted

		vibration
Coal Mining	Coal miner	Overload
Quarrymen	Quarryman (general)	Overload, potentiation due to hand- transmitted vibration
Food Industry	Butcher (slaughterer), confectionery maker	Overload
Textile Industry	Sewer, embroiderer, hatmaker	Overload, potentiation due to improper posture
Public Administration	Administrative assistant, typist	Overload
Health System	Dentist, dental technician	Overload, potentiation due to hand- transmitted vibration
Hotel or Restaurant Service	Waiter	Overload
Metal Industry	Melter, welder, moulder, coremaker, fitter	Overload
Furniture Manufacture	Upholsterer, woodworker	Overload
Electronic equipment assemblers	Coil winder	Overload
Non-Metal production	Glass-blower, Glass-cutter	Overload, potentiation due to hand- transmitted vibration
Building Trade	Brick-layer, floor-fitter, painter	Overload
Shoe Industry	Shoemaker	Overload

☞ See **the English-Czech Dictionary of in the Text Mentioned Occupations** .

Disorders of Peripheral Nerves of the Upper Extremities: Entrapment Neuropathies

Disorders of peripheral nerves of the upper extremities can be caused by the exposure to **vibration, overload to upper extremity, pressure and torsion** (☞ see the chapters above). Occupational disease can be acknowledged if an objective evidence of a hazardous workplace was verified. A hazardous workplace in connection to vibration and overload means that the hygienic limits for the hand-transmitted vibration to the upper extremities and overload of particular muscle groups and nerves are exceeded. In such cases these exposures can undoubtedly induce disorders just mentioned, according to the present level of medical knowledge and evidence.

These disorders are known as occupational peripheral neuropathies, mainly entrapment neuropathies, which develop in anatomically predisposed areas such as carpal tunnel in the wrist. The median entrapment in the carpal tunnel is the most common occupational

peripheral neuropathy: **carpal tunnel syndrome**. The ulnar nerve can be also involved, but less often contrary to the median nerve, developing **cubital tunnel syndrome** at the elbow. Entrapment syndromes can occur also in lower extremities (☞ see Part III).

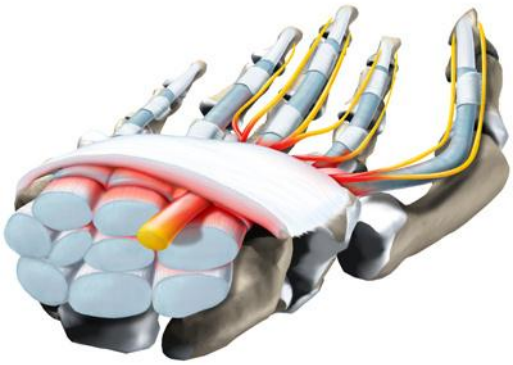

FIG. 9 - CARPAL TUNNEL SYNDROME
Source:
http://www.activemotionphysio.ca/Hand/Hand-Issues/Carpal-Tunnel-Syndrome/a~284/article.html
(cited 22. 9. 2012)

FIG. 10 - CUBITAL TUNNEL SYNDROME
Source:
http://www.orthogate.org/patient-education/elbow/cubital-tunnel-syndrome.html
(cited 22. 9. 2012)

In the case of vibration exposure direct microtraumas and damage to vasa nervorum caused by vibration especially in the terminal branching of nerves play an important role. Overload of the upper extremities provokes swelling of tendons passing through the anatomically confined spaces (carpal or cubital tunnel) and changes in the environment inside these structures. It is likely that inflammatory mechanisms could be involved, the role of ischemia-induced reperfusion injury followed with cellular damage and oxidative stress has also been discussed. However, the exact pathophysiologic mechanism remains rather unclear.

Symptoms – paresthesia, tingling, sometimes itching typically in the median supply area, especially during the rest and night. This can result in sleeping disorders. Other symptoms such as sensory loss, hypesthesia, fine motor skills decrease, weakness of involved muscle groups, convulsions, may severely interfere not only with work but also with common daily activities.

A typical sign is e. g. in carpal tunnel syndrome a so called **Tinnel's sign** – tapping over the transversal carpal ligament induces pain and paresthesia in the median distribution.

Investigation methods – an essential method that enables an objective measurement of the velocity and quality of the sensitive and motor nerve conduction is **electromyography (EMG)** with its several particular parameters. If the nerve is damaged, the conduction velocity is slowed down and distal latency prolonged. The possibility of occupational disease confirmation is also clinically based on **EMG** – **only at least medium stage of disorder** can be confirmed as an occupational disease.

Differential diagnosis – most often problems caused by **cervical vertebrogenic pain syndrome** can mimic symptoms of peripheral neuropathies. Therefore severe pathologic changes in cervical spine have to be excluded by X-ray of cervical spine and a careful neurological examination. Another group is **polyneuropathies** of various origins – diabetic, paraneoplastic, ethylic. **EMG** examination of lower extremities can be a very contributory mean in accordance to verifying polyneuropathies. Once especially severe polyneuropathy is detected occupational aetiology seems unlikely.

Treatment – long-term administration of vasodilatation therapy, Vitamin B complex, physical therapy, local treatment with corticosteroids, operative treatment. In the case of at least medium stage of damage the removal of patient from the causative risk exposure, vibration or overload, is a crucial management.

HAND VASCULAR DISEASES CAUSED BY EXPOSURE TO HAND-TRANSMITTED VIBRATION TO THE UPPER EXTREMITIES: OCCUPATIONAL TRAUMATIC VASONEUROSIS – SECONDARY RAYNAUD'S PHENOMENON (SYNDROME) DUE TO VIBRATION EXPOSURE

Note: *There are more synonyms that denote this disease: e. g. vibration-induced white finger or white finger syndrome.*

☞ See also the chapters "**Risk Ractor: Hand-Transmitted Vibration to the Upper Extremity**", **Assessment and Classification of Occupational Risks.**"

It is a disorder of peripheral microcirculation due to hand-transmitted vibration – namely in hands and palms. Vibration affects vessel elasticity; sympathetic system increases the tone of vascular smooth muscle. Direct damage of the vessels caused by chemical mediators including platelet coagulation activators and increase in blood viscosity are also supposed. Except of vibration cold environment with its vasoconstriction effects represents a strong influencing factor.

☞ **See the occupations with the risk of hand-transmitted vibration**.

- **1st stage – mild vasospastic stage**, mainly reversible, blood return into affected fingers is slowed down, removal of the patient from the risk of vibration is not necessary. Paresthesias during the work with vibrating tools occur.
- **2nd stage – developed vasospastic stage**, Raynaud's phenomenon, remarkable bleaching of fingers. Affected perfusion and reperfusion, cyanotic coloration of the skin are present. The skin is cold and trophic changes may also be detected. The possibility of occupational disease with a necessary removal from the risk of vibration is likely. In terms of confirmation of the clinical diagnosis of this disease the evidence of at least 4 bleaching phalanges and concomitantly present advanced vasospastic changes are needed.
- **3rd stage – vasoparalytic stage**, smooth muscles of blood vessels are paralysed with cyanotic coloration of the skin (trophic alterations). This state is irreversible. Nowadays such a severe stage of Raynaud's phenomenon is very rare.

FIG. 11 - OCCUPATIONAL RAYNAUD'S PHENOMENON I.

FIG. 12 - OCCUPATIONAL RAYNAUD'S PHENOMENON II.

FIG. 13 - OCCUPATIONAL RAYNAUD'S PHENOMENON III.

FIG. 14 - OCCUPATIONAL RAYNAUD'S PHENOMENON IV.

Symptoms – cold hands, paresthesia, numbness in fingers and hands.

Investigation methods – water cold test and plethysmography to verify finger bleaching and vasospastic changes. As it was already mentioned above the evidence at least of 4 bleaching phalanges supported by the plethysmographically proven severe vasospastic changes is needed for the confirmation of a solid clinical diagnosis of the suspicious occupational Raynaud's phenomenon.

Differential diagnosis – excluding other general causes of the Raynaud's phenomenon: entrapment of nerves and vessels in the shoulder girdle (cervical rib, aberrant course of vessels etc.), disorders of cold agglutinins or cryoglobulins, polycythemia, systemic disorders (e. g., scleroderma, rheumatoid arthritis, and systemic lupus erythematosus), primary biliary cirrhosis, atherosclerosis, Buerger's disease, posttraumatic states, congenital arterial stenosis etc.

Treatment – removal from the risk of hand-transmitted vibration in advanced stages. Long-term vasodilatation therapy and various kinds of physical therapy including baths are administered. Strict smoking cessation is indicated. Also preventive measures such as protection against cold are of elemental importance. Another type of physical and physiotherapeutic treatment has been proven: **vacuum-compression therapy**.

FIG. 15 - **VACUUM-COMPRESSION THERAPY I.**

FIG. 16 - **VACUUM-COMPRESSION THERAPY II.**

The principle of this method subsists in the alternation of negative and positive pressures inside a tube where one extremity (in the case of occupational Raynaud's phenomenon upper extremity) is placed. Nourishment, perfusion and healing processes in soft tissues are positively influenced. The vacuum-compression therapy is also useful in the treatment of the general Raynaud's phenomenon, other types of vascular diseases (e. g. diabetic angiopathies in lower extremities) and defects in extremities.

OTHER MUSCULOSKELETAL DISORDERS

1. DISEASES OF BONES AND JOINTS OF HANDS, WRISTS OR ELBOWS DUE TO VIBRATION EXPOSURE

☞ See also the chapters "**Risk Ractor: Hand-Transmitted Vibration to the Upper Extremity**" and "**Assessment and Classification of Occupational Risks**".

Exposure to hand-transmitted vibration and its transmission to the upper extremities can be responsible for the development of particular diseases of bones and joints of hands, wrists or elbows – mostly expressed as **isolated arthrosis or clinically silent bone cysts**. Some rare cases of **carpal or metacarpal bones necrosis** may occur, too.

Length of exposure to vibration, more powerful grip of tools, weight of vibrating tools, unsatisfactory technical state of tools, unfavourable shape of grasp parts of tools, unphysiological posture of hands during work, hardness of material, cold and wet environment – all these characteristics may strongly influence the transmission and effects of vibration on the organism.

Risky occupations are those occupations with the risk of hand-transmitted vibration mentioned above, for clearly **excessive** vibration namely miners, drillers, construction workers, forestry workers (work with power saw) (☞Video No. **4**) or foundry workers (☞Videos No. **11**, **12**, **13**, **14**).

Criteria for the confirmation of **occupational arthrosis** are the same as for isolated arthrosis due to the exposure to overload and **are discussed elsewhere**.

Pathophysiology – it is assumed that the summation of microtraumas due to mechanic effect of vibration, concussions and impact injuries are the principles. Primary disorder in arthrosis is probably localized in the damaged articular cartilage. Traumatism of small vessels with their consecutive thrombosis may play an important role in the pathophysiology of bone cysts and necrosis.

FIG. 17 - KIENBOECK'S DISEASE
Source:
http://www.assh.org/Public/HandConditions/Pages/KienbocksDisease.aspx
(cited 22. 9. 2012)

Symptoms – are the same like in general diseases of this group. The localization of disorders is closely associated with the working operation, way of transmission of vibration. **Asymmetric distribution** of disorders is also typical. Bone cysts are often clinically silent and tend to be accidental findings. Sporadic carpal and metacarpal bones necrosis, e. g. **Kienboeck's disease** which is aseptic necrosis of lunate bone, are accompanied by pain, swelling, and affected mobility of the wrist.

Only isolated arthrosis of the joints of hands, wrists or elbows and aseptic necrosis of carpal and metacarpal bones can be acknowledged as occupational diseases. Despite of isolated arthrosis, bone cysts cannot be evaluated as occupational diseases because they do not cause pathologic fractures, they do not result in any other adverse consequences and do not diminish the working ability of patients.

Investigation methods – X-ray and orthopaedic examination, in more complicated cases arthroscopy, computed tomography or magnetic resonance imaging (**MRI**).

Differential diagnosis – excluding other causes of osteoarthrosis or bone changes (congenital bone cysts, infectious osteomyelites, posttraumatic, hormonal and other degenerative arthrosis, chondrocalcinosis etc.).

Treatment – in the case of occupational disease, strict removal of the patient from the risk of vibration is necessary. There is no known treatment for advanced disorders. Care is focused on symptomatic treatment – administration of analgesics, physical and rehabilitation therapy.

Prognosis – degenerative arthrotic changes, bone cysts or aseptic necrosis caused by exposure to vibration do not progress substantially if the patient was removed from the risk. If there is any progression it is only mild.

2. Diseases of Ligaments, Tendon Sheaths, Muscle Insertions, Muscles and Joints Caused by Exposure to Long-term Overload of the Upper Extremities

☞ See also the chapters "**Risk Factor: Overload, Pressure, Torsion**" and "**Assessment and Classification of Occupational Risks.**"

A wide range of nosological units from the group of musculoskeletal disorders of the upper extremities belongs to this group. These diseases are caused by one risky agent: long-term and monotonous overload which leads to repeated microtraumas. Improper working position is also common.

Pathophysiology – damage of the overloaded tissue progresses faster than its regeneration or reparation. Consequently, microtraumas, dystrophic changes, disorders of perfusion and oedema develop in affected areas. Micrographic fissures, aseptic necroses, residues of hematomas and degenerative changes of connective tissue can be observed.

Symptoms – pain, oedema, function disorders in affected area, later also joint deformities, ligament ruptures etc.

Differential diagnosis – excluding general causes (injuries, congenital or acquired disorders).

Impingement Syndrome of the Shoulder Joint

This disorder of the rotator cuff of the shoulder joint develops due to its chronic overload and improper working position (e. g. arms above shoulders).

Pathogenesis – head of humerus compresses rotators and bursa against the acromion mainly in abduction, elevation and rotation. Insertion of shoulder rotators (supraspinatus muscle, infraspinatus muscle, teres minor muscle, subscapularis muscle), especially area of the supraspinatus tendon, are most exposed. Insertion has a poor vessel supply therefore is very susceptible to trophic changes.

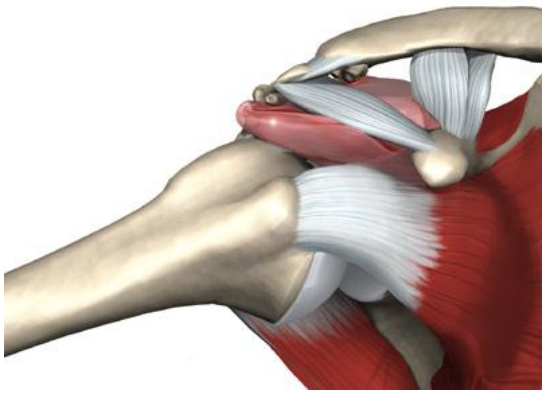

FIG. 18 - SHOULDER IMPINGEMENT SYNDROME
Source:
http://www.kneeandshouldersurgery.com/shoulder-disorders/impingement-syndrome.html
(cited 22. 9. 2012)

Secondary impingement syndrome can be acknowledged as occupational only if **complete rupture of the rotator cuff (3rd stage of the disease)** is present, deposits of calcium in supraspinatus tendon and exophyte acromial deposition can be present as well. At the same time substantial limitation of mobility, decrease of muscle strength, resting pain and pain during exercise are reported by patients. These occupational diseases are chronic (at least 6 months of lasting).

Clinical findings – decrease in active abduction – painful abduction between 60° and 120° (supraspinatus muscle),

disappearing pain after exceeding 120° in abduction, painful abduction of the upper extremity against the resistance, painful press of the arm against the acromion (apprehension test) are typical symptoms. Positive Neer's test – relief after the subacromial administration of an anaesthetic can be helpful.

Investigation methods – ultrasound of the rotator cuff – defects, their size, calcification, thinning, scaring. Native X-ray – narrow subacromial space, humeral decalcification and presence of a sclerotic margin, sometimes calcifications in the rotator cuffs tendons. **MRI** and arthroscopy.

Differential diagnosis – excluding nonoccupational aetiologies – traumas, cervical spine disorders, arthritis, tumours etc. Less often e. g. tendovaginitis of the long head of the biceps muscle can be discovered.

Treatment – removal from the risky exposure, classic or arthroscopic surgery – revision of the subacromial area and rotator cuff, reconstruction of the rotator cuff and acromioplastic.

Enthesopathy (Insertion Pain Syndrome)

Inflammatory changes in tendoperiosteal junction of ligaments of particular muscles can be caused mechanically by the long-term and repeated overload of muscles or muscle groups. Erosions with consecutive fibrosis and new bone formation can also be present at the site of insertions. Enthesopathies manifest themselves with pain and loss of function.

They can develop in occupations such as using pneumatic tools or power saws (☞Videos No. **1**, **2**, **3**, **4**, **6**, **11**) in improper working positions of the upper extremities.

Symptoms – the leading symptom is the pain during palpation at the site of insertion and close areas which is worsened by tension of particular muscles or provoking tests. The pain spreads along the muscle. Incipient muscle hypotrophy of extensor/flexor muscle group of the forearm can be detected. Marked decrease in the hand grip strength can be commonly found.

Investigation methods – correlation between clinic symptoms and **positive three-phase scintigraphy of the elbows in its third phase**, the bone-connective tissue phase, is crucial for the confirmation of the disease as an occupational disorder. This investigation is benefit in post-operative states at least after 6 months. Additional investigations represent X-ray of the elbows where a slight margin of the new bone tissue in the region of the damaged epicondyle can be found, then ultrasound, thermovision, or sometimes **CT**.

Differential diagnosis – excluding the vertebrogenic pain syndrome of the cervical spine causing the irradiation of pain into the entire upper extremity, chondromalacia of the head of the radius, peripheral neuropathies, synovitis, e. g. rheumatoid arthritis, chondromatosis, osteochondrosis, aseptic necrosis and others.

Radial Epicondylitis of the Humerus (Tennis Elbow) – damage of extensor muscles, especially extensor carpi radialis. These muscles are subjected to overload during pronation and extension against resistance, fast repeated movements, pressing grip in pronation etc. E. g. operations like screwing, wringing and overgripping. Nonoccupational radial epicondylitis occurs in tennis, handball, volleyball, table tennis players or ski runners.

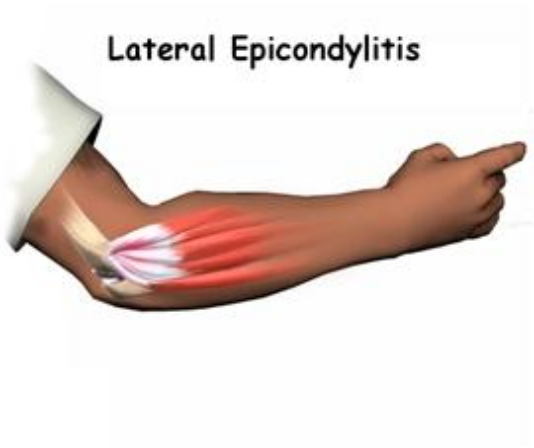

FIG. 19 - LATERAL EPICONDYLITIS
Source: http://www.methodistorthopedics.com/lateral-epicondylitis-tennis-elbow (cited 22. 9. 2012)

FIG. 20 - SCREWING

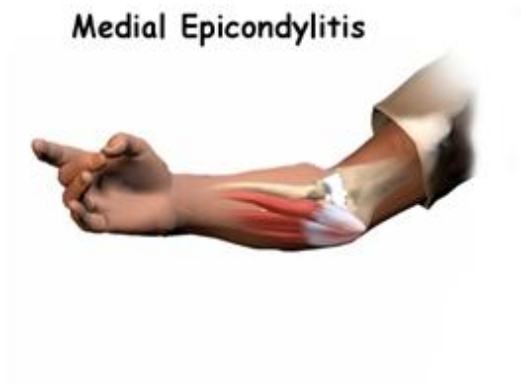

FIG. 21 - MEDIAL EPICONDYLITIS
Source: http://www.concordortho.com/patient-education/topic-detail-popup.aspx?topicID=a5c83611d9c77c48b5493b5bf9826c52 (cited 22. 9. 2012)

Clinical findings, provoking tests in radial epicondylitis – painful handgrip, **chair raise test**: pain occurs in lifting up the chair with one hand in pronation and extension of the forearm; **Thomson's test**: pain in dorsal flexion of the wrist against the resistance; middle finger test: painful extension of this finger in extended and pronated forearm against the resistance.

Ulnar Epicondylitis of the Humerus (Spear Elbow) – the main factor of overload is the tension of flexors in supination of the forearm. Compared to radial epicondylitis, ulnar epicondylitis is rare.

Clinical findings, provoking tests in ulnar epicondylitis – most prominent pain in extension of the flexor carpi radialis and ulnaris muscles, palmaris longus and flexor digitorum superficialis muscles in supination of the forearm. Painful pronation of the forearm against the resistance, reversed Thomson's and chair tests.

Clinical criteria for the acknowledgement of humeral epicondylitis as occupational diseases:

1. chronic persistent form without relief resulting from therapy in the period of 6 months and more
2. positive three-phase scintigraphy
3. marked work disability

Treatment – local corticosteroid therapy, X-ray therapy. Surgery in the cases of chronic sustaining difficulties: incision or excision of the painful muscle insertion, e. g., Boyd and McLeod procedure.

Aseptic Tendinitis and Tendovaginitis

Overload and working in improper postures with repetitive movements of the fingers of hands and wrists without sufficient rest pauses are the main etiopathogenetic mechanisms. Muscle tiredness, ischemization and creation of microtraumas follow; aseptic inflammation, degenerative changes and thickening of the fibrous sheath are developed and limitation of the tendon movements due to the narrowed synovial sheath can occur as well.

Traditional occupations according to the possible development of tendinitis and tendovaginitis are described as following examples: musicians (Videos No. **30**, **31**), milkers, embroiderers, upholsterers and waiters.

Tendinitis or tendosynovitis – the tendon is painful and swollen during palpation, during the movements typical crepitations can be detected with palpation.

Investigation methods – soft X-ray or ultrasound, additionally **MRI**, termovision, biochemical investigations.

Creptizing tendovaginitis – typical auscultatory findings: slight **crepitations** in the chronic state during the movement of the damaged tendon.

Stenosing tendovaginits – marked stenosing of the tendosynovial sheath leads to the limitation of movements and causes the "**click phenomenon**" which is palpable and sometimes also hearable. The most common localization is the wrist where the extensor digitorum communis muscle sheath or the abductor pollicis longus or extensor pollicis brevis sheaths are involved. **De Quervain's tendovaginitis** represents tendovaginitis of the last named muscle, extensor pollicis brevis muscle. Narrowing of the flexor tendon sheath proximally from the metacarpophalangeal joint causes the so called **"trigger finger"** development. This flexor tendon is nodoselly changed and gets stuck proximally from the narrowed place during flexion. Extension is possible only by the help of the other hand and accompanied with loud cracking.

FIG. 22 - DE QUERVAIN'S TENDOVAGINITIS
Source: http://www.orthogate.org/patient-education/wrist/de-quervains-tenosynovitis.html (cited 22. 9. 2012)

FIG. 23 - DE QUERVAIN'S TENDOVAGINITIS
Source: http://en.wikipedia.org/wiki/De_Quervain_syndrome (cited 22. 9. 2012)

As occupational diseases only **chronic forms** (at least 6 months), typical for crepitations hearable when using a stethoscope, can be acknowledged. Other typical signs of these chronic forms are limitation in the hand grip and limitation of active joint excursions more than 1/3, incipient muscle hypothrophy, palpable thickening of tendons and typical saltations during movements of the tendons.

Differential diagnosis – excluding infectious diseases and tendinitis within systemic disorders – rheumatoid, metabolic.

Treatment – immobilization in acute tendinitis, local application of nonsteroid antirrheumatics or corticosteroids. Surgery in stenosing tendovaginites: incision of the fibrous layer of the tendon sheath.

ISOLATED ARTHROSIS

☞ See also the chapter "**Diseases of Bones and Joints of Hands, Wrists or Elbows Due to Vibration Exposure**".

Occupational arthrosis caused by the exposure to overload occur approximately after at least 15 – 20 years of work under the risk conditions. Typical occupations are especially miners, metal processing workers (☞Videos No. **7**, **8**, **9**, **10**, **13**) and construction workers. Men of the age between 40 and 55 year are mostly affected.

Degeneration of the hyaline cartilage with its consecutive shrinkage followed by the changes in close epiphyses and accompanied by the damage of ligaments and joint capsule make up the pathogenetic background. Pain, limitation of movements and joint deformities occur. The course of the disease is accompanied by synovitis which worsens patients' difficulties.

The most frequent occupational isolated arthrosis according to the location: shoulder joint, elbow, knee (☞ **see Part III**) wrist and hand joints: radiocarpal, rhizarthrosis, fine

finger joint arthrosis – in this localisation Heberden's and Bouchard's nodules have to be excluded.

Differential diagnosis – primary and other secondary causes have to be excluded – e. g., arthrosis due to the intra-articular fractures, overload in sportsmen, consequences of chronic joint inflammantions, systemic connective tissue diseases or metabolic diseases.

Subjective difficulties and physical findings sometimes do not correlate with X-ray changes.

Staging of severity of osteoarthrosis is based on the X-ray findings: **Kellgren's and Lawrence's classification** for the main bearing joints:

0	Normal joint.
I.	Infinite narrowing of the joint fissure.
II.	Definite osteophyte and slight narrowing of the joint fissure.
III.	Mild stage of the multiple osteophytosis, definite narrowing of the joint fissure with subchondral bone sclerotization, slight deformation of joint outlines.
IV.	Massive osteophytes, unambiguously narrowed or disappeared joint fissure, severe sclerosis, creation of geodes in the bone of articular surfaces, changes of the shape, centration and eventually axis of the joint.

Criteria for the Assessment of Occupational Isolated Arthrosis

- Only the joint exposed to the occupational load (overload) is affected. Findings in neighbouring and other joints are normal or markedly better.
- The stage of osteoarthrosis reaches **the 2nd or 3rd grade** according to the X-ray picture evaluated with the **Kellgren's and Lawrence's classification**.
- Relevant functional loss is present, joint excursions are obviously limited at least to 2/3 of normal range.
- The disease lasts at least 6 months, i. e. is chronic.
- Pronounced restriction of work ability is present.
- Previous traumas and dysplasias were excluded.

Treatment – prevent the progression, relief the pain, rehabilitation, anti-inflammatory and physical therapy, spa therapy. Also administration of analgesics, nonsteroid antirrheumatics, chondroprotective drugs and intra-articular administration of steroids are the part of pharmacotherapy. Surgical interventions include several possibilities, e. g., synovectomy, joint debridement, osteotomy, alloplasty, arthrodesis etc.

COMPRESSION BURSITIS

FIG. 24 - OLECRANON BURSITIS
Source: http://www.uptodate.com/contents/image?imageKey=RHEUM/64359&topicKey=RHEUM/7756&source=outline_link&search=compression%20bursitis&utdPopup=true (cited 15. 9. 2012)

These diseases are defined as aseptic inflammations of bursas and develop during work when the damaged bursa is compressed during the **substantial part of the workshift**.

Typical risky occupations according to the localisation of the affected bursa are: glass cutters with olecranon bursitis and when heavy burdens are transported on shoulders, a so called porters' shoulder, i. e. acromial bursitis, can develop. In general – these diseases are rather rare. Compression bursitis can also develop in the lower extremities (☞ **see Part III**).

Pathogenesis and symptoms – more than 6 months lasting chronic forms are characterized by a gross bursa wall with a chronic overproduction of synovial fluid, often with the presence of "rice corpuscules". Calcifications in wall of bursas, hyperkeratosis, calluses or incrustations, intermittent inflammations, even incipient joint capsulitis and initial muscle hypotrophy (due to the diminished function of joint) can arise.

Investigation methods – X-ray, ultrasound, puncture with aspiration.

Differential diagnosis – exclude nonoccupational aetiology – rheumatoid, metabolic, infectious or specific bursitis, and trauma.

As occupational diseases only **chronic forms**, i. e. lasting at least 6 months, can be acknowledged.

Treatment – removal from the risky occupation. Evacuation of effusions with the lavage can be completed if necessary, then unguent or gel with nonsteroid antirrheumatics. Corticosteroids into the bursa are administered in the case of recurrences; the last possibility is extirpation of the affected bursa.

PREVENTION

PREVENTION OF THE DISEASES OF THE UPPER EXTREMITIES DUE TO VIBRATION EXPOSURE

The aim is to prevent the transmission and effects of vibration on the workers or at least diminish their effects and maintain hygienic norms and limits.

The most effective means are technique and technologic measures, change of technologies, automatization of production.

All other additional measures have only corroborative influence: e. g., adjustment of working position, regime of work and rest, alternation of workers at risk, use of anti-vibration gloves, and protection against cold and wet environment.

FIG. 25 - PAIR OF ANTI-VIBRATION GLOVES
Source: http://www.ariete-group.com/en/prod-140-1945-anti_vibration_glove_1121_7e,_cotton_glove,_ppe_on_the_palm,_cotton_wrist.asp (cited 22. 9. 2012)

In terms of medical prevention especially entering and periodic preventive examinations are of the biggest importance. They help to disclose predispositions and assess contraindications for the work at risk of vibration and to detect initial changes. Secondary prevention then stands for the treatment of reversible changes aimed at the maintenance of the worker's occupation. If this is not possible and the worker has to be removed and if the disease develops into the severity and stage of an occupational disease, a long-term treatment and dispensary care for the patient are necessary.

Prevention of Occupational Diseases of the Upper Extremities Due to Overload Exposure

The aim is prevention of overload of individual parts of the musculoskeletal system. The most effective preventive measures are the technique and technologic ones. Automatization of production, use of new technologies and machines removes or at least diminishes portions of physical work, especially static work.

Ergonomic measures – adjustment of the work place and a correct choice of seats prevents improper positions and excessive ranges of movements.

By the help of organizational measures (regime of work and rest, alternation of workers and operations) intensity of work can be reduced.

Entering and periodic preventive examinations are of the biggest medical importance as well.

PART III: OCCUPATIONAL LOWER EXTREMITY DISEASES

"Look before you leap..."

Work-related musculoskeletal diseases of the lower extremities are far less common than occupational upper extremity diseases. They are typical for some specific kinds of working operations and overload of lower extremities. According to the List of Occupational Diseases, **meniscus damage to the knee**, **bursitis (prepatellar)** and **arthrosis (mainly knee arthrosis)** can be acknowledged as occupational diseases. Other possible disorders resulting from overload to the lower extremity are **entrapment syndromes of the tibial nerve** or **posterior impingement syndrome**. In the lower extremities occupational Achilles tendinitis in dancers in some cases may also occur.

Meniscus Damage to the Knee

Typical occupations in the reference to the possible development of the meniscus damage are generally occupations when workers work in the crouching and kneeling position, such as miners, gardeners or floor-fitters. The pathophysiological background of microtraumas' development is based on the constant pressure and torsion. Degenerative changes can lead even to the rupture of the meniscus. More often the inner meniscus is involved. The clinically obvious disease develops approximately after 13 years of exposure.

FIG. 26 - MENISCUS DAMAGE
Source: http://www.weight-lifting-complete.com/knee-meniscus-injury/ (cited 22. 9. 2012

Symptoms – swelling and pain in the region of the knee joint or painful blockage of the joint.

Investigation methods – X-ray and orthopaedic examination, arthrography, arthroscopy, ultrasound, **CT** or **MRI** examination.

Differential diagnosis – excluding nonoccupational causes, especially traumas.

Treatment – removal from the risky exposure, depending on severity and reaction to therapy, conservative care or surgery.

For the needs of the acknowledgement of occupational meniscal damage it has to be well documented that the employee worked in the kneeling or crouching position during **the prevailing portion of the work-shift.**

Prepatellar Compression Bursitis

FIG. 27 - CHARWOMAN

Mechanisms of development, symptoms and presumptions for the occupational disease acknowledgement are identical to the ones mentioned in connection to **compression bursitis of upper extremities**.

Typical occupations are charwomen, floor-fitters or miners. The disease develops approximately after 13 years at risk.

ARTHROSIS

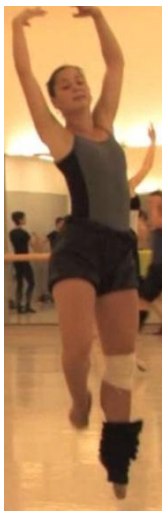

FIG. 28
- A BALLET DANCER

Isolated arthrosis, most frequently of the knees, due to overload of lower extremity develops after approximately 20 year of exposure. It can be associated with occupations such as miners but also professional dancers (☞ Video No. **29**).

Pathophysiology, symptoms and treatment of these disorders as well as the system of their assessment as suspicious occupational diseases are identical to the other occupational arthrosis due to overload discussed elsewhere (☞ see **"Isolated Arthrosis"**).

LOWER EXTREMITY ENTRAPMENT SYNDROMES

Lower extremity entrapment syndromes of nerves represent quite rare disorders resulting from the exposure to the risk of overload of lower extremities. Entrapment syndromes of the lower extremities occur in anatomically predisposed narrow areas as well as entrapment syndromes of the upper extremities as it has been already discussed above (see "**Disorders of Peripheral Nerves of Upper Extremities: Entrapment Neuropathies**"). These susceptible areas in the lower extremities are:

- tarsal tunnel – entrapment of terminal braches of the tibial nerve
- **popliteal fossa** – entrapment of the tibial nerve,
- **retro peroneal space** – entrapment of the fibular nerve.

The first mentioned entrapment syndrome, **tarsal tunnel syndrome**, is typically reported by ballet dancers (☞ Video No. **29**) due to the elongation of the tunnel and nerve, especially during the "pointe work" (tiptoe dance). Also repeated traumas may play a role. The other two entrapments of nerves in predisposed spaces can occur in workers who work in the kneeling or crouching position.

FIG. 29 - TARSAL TUNNEL SYNDROME
Source:
http://www.orthogate.org/patient-education/foot/tarsal-tunnel-syndrome.html
(cited 22. 9. 2012)

FIG. 30 - "POINTE" WORK
Source:
http://www.4dancers.org/2010/11/about-pointe-shoes/
(cited 22. 9. 2012)

POSTERIOR IMPINGEMENT SYNDROME ("DANCER'S HEEL")

This syndrome, also known as "Dancer's Heel", is typical for professional ballet dancers (☞Video No. **29**) as they repeatedly bent their feet downwards, feet are plantarflexed to the maximum, especially during their "pointe" work (see above).

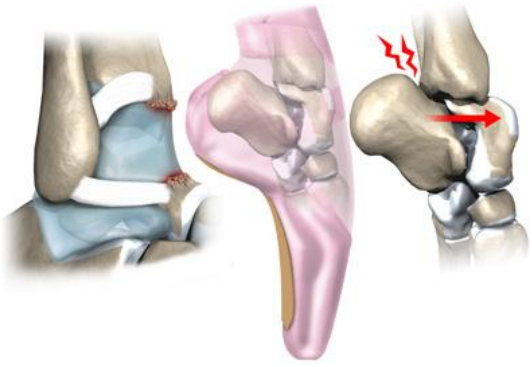

FIG. 31 - DANCER'S HEEL
Source:
http://www.orthogate.org/patient-education/ankle/ankle-impingement-problems.html
(cited 22. 9. 2012)

Pathophysiology – compression or impingement of the bony and soft tissue structures at the posterior side of the ankle which leads to the pathological changes including inflammation. Posterior impingement syndrome can be caused by various reasons such as the presence of an accessory bone called os trigonum at the back of the talus, prominent bony process at the back of the talus or on the upper surface of the calcaneus or ankle joint instability as a result of previous traumas.

Symptoms – pain during and after exercise, painful forced plantar flexion, swelling and tenderness in the area, irradiation of pain in other parts of lower extremity.

Investigation methods – X-ray, orthopaedic examination, **CT** or **MRI** to detect soft tissue changes.

Treatment – conservative (rest, cooling, compressing the involved area), use of analgesics, steroid injections in the area, splinting. If the condition does not respond to conservative therapy means, surgery may be indicated.

PART IV: CHRONIC VERTEBRAL COLUMN DISEASES, LUMBAR VERTEBRAL COLUMN DISEASES

"Prevention is better than cure."

☞ See also the chapter "**Assessment and Classification of Occupational Risks**".

(Because acute vertebral column diseases can be evaluated as occupational traumas in the Czech Republic – if they were caused by performing working duties – only chronic vertebral column diseases, namely chronic lumbar vertebral column diseases, will be discussed here.)

FIG. 32 - LOW BACK PAIN
Source: http://newyork.olx.com/ny-workers-compensation-doctor-iid-169422001 (cited 22. 9. 2012)

Among the most frequent musculoskeletal disorders are chronic dorsopathies, especially **low back pain and sciatica**. Lifelong prevalence of chronic dorsopathies is high. It is estimated at 60-85%. Aetiology of dorsopathies is typically multifactorial. As shown by epidemiological studies, many factors can contribute to their occurrence – individual, psychosocial, and physical risk factors, including the factors associated with work.

For an array of occupations, epidemiological studies have shown statistically significant population etiological fractions in the occurrence, especially in **chronic lumbar vertebral column diseases – low back pain and sciatica.**

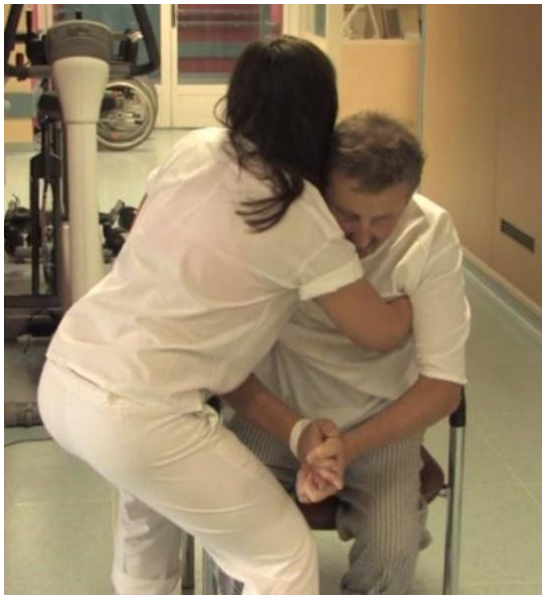

FIG. 33 - HANDLING OF A HEMIPLEGIC PATIENT BY A PHYSIOTHERAPIST

Among the occupational risk factors, there are especially **manual handling of heavy loads – for health care professionals handling of patients (Videos No. 27, 28), frequent bending and twisting, improper working postures, high physical load and also exposure to whole-body vibration** (e. g. as for the drivers of lorries).

European list of occupational diseases contains two items related to dorsopathies. In some EU member states the dorsopathies can be acknowledged as occupational diseases, e. g. in Belgium, Bulgaria, Denmark, France, Italy, Rumania, Slovak Republic, Slovenia, and Spain.

The Czech List of Occupational Diseases does not involve such an item, and therefore, dorsopathies cannot be currently acknowledged as occupational diseases and compensated in the Czech Republic. In connection with these issues, scientific and legal research is in progress these days in terms of efforts to change this situation in the Czech Republic. As it was mentioned above, vertebral column disorders are very frequent in population – the first and the most important goal in the present research will be the precise definition of criteria needed for the assessment and acknowledgement of dorsopathies as occupational diseases. The standardized criteria will have to include specifications both in terms of objective findings (also radiological and neurological findings), subjective symptoms (length and severity of difficulties) and in terms of industrial hygienic and workplace characteristics. Cases of dorsopathies with the high share of occupational aetiology could be then (in the future) considered as **occupational diseases** with entitlement to compensation.

LOW BACK PAIN AND SCIATICA

Although it may be not possible to define a precise cause of low back symptoms for most patients, it is very important to complete a detailed history and examination. The history should include location, duration, severity of the pain and details of any previously reported back pain.

Symptoms – vary depending on the aetiology of low back pain. In the case of degenerative aetiology of low back pain the pain remains rather local, without irradiation and is caused due to the local involvement of spine structures – muscles, ligaments, intervertebral discs and intervertebral joints. Neurological involvement is suggested by symptoms of sciatica or pseudoclaudication. Pain irradiating below the knee represents rather radiculopathy than pain radiating only to the posterior thigh. Numbness or weakness in the legs marks the likelihood of neurological involvement as well.

Differential diagnosis is wide: so called “mechanical” causes of low back pain stand for these examples: degenerative diseases (with discs and facet joints involvement), spondylolisthesis, herniated disc, spinal stenosis, fractures and congenital states. To “non-mechanical” spine diseases belong neoplasias, infections, inflammatory arthritis, Scheuermann’s diesease, Page’s disease. Also internal diseases can present with the low back pain: pelvic organs involvement, renal or gastrointestinal diseases and even aortic aneurysm or fat herniation of lumbar space.

Investigation methods – a plain anterior-posterior and lateral X-ray of the lumbar spine is the investigation method of the first choice (according to the newest guidelines imaging studies in the first 4 to 6 weeks are not necessary, unless there are progressive neurological findings or a high suspicion of a systemic aetiology; then after this period of time plain X-ray with other possibly needed tests is indicated). Modern **CT** and **MRI** studies are more sensitive for detecting infection, cancer, disc pathology and spinal stenosis. These investigations are indicated for progressive neurological deficits, cancer or infection suspicion, or after approximately 12 weeks and more of persistent low back pain.

Treatment – is closely associated with the cause of back pain. Urgent referral is indicated for patients with suspected cauda equina syndrome (present sphincter symptoms) or spinal cord compression. Surgical referral is also indicated for patients with progressive or severe neurological deficits. In terms of the therapy of chronic low back pain self-care therapy and pharmacologic therapies can be combined. In the first group e. g. various types of exercise, lumbar supports or proper bed mattress usage can be named. The basement of pharmacologic therapy shapes the use of **analgesics** – nonopioid analgesic medications or nonsteroidal antiinflammatory drugs (NSAIDs) with a wide range of available remedies. Opioids may be appropriate for a short-term use in patients with severe acute low back pain but should be used with caution for the long-term treatment. Opioid use should be necessarily monitored. Other groups of medication potentially benefit in chronic back pain are also skeletal muscle relaxants, antiepileptic medications such as (gabapentin), antidepressants and benzodiazepines. A large number of modalities of physical therapy have been used in patients with chronic low back pain – to name a few: ultrasound, traction or transcutaneous electrical nerve stimulation methods.

Prevention – because of the lack of sufficient data (difficult prediction of person’s disposition of developing vertebral column disorders) the recommendation of primary prevention means is complicated. However, exercise therapy may probably have an important role in secondary prevention.

Despite the general low back pain, the occupational aetiology fraction of these disorders can be considered as **preventable**. Provided that effective preventive measures are implemented, decrease of population burden from occupationally caused back pain can be expected.

PART V: SHORT-FORM VIDEOS: OCCUPATIONS AT RISK AND OCCUPATIONS AT POTENTIAL RISK

VIDEO NO. 1: WORK IN STONE QUARRIES: STONE SPLITTER

Risks and categories

- 3rd category
  - overload of the upper extremities
  - noise
  - exposure to silica dust
- 2nd category
  - exposure to cold
  - working posture
  - psychological load

The worker splits about 6 tones of stone per one work-shift.

WATCH THE VIDEO

FIG. 34 - STONE SPLITTER

VIDEO NO. 2: WORK IN STONE QUARRIES: STONE BREAKER

WATCH THE VIDEO

Risks and categories

- 4th category (extreme)
  - hand-transmitted vibration to the upper extremities
  - noise
  - exposure to silica dust
- 3rd category
  - overload of the upper extremities
- 2nd category
  - exposure to cold (low temperatures)
  - working posture

FIG. 35 - STONE BREAKER

Total time of work with pneumatic hammers is approximately 3 – 4 hours per one work-shift. During this time the worker is also exposed to extreme levels of noise, silica dust and also overload of the upper extremities with exposure to low temperatures as environmental factors.

VIDEO NO. 3: WORK IN STONE QUARRIES: SLICER

WATCH THE VIDEO ☞

Risks and categories

- 4th category (extreme)
  - hand-transmitted vibration to the upper extremities
- 3rd category
  - overload of the upper extremities
  - noise
  - exposure to silica dust
- 2nd category
  - exposure to (low temperatures)
  - working posture

FIG. 36 - SLICER

Total time of work with pneumatic hammers is approximately 4 – 5 hours per one work-shift.

VIDEO NO. 4: FOREST WORKER, WORK WITH THE POWER SAW

WATCH THE VIDEO

Risks and categories

- 3rd category
  - hand-transmitted vibration to the upper extremities
  - noise
  - overload of the upper extremities in some cases
- 2nd category
  - exposure to cold (low temperatures)
  - working posture
  - biologic hazards

FIG. 37 - FOREST WORKER, WORK WITH THE POWER SAW

Total time of work with the power saw would make up approximately one half of the work-shift.

VIDEO NO. 5: WORK WITH THE SCRUB-CUTTER

WATCH THE VIDEO

Risks and categories

- 3rd category
  - hand-transmitted vibration to the upper extremities
  - noise
- 2nd – 3rd category
  - overload of the upper extremities

The work with the scrub-cutter is seasonal, total time of exposure is variable.

FIG. 38 - WORK WITH THE SCRUB-CUTTER

VIDEO NO. 6: FOUNDRY WORK: HAND MOULDER

WATCH THE VIDEO

Risks and categories

- 3rd category
  - noise
- 2nd category – risky (2R)
  - foundry sand (of silica content)
- 2nd category
  - overload of the upper extremities
  - hand-transmitted vibration to the upper extremities
  - psychological load

FIG. 39 - HAND MOULDER

The manufactured core is placed in the form. The form is filled up with the foundry sand and compressed firmly with the pneumatic hammer.

VIDEO NO. 7: FOUNDRY WORK: ALUMINIUM SMELTER

WATCH THE VIDEO

FIG. 40 - ALUMINIUM SMELTER

Risks and categories

- 3rd category
  - overload of the upper extremities
  - noise
- 2nd category – risky (2R)
  - foundry sand (of silica content)
- 2nd category
  - psychological load

Aluminium smelters melt aluminium used

for the procession of forms.

VIDEO NO. 8: FOUNDRY WORK: SMELTING INTO THE MOULDS

WATCH THE VIDEO ☞ Video

Risks and categories

- 3rd category
  - overload of the upper extremities
  - noise
  - exposure to heat (high temperatures)
- 2nd category – risky (2R)
  - foundry sand (of silica content)
- 2nd category
  - psychological load

FIG. 41 - SMELTING INTO THE MOULDS

VIDEO NO. 9: FOUNDRY WORK: SMELTING INTO THE CASTING MOULDS I.

WATCH THE VIDEO

Risks and categories

- 3rd category
  - overload of the upper extremities
  - noise
  - exposure to heat (high temperatures)
- 2nd category – risky (2R)
  - foundry sand (of silica content)
- 2nd category
  - psychological load

FIG. 42 - SMELTING INTO THE CASTING MOULDS I.

VIDEO NO. 10: FOUNDRY WORK: SMELTING INTO THE CASTING MOULDS II.

WATCH THE VIDEO

Risks and categories

- 3rd category
  - overload of the upper extremities
  - noise
  - exposure to heat (high temperatures)
- 2nd category – risky (2R)
  - foundry sand (of silica content)
- 2nd category
  - psychological load

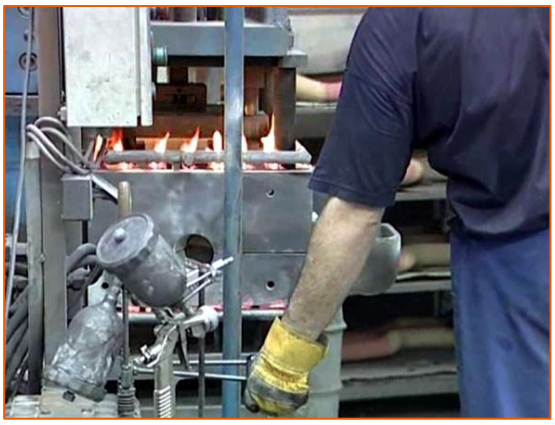

FIG. 43 - SMELTING INTO THE CASTING MOULDS II.

VIDEO NO. 11: FOUNDRY WORK: BREAKING CORES

WATCH THE VIDEO

Risks and categories

- 4th category (extreme)
  - hand-transmitted vibration to the upper extremities
  - noise
  - foundry sand (of silica content)
- 3rd category
  - overload of the upper extremities
- 2nd category
  - psychological load

FIG. 44 - BREAKING CORES

The worker breaks the cores by the help of electrical pneumatic devices – he separates the sand from the castings. Then these castings are collected and prepared for another processing by the belt saws.

VIDEO NO. 12: FOUNDRY WORK: WORK WITH THE BELT SAW

Risks and categories

- 3rd category
  - hand-transmitted vibration to the upper extremities
  - noise
- 2nd category – risky (2R)
  - foundry sand (of silica content)
- 2nd category
  - overload of the upper extremities

WATCH THE VIDEO

FIG. 45 - WORK WITH THE BELT SAW

VIDEO NO. 13: FOUNDRY WORK: WORK WITH THE FLOOR GRINDER

WATCH THE VIDEO ☞ Video

FIG. 46 - WORK WITH THE FLOOR GRINDER

Risks and categories

- 4th category (extreme)
  - noise
- 3rd category
  - hand-transmitted vibration to the upper extremities
- 2nd category – risky
  - foundry sand (of silica content)
- 2nd category
  - overload of the upper extremities
  - psychological load

VIDEO NO. 14: FOUNDRY WORK: WORK WITH THE MANUAL GRINDER

WATCH THE VIDEO

FIG. 47 - WORK WITH THE MANUAL GRINDER

Risks and categories

- 4th category (extreme)
  - noise
- 3rd category
  - hand-transmitted vibration to the upper extremities
- 2nd category – risky (2R)
  - foundry sand (of silica content)
- 2nd category
  - overload of the upper extremities
  - psychological load

VIDEO NO. 15: ASSEMBLY OF ELECTRIC MOTORS: MANUAL INSERTION OF COILS

WATCH THE VIDEO ☞ Video

Risks and categories

- 3rd category
  - overload of the upper extremities

FIG. 48 - MANUAL INSERTION OF COILS

VIDEO NO. 16: ASSEMBLY OF ELECTRIC MOTORS: INTEGRATING AND STITCHING OF WINDING

WATCH THE VIDEO ☞ Video

Risks and categories

- 3rd category
  - overload of the upper extremities

FIG. 49 - INTEGRATING AND STITCHING OF WINDING

VIDEO NO. 17: ASSEMBLY OF ELECTRIC MOTORS: MACHINE RETRACTION OF WINDING

WATCH THE VIDEO ☞ Video

Risks and categories

- 3rd category
  - overload of the upper extremities

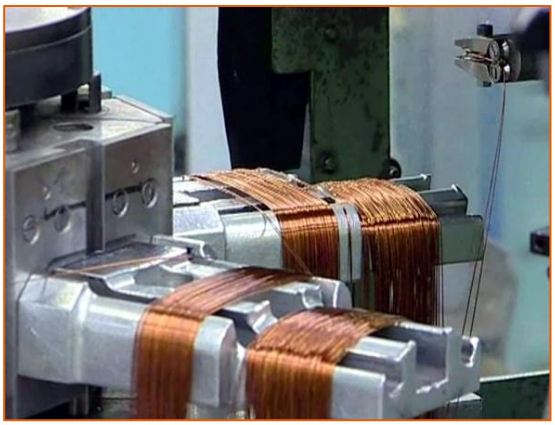

FIG. 50 - MACHINE RETRACTION OF WINDING

VIDEO NO. 18: ASSEMBLY OF ELECTRIC MOTORS: FINAL ASSEMBLING OF WINDING

WATCH THE VIDEO ☞ Video

Risks and categories

- 3rd category
  - overload of the upper extremities

FIG. 51 - FINAL ASSEMBLING OF WINDING

VIDEO NO. 19: WORK OF THE DENTAL TECHNICIAN 1

- **grinding a plaster model** of teeth to prepare the model of a denture

Risks and categories

- 3rd category
  - exposure to dust of amorphous silica content
- 2nd category
  - hand-transmitted vibration to the upper extremities
  - noise
  - overload of the upper extremities
  - working posture
  - visual load

WATCH THE VIDEO

FIG. 52 - GRINDING A PLASTER MODEL

VIDEO NO. 20: WORK OF THE DENTAL TECHNICIAN 2

- **grinding dental material** – photopolymers, removing of material residues

Risks and categories

- 3rd category
  - exposure to dust of amorphous silica content
- 2nd category
  - hand-transmitted vibration to the upper extremities
  - overload of the upper extremities
  - working posture
  - visual load

WATCH THE VIDEO ☞

FIG. 53 - GRINDING DENTAL MATERIAL - PHOTOPOLYMERS

Video No. 21: Work of the Dental Technician 3

- **work with pliers**
- loading the muscles of hands, torsion movements, frequent repetition of movements

Risks and categories

- 3rd category
  - exposure to dust of amorphous silica content
- 2nd category
  - hand-transmitted vibration to the upper extremities
  - noise
  - overload of the upper extremities
  - working posture
  - visual load

Watch the Video ☞ Video

FIG. 54 - WORK WITH PLIERS

VIDEO NO. 22: WORK OF THE DENTAL TECHNICIAN 4

- **grinding a plaster model by the help of a floor plaster grinder**
- loading the hands due to the hand-transmitted vibration, but also muscles of entire arms and muscles trunk

Risks and categories

- 3rd category
  - exposure to dust of amorphous silica content
- 2nd category
  - hand-transmitted vibration to the upper extremities
  - noise
  - overload of the upper extremities
  - working posture
  - visual load

WATCH THE VIDEO ☞

FIG. 55 - GRINDING A PLASTER MODEL, FLOOR PLASTER GRINDER

VIDEO NO. 23: WORK OF THE DENTIST 1

- **treatment in the Department of Conservative Dentistry**
- loading the hands due to the hand-transmitted vibration
- working posture (loading the vertebral column), visual load

Risks and categories

- 3rd category
  - use of lasers (in some cases)
- 2nd category
  - hand-transmitted vibration to the upper extremities
  - overload of the upper extremities
  - noise
  - working posture
  - psychological load
  - biologic hazards
  - visual load

WATCH THE VIDEO ☞

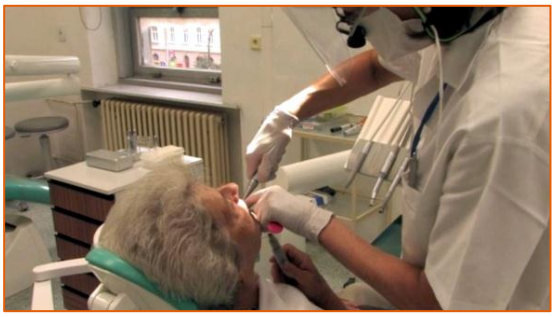

FIG. 56 - TREATMENT IN THE DEPARTMENT OF CONSERVATIVE DENTISTRY

VIDEO NO. 24: WORK OF THE DENTIST 2

- **treatment of root canals**
- loading the hands due to the hand-transmitted vibration
- working posture (loading the vertebral column), visual load

Risks and categories

- 3rd category
  - use of lasers (in some cases)
- 2nd category
  - hand-transmitted vibration to the upper extremities
  - overload of the upper extremities
  - noise
  - working posture
  - psychological load
  - biologic hazards
  - visual load

WATCH THE VIDEO

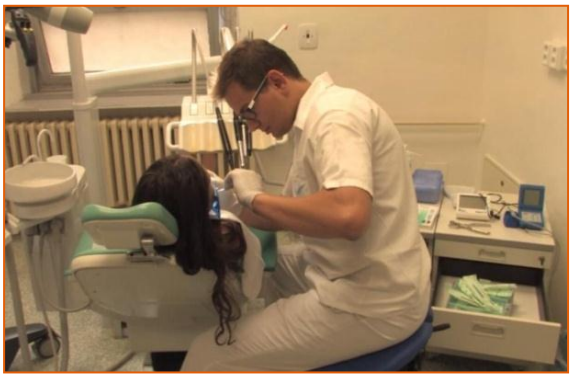

FIG. 57 - TREATMENT OF ROOT CANALS

VIDEO NO. 25: WORK OF THE DENTIST 3

- **treatment of root canals, use of a microscope**
- loading the hands due to the hand-transmitted vibration
- working posture (loading the vertebral column), visual load

Risks and categories

- 3rd category
  - use of lasers (is some cases)
- 2nd category
  - hand-transmitted vibration to the upper extremities
  - overload of the upper extremities
  - noise
  - working posture
  - psychological load
  - biologic hazards
  - visual load

WATCH THE VIDEO ☞

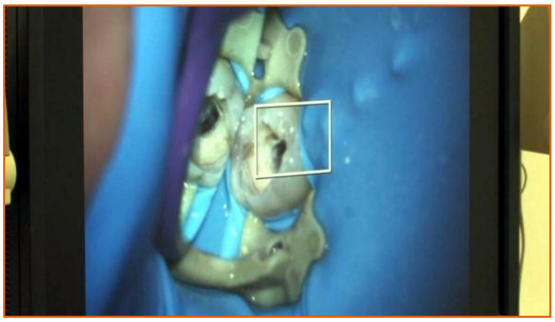

FIG. 58 - TREATMENT OF ROOT CANALS, USE OF A MICROSCOPE

VIDEO NO. 26: WORK OF THE DENTIST 4

- **impression of palatine arches into an impression material** (for the manufacture of a denture)
- working posture (loading the vertebral column), visual load

Risks and categories

- 3rd category
  - use of lasers (in some cases)
- 2nd category
  - hand-transmitted vibration to the upper extremities
  - overload of the upper extremities
  - noise
  - working posture
  - psychological load
  - biologic hazards
  - visual load

WATCH THE VIDEO ☞

FIG. 59 - IMPRESSION OF PALATINE ARCHES

VIDEO NO. 27: WORK OF THE PHYSIOTHERAPIST 1

- **handling of a paraplegic patient**
- loading the lumbar vertebral column

Risks and categories

- 3rd category
  - working posture
- 2nd category – risky (2R)
  - physical load
- 2nd category
  - psychological load

WATCH THE VIDEO ☞

FIG. 60 - HANDLING OF A PARAPLEGIC PATIENT

VIDEO NO. 28: WORK OF THE PHYSIOTHERAPIST 2

- **handling of a hemiplegic patient** (the right side of the body involved)
- physical load – loading the lumbar spine

Risks and categories

- 3rd category
  - working posture
- 2nd category – risky (2R)
  - physical load
- 2nd category
  - psychological load

WATCH THE VIDEO

FIG. 61 - HANDLING OF A HEMIPLEGIC PATIENT

VIDEO NO. 29: BALLET DANCERS

- extreme physical load – bones and joints of lower extremities (ankles, knees, hips), also shoulders, vertebral column (impacts due to hops)

WATCH THE VIDEO

FIG. 62 - BALLET DANCERS

VIDEO NO. 30: PIANIST

- load of hands – fingers, wrists – frequent repetitive movements

Risks and categories

- 3rd category
  - noise
- 2nd category
  - psychological load

WATCH THE VIDEO ☞

FIG. 63 - PIANIST

VIDEO NO. 31: ORCHESTRA

- loading the upper extremities – repetitive movements of hands, wrists, shoulders, elbows (e. g. harpist)
- in some case overload of the upper extremities (violinist)
- risk of noise

Risks and categories (musicians)

- 3rd category
  - noise
- 2nd category
  - psychological load

Risks and categories (violinist)

- 3rd category
  - overloading the upper extremities
  - noise
  - working posture

WATCH THE VIDEO ☞ Video

FIG. 64 - ORCHESTRA, VIOLINIST

PART VI: CASE-REPORTS

OCCUPATIONAL RAYNAUD'S PHENOMENON

☞ See the chapter "**Hand Vascular Diseases Caused by the Exposure to the Hand-Transmitted Vibration to the Upper Extremity: Occupational Traumatic Vasoneurosis – Secondary Raynaud's Phenomenon (Syndrome) Due to Vibration Exposure**

☞See the video No. **14** – "**Work with the Manual Grinder**" .

- man, 49 years old, 70 kg, 169 cm, right-handed, non-smoker
- occupational history
  - worked last seven years as a locksmith, used vibrating tools (hand grinding machine, milling-machines) sometimes during the whole work-shift, processed steel materials
- medical history
  - on inquiry the patient admitted blanching of fingers in cold environments
  - only chronic nasal polyposis from other diseases
- **positive water cold test and severe pletysmographical changes**
  - the water cold test induced blanching of 6 phalanges which was confirmed by the pletysmographical finding of severe changes – curve breakdowns in all the fingers of hands
  - the water cold test of the lower limbs was negative, pletysmography showed no pathological changes
- laboratory and additional findings
  - in laboratory tests and X-rays of bones of the upper extremities and cervical spine no serious pathological findings were detected
  - **EMG** examination of nerves of the upper extremities was normal
- conclusion
  - after the completion of the hygienic assessment of patient's workplace and confirmation of hazardous conditions due to hand-transmitted vibration the disease **was acknowledged and compensated as occupational Raynuad´s phenomenon of the upper extremities due to vibration exposure**
  - the patient was removed from the hazardous exposure

- ***note***
    - *based on the data from our documentation mild vasospastic changes were detected approximately five years before the occupational disease acknowledgement (at that time they were not the reason for removal of the patient nor they could be acknowledged as an occupational disorder).*

NEUROSYPHILIS INITIALLY IMITATING CARPAL TUNNEL SYNDROME

☞ See the chapter "**Disorders of Peripheral Nerves of Upper Extremities: Entrapment Neuropathies**".

- man, 44 years old
- occupational history
  - worked 3 years as a polisher of metal plates, used vibrating tools
- medical history
  - symptoms of 1 year lasting paresthesia of upper limbs (mainly hands and fingers)
  - initially he reported no relevant facts from his medical history →
  - suspicion of **bilateral carpal tunnel syndrome of severe stage** based on the clinical picture and electromyographical examination was pronounced:
    - **EMG** parameters:
      - right median nerve: distal motor latency: 8,40 ms; sensitive velocity: 26,2 m/s
      - left median nerve: 7,75 ms; sensitive velocity: 25,9 m/s
- **syphilis in the past**!
  - the patient later reported that he was treated for syphilis years ago, **latent seropositive syphilis was confirmed** at that time, he was treated with penicillin; clinical and neurological examination did not support the diagnosis of neurosyphilis
- pathological laboratory findings
  - blood count: **leucocytosis** (15,05 x 10^9/L), neutrophilia, monocytosis
  - **positive anti-cardiolipin antibodies**
  - **positive TPPA** (Treponema pallidum particle agglutination assay)

4. lumbar puncture
    - **positive specific anti-treponemal IgG antibodies**

- other investigations
  - **sensomotor demyelinating lower limbs neuropathy of the medium stage** detected by electromyography
  - a more detailed **EMG** examination confirmed **polyneuropathy** (not only involvement of the median nerve at the wrist)
  - **MRI** of the wrist – detected no signs of compression of the median nerve
- conclusion
  - a suspicion of polyneuropathy caused by neurosyphilis was pronounced

- isolated carpal tunnel syndrome of occupational aetiology was excluded
- patient was treated with benzyl penicillin

- ***note***
  - *sometimes for the first look not so important and by the patient not emphasized facts from medical history can be crucial*
  - *remember that exclusion of other "general" diseases, in this case namely neuropathies including neuropathies of infectious origin, is the first step before occupational disease clinical suspicion enouncement*

Occupational Carpal Tunnel Syndrome in a Worker in Integrating and Stitching of Winding

☞ See the video: "Worker in Integrating and Stitching of Winding" (Video No. **16**).

☞ See the chapter "**Disorders of Peripheral Nerves of Upper Extremities: Entrapment Neuropathies**".

- woman, 35 years old, 76 kilos, 160 cm, right-handed
- occupational history
  - last 11 years worked as a worker in integrating and stitching of winding, known risk of overload to the upper extremities (repetitive movements)
- medical history
  - last 6 to 7 years symptoms of tingling, numbness and pain especially in the right hand
  - additionally chronic lumbar vertebral problems and general arthrosis of the right knee joint
- **EMG** examination
  - confirmed **carpal tunnel syndrome of the medium stage** in the right hand
    - distal motor latency: 5,5 ms; sensitive velocity: 32.9 m/s
    - conduction parameters of the ulnar nerve were normal
- laboratory and additional findings
  - laboratory tests discovered only mild hyperlipidemia
- neurological examination confirmed isolated neuropathy of the median nerve
- conclusion
  - after the completion of the hygienic assessment of patient's workplace and confirmation of hazardous conditions due to overload of the upper extremities **carpal tunnel syndrome of the right extremity was acknowledged and compensated as the occupational disease**
  - the patient was removed from the hazardous exposure

OCCUPATIONAL RADIAL EPICONDYLITIS

☞ See the chapter "**Enthesopathy (Insertion Pain Syndrome)**".

- woman, 39 years old, 62 kg, 173 cm, left-handed
- occupational history
  - last 3 and half years worked as a handling worker, prepared material, worked as a saw machine operator and used a grinding machine occasionally
- medical history
  - last 18 months itching irradiating pain of the right elbow, worst during work and exercise but annoying also during rest
  - followed-up with general (primary) Raynaud's phenomenon
- **three-phase scintigraphy**
  - **positive, confirmed increased bone remodeling in the right radial epicondyle**
- laboratory and additional findings
  - revealed no serious findings
- conclusion
  - after the completion of the hygienic assessment of patient's workplace and confirmation of hazardous conditions due to overload of upper extremities **radial epicondylitis of the right extremity was acknowledged and compensated as the occupational disease**
  - the patient was removed from the hazardous exposure

- ***note***
  - *remember that correlation between clinic symptoms and **positive three-phase scintigraphy** is the crucial point which is needed for the confirmation of epicondylitis as an occupational disorder*

Occupational Carpal and Cubital Tunnel Syndromes in a Quarryman

☞See the video: "Slicer of Stones"- Video No. **3**

☞ See the chapter "**Disorders of Peripheral Nerves of Upper Extremities: Entrapment Neuropathies**".

- man, 55 years old, 95 kg, 165 cm, right-handed, smoker
- occupational history
    - worked 35 years as a quarryman, last 10 year as a slicer (☞Video No. **3**)
- medical history
    - last 2-3 years tingling and numbness of fingers of hands, sometimes pain irradiating to the forearm
    - reported no finger blanching or hearing problems
    - treated for arterial hypertension, heart systolic murmur due to degenerative aortic stenosis (follow-up), chronic bronchitis, hyperlipidemia and chronic lumbar back pain
    - 5 years ago treated for borreliosis
- **EMG** examination
    - confirmed **carpal tunnel syndrome of the medium stage in the right hand**
        - distal motor latency: 6.2 ms; sensitive velocity: 30.8 m/s
    - **cubital tunnel syndrome of the medium stage in the left hand**
        - motor velocity: 35.5 ms
- laboratory and additional findings
    - positive anti-Borrelia antibodies (IgM – were not confirmed with the use of blotting techniques)
    - X-ray of bones of the hands and elbows and cervical spine: without clear pathological changes
    - chest X-ray (performed because of the risk of silica dust exposure) was normal
- **EMG** examination of lower extremities
    - aimed at excluding polyneuropathy (hypothetically caused by borreliosis)
    - **negative** result, parameters in the normal range
- neurological examination confirmed isolated neuropathies of the median and ulnar nerves
- conclusion
    - after the completion of the hygienic assessment of patient's workplace and confirmation of risky conditions due to hand-transmitted vibration

and overload of upper extremities **carpal tunnel syndrome of the right extremity and cubital tunnel syndrome of the left extremity were acknowledged and compensated as occupational diseases**

- the patient was removed from the hazardous exposure

PART VII: ENGLISH-CZECH DICTIONARY OF IN THE TEXT MENTIONED OCCUPATIONS

Name of Occupation in English	**Name of Occupation in Czech**
Administrative assistant	Administrativní pracovnice
Aluminium smelter	Tavič hliníku
Ballet dancer	Baletní tanečník
Breaking cores	Vytloukání jader
Brick-layer	Zedník
Butcher (slaughterer)	Řezník-bourač
Charwoman	Uklízečka
Confectionery maker	Cukrář
Coal miner	Horník
Coil winder	Elektronavíječka
Coremaker	Jádrař
Dental technician	zubní technik (laborant)
Dentist	Zubní lékař
Embroiderer	Vyšívač
Floor-fitter	Podlahář
Final assembling of winding (of electric motors)	Dokompletace vinutí (elektromotorů)
Fitter	Montér (obecně)
Forestry worker, logger, work with the power saw	Lesní dělník, dřevorubec, práce s motorovou pilou
Gardener	Zahradník
Glass-blower	Sklář
Glass-cutter	Brusič skla
Grinding machine operator	Obsluha brusky
Handling worker	Manipulační dělník
Hand moulder	Ruční formíř
Harpist	Harfenista
Hatmaker	Klouboučník
Integrating and stitching of winding (of electric motors)	Zapojování a obšívání vinutí (elektromotorů)
Locksmith	Zámečník
Melter	Tavič
Metal grinder	Brusič kovů
Saw machine operator	Obsluha strojní pily

Smelting into the casting moulds	Odlévání do kokil
Smelting into the moulds	Odlévání do forem
Machine retraction of winding (of electric motors)	Strojní zatahování vinutí (elektromotorů)
Manual insertion of coils (of electric motors)	Ruční vkládání cívek (elektromotorů)
Milker	Dojička
Moulder	Slévač
Musician	Hudebník
Painter	Natěrač
Physiotherapist	Fyzioterapeut
Pianist	Klavírista
Polisher	Leštič, cídič
Sewer	Šička (krejčí)
Shoemaker	Obuvník
Slicer	Plátkař
Stone braker	Lamač kamene
Stone splitter	Štípač kamene
Typist	Písařka na manuálním psacím stroji
Upholsterer	Čalouník
Violinist	Houslista
Waiter	Číšník
Welder	Svářeč
Woodworker	Dřevoobráběč
Work with the belt saw	Práce s pásovou pilou
Work with the floor grinder	Práce se stojanovou bruskou
Work with the manual grinder	Práce s ruční bruskou
Work with the scrub-cutter	Práce s křovinořezem

PART VIII: TEST OF KNOWLEDGE

"Knowledge is power."

Choose the correct answer (there is only one):

1. **Epicondylitis can be aknowledged as an occupational disease:**
   a) if it lasts 6 months at least
   b) if three-phase scintigraphy is positive
   c) only if it is associated with cervical vertebral column disorders
   d) a) and b) are correct

2. **Occupational Raynaud´s phenomenon (traumatic vasoneurosis) is caused by:**
   a) immunocomplex production
   b) atherosclerotic alterations
   c) hand-transmitted vibration to the upper extremities
   d) hand-transmitted vibration to the upper extremities and atherosclerotic alterations

3. **Work with vibrating tools with hand-arm vibration exposure can cause:**
   a) vascular disorders
   b) nerve disorders
   c) vascular, nerve disorders
   d) vascular, nerve, bone, joint disorders

4. **Conditions at the workplace are considered as risky if:**
   a) the employer says so
   b) the employee says so

c) occupational traumas occur frequently
d) hygienic limits for particular risk factors are exceeded (based on the hygienic assessment and measurement at the workplace)

5. **The most important examination for the diagnosis of carpal tunnel syndrome is:**
   a) electromyographic testing (**EMG**) of the median nerve
   b) orthopaedic examination
   c) X-ray examination of wrists
   d) thermographic examination

6. **Tarsal tunnel syndrome:**
   a) does not exist – it is carpal tunnel syndrome
   b) it is an entrapment of the tibial nerve
   c) it is and entrapment of the ulnar nerve
   d) it is not an entrapment syndrome at all

7. **For the diagnosis of the occupational Raynaud´s phenomenon (traumatic vasoneurosis) is not used:**
   a) Lewis-Prusik test
   b) cold water test
   c) finger pletysmography
   d) **EMG** examination

8. **An occupational disease can be assessed only by:**
   a) specialist with a super-specialization
   b) occupational physician (from occupational diseases centre)
   c) company doctor
   d) special expert committee

9. **Posterior impingement syndrome means:**
   a) impingement syndrome of the shoulder
   b) impingement syndrome of the posterior part of the ankle
   c) is not common in ballet dancers
   d) no answer is correct

10. **For the diagnosis of occupational Raynaud´s phenomenon (traumatic vasoneurosis) which is/are crucial:**
    a) finger bleaching

b) pulse waves decomposition evidence based on pletysmography
c) objective evidence of finger bleaching (positive water cold test) and confirmation of severe pathologic changes on pletysmography
d) trophic alterations of skin and nails

11. As an occupational disease can be acknowledged only a disease which:

a) developed at the workplace
b) was considerably worsened by work
c) developed in a direct causal relation with occupational activity and does not have to be stated in the List of Occupational Diseases (Supplement of the Order of the Government No. 114/2011, Digest)
d) developed in a direct causal relation with occupational activity and is stated in the List of Occupational Diseases (Supplement of the Order of the Government, No. 114/2011, Digest)

12. Carpal tunnel syndrome is:

a) entrapment of the median nerve
b) typical for symptoms of bleaching of fingers
c) entrapment of the ulnar nerve
d) disease of tendons in the wrist

13. Mechanisms which are not responsible for the development of occupational bursitis:

a) repeated pressure
b) repeated acute viral of bacterial infections
c) repeated impacts
d) repeated friction in the area of bursa

14. Hand-transmitted vibration can cause:

a) damage to vessels and nerves of the upper extremities
b) cerebral damage
c) damage to bones of hands
d) a) and c) are correct

15. As an occupational disease can be acknowledged:

a) polyarthrosis
b) isolated initial arthrosis
c) isoleted arthrosis of 2^{nd} to 3^{rd} stage
d) posttraumatic arthrosis

16. **As an occupational disease only carpal tunnel syndrome with following characteristics can be acknowledged:**
    a) at least medium stage of damage according to the **EMG** examination
    b) severe stage of damage according to the **EMG** examination
    c) positive Lewis-Prusik test
    d) severe arthrotic changes

17. **Arthrosis of lower extremities can be acknowledged as occupational disease:**
    a) cannot be acknowledged at any case
    b) can occur e. g. in floor-fitters or miners
    c) is caused due to the exposure to cold environment
    d) if it is a consequence of a trauma

18. **Cubital tunnel syndrome is:**
    a) entrapment syndrome of the ulnar nerve
    b) entrapment syndrome of the radial nerve
    c) tendovaginits
    d) severe artrosis

19. **Aseptic necrosis of carpal bones can be caused by:**
    a) exposure to low temperatures
    b) exposure to high temperatures
    c) overload of upper extremities
    d) exposure to hand-transmitted vibration to the upper extremities

20. **Definite risky category according to the classification of risks at the workplace is:**
    a) at least the 3rd category
    b) the 1st category
    c) at least the 2nd category
    d) only the 4th category

Correct answers:

1. d), 2. c), 3. d), 4. d), 5 a), 6. b), 7. d), 8. b), 9. b), 10. c), 11. d), 12. a), 13. b), 14. d), 15. c), 16. a), 17. b), 18. a), 19. d), 20. a).

PART IX: LIST OF ABBREVIATIONS

ACT – Autoridade para as Condições do Trabalho
CDC – Centers for Disease Control
CLA – Council for Labor Affairs
CNPRP – Centro Nacional de Protecção contra os Riscos Profissionais
CT – Computed Tomography
CTDs – Cumulative Trauma Disorders
DOH – Department of Health
DOH – Electromyography
ESSA – Employee's Social Security Act
HSE – Health and Safety Exclusive
ICC – Incident Contact Centre
MRI – Magnetic Resonance Imaging
NIOSH – National Institute of Occupational Safety and Health
OSHA – Occupational Safety and Health Administration
PERCESO – Pertubuhan Keselamatan Sosial
RIDDOR – Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
RMDs – Repetitive Motion Disorders
RPIs – Repetitive Strain Injuries
SOCSO – Social Security Organization
TEOMA – Taiwan Environmental and Occupational Medicine Association
TPPA – Treponema pallidum particle agglutination assay

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