Guidelines on basic training and safety

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Contents

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2. Introduction

Manual Medicine

Manual Medicine is a branch of medicine, which addresses management issues relating primarily to the neuro-musculoskeletal (nervous and locomotor) system. Physicians [a] practice Manual Medicine worldwide and are regulated by law in some 40 countries.

It was developed as a specialty, subspecialty or capacity within the medical science and profession in those countries, where a need was identified for non-surgical treatment of disorders of the locomotor system.

In those countries where the legal regulations do not list the specialty of Musculoskeletal Medicine or its equivalent, Manual Medicine is a subspecialty or an additional qualification related to one of the historically established specialties dealing with the locomotor system including those such as Neurology, Orthopaedics/Orthopaedic surgery, Physical Medicine and Rehabilitation, Rheumatology and Family Medicine/General Practice. In some countries Manual Medicine may also be an integrated component of the curriculum of those specialties [1].

Musculoskeletal Medicine

Musculoskeletal Medicine deals with medical diagnosis and medical therapy referring to all functional disorders and structural lesions of the locomotor system. This medical specialty is established predominantly in those countries whose structures of their national health care systems do not otherwise imply non-surgical treatment of the locomotor system. Musculoskeletal Medicine is practised in various countries worldwide and regulated by law in some of those. In these countries Manual Medicine is defined as a component of the curriculum of Musculoskeletal Medicine [2].

Neuromusculoskeletal Medicine

Neuromusculoskeletal Medicine is the equivalent medical specialty practised by the osteopathic medical profession in the USA [b]. The training for the Doctor of Osteopathic Medicine degree uniquely includes more than 300 hours of Manual Medicine specialty training at the predoctoral level [3]; this specialty further requires three or more years of fulltime residency with all component model education and testing under direct supervision of MM medicine specialists [4] [5].

[a] For the purpose of this document the term *physician* includes *surgeon* there where not mentioned.

[b] In the United States, specific core manual medicine capacities are specified for osteopathic curricula and specifically tested at State and/or national levels as part of the licensure process.

Manual Therapy

In Russia the equivalent medical specialty is called *Manual Therapy* and requires a complete medical training of Neurology or Orthopaedics/Traumatology, prior to the Manual Medicine Training [6] [7].

Arthrokinematics

The concept of arthrokinematics is an approach to teach and perform manual techniques, which are designed to influence the interrelation between the surfaces of the synovial joints in vertebral and peripheral joint dysfunctions. It has a scientific base [8] [9] and is implemented predominantly in some Japanese schools of Manual Medicine.

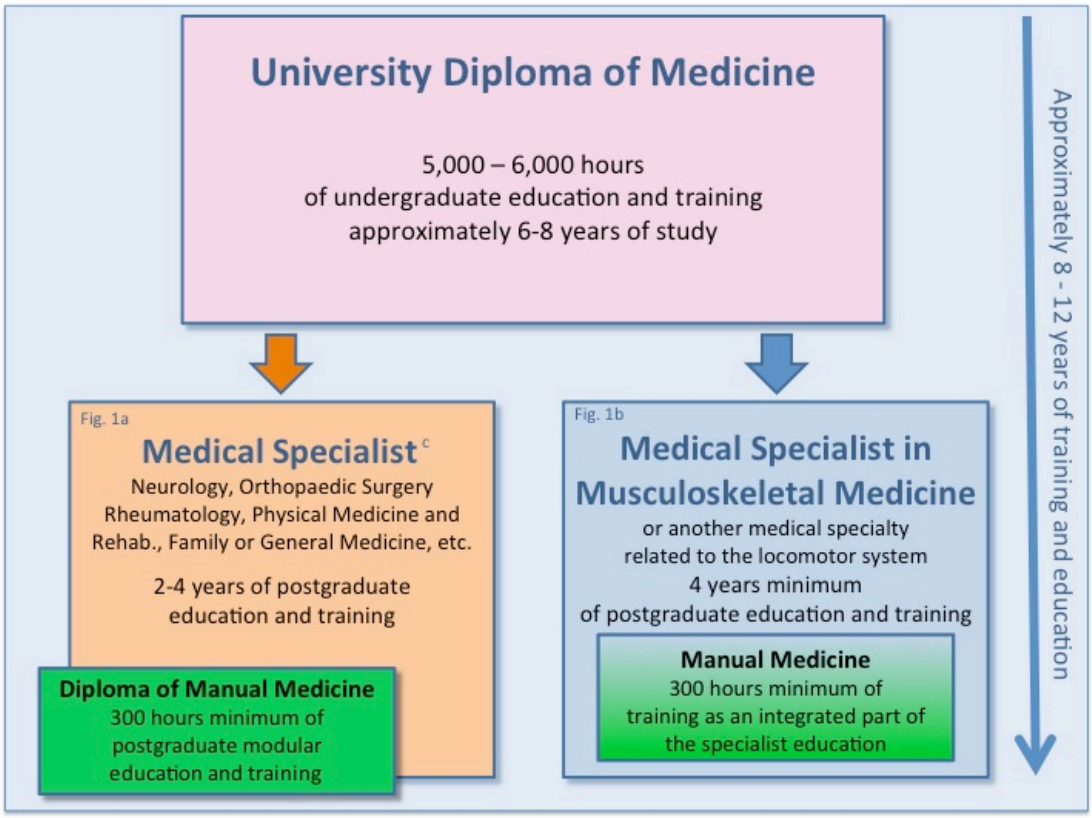

Fig. 1a: The *capacity model*. Manual Medicine is a subspecialty or capacity in relation to any medical/surgical specialty [c] dealing with clinical medicine.

Fig. 1b: The *component model*. Manual Medicine is an integrated component of the curriculum of the medical specialty of Musculoskeletal Medicine or another medical specialty related to the locomotor system.

MM medicine

In this document and the FIMM Glossary of Terminology, the acronym *MM medicine* defines all scopes of Manual Medicine *and* the non-invasive part of

[c] The term *Medical Specialist* includes physicians and surgeons as defined according to the responsible national Health Regulations.

Musculoskeletal Medicine as exemplified above (also including Neuromusculoskeletal Medicine, Manual Therapy and Arthrokinematics).

Thus, these guidelines cover both the *manual* as well as the non-invasive part of the *musculoskeletal* approach. They deal exclusively with the training and safety of these approaches practised either as a *capacity* or as a *component* (see *Fig. 1a* and *Fig. 1b* below).

In summary MM medicine is practised worldwide mainly in two different models:

- Manual Medicine as a subspecialty or capacity in relation with any medical specialty dealing with clinical medicine (*Fig. 1a:* capacity model).
- Manual Medicine is an integrated component of the curriculum of the medical specialty of Musculoskeletal Medicine or its equivalent or another medical specialty in which support of the locomotor system plays a role in preventive healthcare, health enhancement or improved quality of life. The integrated training must be equivalent to the requirements of Category 3, Specialty Level (*Fig. 1b:* component model).

As a medical health care service, MM medicine offers a conservative management approach and rarely requires auxiliary staff although it requires appropriately trained and skilled physicians. Therefore, one of the benefits of MM medicine is that it offers the potential for cost-effective management of disorders of the locomotor system.

Diagnostics in MM medicine is based on physician's skills in biomechanics, anatomy, neurophysiology, and psychosocial analysis and is usually done in the ambulatory care setting. The history, examination findings, and investigations are all considered in order to generate a working diagnosis. The MM physician then discusses and decides with the patient the therapeutic regime, which includes pharmacological prescription and manual treatment as well as rehabilitation prescription and advice. The MM physician therefore represents an appropriately trained practitioner with a broad skill set otherwise only available through a multidisciplinary approach. In those areas where patients with locomotor systems disorders might benefit from interprofessional interactions, MM medicine educated physician possess skills and perspectives useful in coordinating or directing others to incorporate appropriate risk-benefit and cost-effective strategies in the context of total patient care.

Musculoskeletal conditions are a major burden on individuals, health systems, and social care systems, with indirect costs being predominant. This burden has been recognized by the United Nations and WHO, by endorsing the Bone and Joint Decade 2000–2010 [10]. The number of patients presenting with problems related to MM medicine vary quite broadly from country to country. That said, the burden in understanding the scope of musculoskeletal conditions is huge and not reflected in national health priorities [11]. In countries that provide statistical data the lifetime prevalence of neck- and back-pain ranges from 70% to 75%. Only 5% of these patients have non-reversible, pathological disorders [12]. Indeed, musculoskeletal conditions cause more functional limitations in the adult population in most welfare states than any other group of disorders. They are a

major cause of years lived with disability in all continents and economies. One survey in the Journal of Rheumatology suggests that musculoskeletal conditions cause 40% of all chronic conditions, 54% of all long-term disability, and 24% of all restricted activity days. In other surveys carried out in Canada, the USA, and Western Europe, the prevalence of physical disabilities caused by a musculoskeletal condition repeatedly has been estimated at 4–5% of the adult population [13] [14]. The total costs of back pain in The Netherlands in 1991 were more than 4 billion Euros, in the United Kingdom in 1992 more than 2.7 billion Euros, and in Sweden in 1995 more than 2 billion Euros [15]. In 1998, total U.S. health care expenditures for low back pain were estimated at 90 billion U.S. dollars [16]. Average total health expenditures for patients with back and neck problems increased from 4,795 U.S. dollars per year in 1997 to about 6,096 U.S. dollars per year in 2005, an inflation-adjusted increase of 65% [17]. In Germany the costs for low back pain were 8.5 billion Euros in 2006. Approximately 90% of the total costs were indirect costs due to work absenteeism and disablement reflecting the fact that back pain typically affects the working population [18].

A mismatch exists between the numbers of patients presenting with problems of the locomotor system and the knowledge base of those caring for them. In North America it was estimated that between 13.7% and 27.8% patients present to a primary care physician with a chief symptom directly related to the musculoskeletal system but that on the average, medical schools in Canada devoted only 2.26% (range, 0.61% to 4.81%) of their curriculum time to musculoskeletal education [19]. In the USA, a survey of family practice physicians found 51% of respondents felt that they had insufficient training in orthopaedics. Furthermore, 56% of those surveyed claimed that medical school was their only source for formal musculoskeletal training. This prompted 100 medical school deans to launch "Project 100" to improve the discrepancy.

As dysfunction in the locomotor system most commonly includes pain, MM medicine is perfectly placed for early intervention, thus avoiding the long and sometimes endless path of chronic pain and invalidity. The International Federation for Manual/Musculoskeletal Medicine (FIMM) supports the medical societies in all countries to encourage their national health services to implement and maintain safe and effective training of physicians in diagnosis and therapy in MM medicine as delineated in this document.

Regulations for physicians who practice MM medicine vary considerably from country to country. In some countries, e.g. New Zealand and Russia have specialty status as mentioned (component model). In some other countries MM medicine has been legally recognized with formal qualifications often as part of another specialty (capacity model). This may include examination, registration and licensing by the government, a university or a Chamber of physicians. In these countries the profession is regulated and the stipulated educational qualifications are generally consistent, satisfying the requirements of the respectively accrediting agencies. In some countries MM medicine is not recognised formally or practised.

However, many countries have not yet developed MM education or established laws to regulate qualified practice of MM medicine.

With the growth in demand for MM medicine services, other medical specialists may wish to gain additional qualifications in MM medicine. Special training programs have been developed to enable physicians with substantial basic medical training to acquire the additional necessary education and skills to become MM specialists, and these could be expanded further. Such programs should be flexible in order to take account of different educational backgrounds and previous medical training of the students.

In countries where no regulatory legislation currently exists there may be no educational, professional or legal framework governing the practice of MM medicine.

FIMM through its Health Policy and Education Boards has delineated what the members of its Federation of National Societies believe to be the minimum educational requirements physicians need to achieve in order to protect patients. FIMM recommends recognition and implementation of these minimum requirements by all countries.

In some countries with limited educational structures, lack of financial resources, or unsatisfactory integration of indigenous communities into mainstream society, non-medical primary health care workers specifically trained in some manual techniques may help to enhance such health care services. This may also help to introduce some principles of MM medicine into national health care systems which otherwise would be unavailable thus increasing access, quality and cost in dealing with the burden of musculoskeletal health care.

3. Purpose of the guidelines

In order to facilitate qualified and safe practice of MM medicine as well as to protect the public and the patients while increasing access to quality and cost effective care, the purposes of these guidelines are:

- to describe and delineate different levels in the requirements for MM medicine education
- to serve as a reference for national authorities in establishing an examination and licensing system for the qualified practice of MM medicine
- to review contraindications in order to minimize the risk of accidents
- to promote the safe practice of MM medicine.

4. How to use this document

Part I of the guidelines covers basic requirements for different training programs, each one designed for trainees with various educational backgrounds.

This part provides a reference for the establishment of various training programs, particularly where no formal education degree has been established. If national health care authorities wish to evaluate the training program, they may consult the FIMM Education Board (http://fimm-online.com). This Board does not function as an accrediting agency, but promotes an understanding of the

variations between recognized educational and accrediting bodies through dialogue and communication.

A system of examination and licensing may be established or adapted on the basis of this training program to ensure the competence of the trainees and to avoid the practice of MM medicine by unqualified practitioners. It is to be hoped that this will deter commercial exploitation of MM medicine education and practice, which is a significant and growing problem in some countries.

Part II of the guidelines deals with the safety of spinal manipulative treatment and the contraindications to its use.

5. General considerations

5.1. Historical information

Physicians have used MM medicine techniques of diagnosis and therapy over thousands of years. The *Edwin-Smith-Papyrus* (3000 to 2500 B.C.E.) notes besides surgical diagnosis also some painful conditions of the neck, where the diagnostic manual procedure is quite similar to that used today. Physicians in India like the surgeon Susruta (1500 B.C.E.), believed to be the founder of *Ayurveda Medicine*, used manual techniques. Although spinal manipulation dates back to Hippocrates (460 to 375 B.C.E.) and the ancient Greek physicians [20] as well as to Galen (130 to 200 C.E.), the evolution of MM medicine is difficult to follow in the Middle Ages. During this period however the philosopher and physician Abu Ibn Sinna from Buchara called Avicenna (980 to 1037 C.E.) published within his *Canonis Medicinae* manual techniques that were taught for some hundred years at all European universities. In the middle of the 19th century the American physician Andrew Taylor Still (1828 to 1917 C.E.) developed a system of manual techniques, which he called *osteopathy* to differentiate it from the two major forms of physician-level care of that period (allopathy and homeopathy) and to credit his biomechanical study of joint function. This system of manual therapy had great success not only in the USA, (leading to the development of its own discipline and later acceptance in the US only of Doctors of Osteopathic Medicine) but also influenced quite broadly the MM-physicians expanding in Europe. In other countries like Japan MM techniques based on arthrokinematics were developed independently. With the foundation of the International Federation for Manual/ Musculoskeletal Medicine FIMM in 1962 in Nice (France) and its triennial International Conferences the process of international exchange, the merger of techniques and concepts was promoted intensely. Today FIMM is able to present a standard of MM medicine on different levels, as is documented below.

5.2. Principles of MM medicine

- MM medicine is the medical discipline of enhanced knowledge and skills in the diagnosis, treatment and prevention of (often painful but reversible) disorders of functions of the locomotor system.
- Disorders of the locomotor system constitute a large proportion of medical consultations at the primary care level. Normal function, biomechanics, diagnosis and management of disorders of the locomotor system are poorly represented in most undergraduate teaching programs. MM medicine completes and complements the syllabi of both undergraduate and postgraduate education underlying the training of physicians.
- Diagnostic skills build on conventional medical techniques using manual assessment of individual tissues and functional assessment of

the entire locomotor system based on scientific anatomy as well as biomechanical and neurophysiologic principles.

- Therapeutic skills add manual and manipulative techniques to conventional treatments for the reduction of pain, improvement of function, or other therapeutic outcome.
- Patients' understanding and involvement in the therapeutic activity help prevent recurrence.
- While there is no special "philosophy" of MM medicine, this field rests upon the following generally accepted principles of today's mainstream medicine:
  - The holistic view of man as a unit of body, mind, and spirit is very common.
  - It is also the common view of mainstream medicine that up to a certain degree the human body has the ability to compensate for disorders by self-regulation. Self-regulation may be influenced by many biological, social and psychological factors.
  - The current concept of MM medicine is based on the clinically proved observation of nocireactive and painful dysfunction of segmentally related tissues. MM specialists describe these findings as segmental or somatic dysfunction (defined by UK "read code") or as painful minor intervertebral dysfunction.

6. Glossary

Most of the terms used in these guidelines are defined in the FIMM-Glossary v7.2, published on the website in three languages (http://fimm-online.com).

The English version of the terms is given hereby.

Only terms used in this document are given.

arthrokinematics Arthrokinematics is the field of kinematics that is a study of the interrelation between the surfaces of synovial joint.

articular neurology The branch of neurology that involves the study of the anatomical, physiological, and clinical features of the nerve supply of the joint systems in various parts of the body [21].

capacity-model The term capacity is part of nomenclature of the Bologna process, which is a series of ministerial meetings and agreements between European countries designed to ensure comparability in the standards and quality of higher education qualifications. The capacity-model describes Manual Medicine as a subspecialty or a capacity in relation with any medical specialty dealing with clinical medicine. It presupposes at least a level of training which continues in the post-graduate, including an exam based on specialty level.

component-model The component-model describes Manual Medicine as an integrated component of the curriculum of the medical specialty of Musculoskeletal Medicine or another medical specialty related to the locomotor system.

diagnosis in Manual Medicine Diagnostic skills in manual medicine build upon conventional medical techniques with manual assessment of individual tissues and functional assessment of the whole locomotor system based upon scientific biomechanical and neurophysiologic principles. In particular, reversible somatic dysfunction and its differential diagnosis related to reversible dysfunction is sought by MM medicine practitioners.

HVLA thrust High velocity, low amplitude thrust.

hypermobility Increase in mobility resulting from congenital, constitutional, structural or functional changes of the joints or soft tissue. It may occur locally, regionally, or generalised.

locomotor system In the context of MM medicine the locomotor (or musculoskeletal) system includes the muscles, aponeuroses, bones and joints of the axial and appendicular skeleton, ligaments, and those parts of the nervous system or the visceral system associated with or significantly affected by their function.

manipulation Traditionally, the term manipulation has been understood to refer to the technique of high velocity, low amplitude thrust (HVLA). With the development of other techniques, manipulation is understood to refer to a variety of methods that restore normal anatomic and functional relationships within the musculoskeletal system. In some countries and in most European

countries, the term is used exclusively for the technique of high velocity, low amplitude thrust.

Manual Medicine Manual Medicine is the medical discipline of enhanced knowledge and skills in the diagnosis, therapy and prevention of functional reversible disorders of the locomotor system. (The members of FIMM adopted this definition in the year 2005. According to the country and the different linguistic customs the terms "Musculoskeletal Medicine", "Myoskeletal Medicine", "Neuromusculoskeletal Medicine", "Orthopaedic Medicine", "Manual Therapy" [e.g. Russian Federation] and others are used interchangeably with "Manual Medicine".)

mechanotransduction The process by which cells convert mechanical stimuli into a chemical response. It can occur in both cells specialized for sensing mechanical cues such as mechanoreceptors, and in parenchymal cells whose primary function is not mechanosensory.

mechanoreceptor Encapsulated nerve endings (receptor endings classified by the method of Freeman and Wyke meeting the following three criteria: [1] encapsulation, [2] identifiable morphometry, and [3] consistent morphometry on serial sections) are believed to be primarily mechanosensitive and may provide proprioceptive and protective information to the central nervous system regarding joint function and position [22].

MM medicine The term defines all scopes of Manual Medicine *and* the non-invasive part of Musculoskeletal Medicine (including Neuromusculoskeletal Medicine and Manual Therapy).

MM physician Physician who performs Manual Medicine either as a capacity or as a component.

MM techniques Methods, procedures, or manoeuvres taught in a recognized school of manual medicine or employed by a MM physician for therapeutic purposes.

mobilization Passive, slow, and usually repeated motion of axial traction and/or rotation and/or translatory gliding with increasing amplitude in order to improve restricted articular mobility.

Manual Therapy related to the Russian Federation In Russia the equivalent medical specialty to Musculoskeletal Medicine is called *Manual Therapy* and requires a complete medical training of Neurology or Orthopaedics/Traumatology, prior to the Manual Medicine Training.

Musculoskeletal Medicine Musculoskeletal medicine embodies all medical disciplines that deal with the diagnosis of acute and chronic conditions affecting the musculoskeletal system in adults and children, including the psychosocial impact of these conditions [23].

Musculoskeletal Medicine is a branch of medicine that deals with acute or chronic musculoskeletal injury, disease or dysfunction. Its aim is to address the somatic dysfunction, which is an impaired or altered function of the components of the somatic (body framework) system. The somatic system includes the skeletal, arthrodial and myofascial structures with their related vascular, lymphatic and neural elements [24].

neuromuscular techniques (NMT) A group of manual techniques that incorporate mobilization by using the contraction force of the agonists (NMT 1), mobilization after postisometric relaxation of the antagonists (NMT 2), or mobilization using reciprocal inhibition of the antagonists (NMT 3).

NMT See: neuromuscular techniques (NMT).

pain provocation test A test which stresses the body part(s) being tested with functional or physical force in order to elicit diagnostic pain.

prevention in MM medicine Patient involvement in the therapeutic activity, resulting from the detailed diagnosis, helps in the prevention of recurrence of somatic dysfunction.

range of motion Range of motion refers to the distance and direction a joint can move between the flexed position and the extended position.

reversible dysfunction A peripheral articular or segmental dysfunction is responsive to manual medicine techniques in the sense of improved or restored function. MM medicine deals primarily with the diagnosis and treatment of reversible dysfunction.

segmental celluloperiosteal myalgic syndrome Painful minor intervertebral Dysfunction causes reflex reactions within the same metamer leading to spinal somatic dysfunction ("syndrome cellulo-périosto-myalgique segmentaire").

self-mobilization Self-stretching techniques that specifically use joint traction or glides that direct the stretch force to the joint capsule or the muscles involved.

segmental dysfunction Segmental dysfunction is an alteration of the normal or physiological vertebral segmental function in the sense of hypo- or hypermobility. Such dysfunction may be reversible or not.

soft tissue treatment techniques Inhibition technique using digital compression for one minute of a tender point. - Deep transverse friction: strong friction of a structure thought to be malfunctioning (e.g. muscle, tendon). - Stretching in a direction perpendicular or parallel to the muscle fibres without tightening the skin.

somatic dysfunction Impaired or altered function of related components of the somatic system (skeletal, arthrodial, myofascial) and related neural, vascular and lymphatic elements. Somatic dysfunction is a reversible dysfunction.

stabilizing techniques Stabilizing techniques in terms of Manual Medicine consider sensory and motor components related to the locomotor system for optimal stabilization of the core, the spine, or a joint.

strengthening techniques Strengthening techniques involve exercises increasing muscle strength by putting more strain on a muscle than it is accustomed to receive. This increased load stimulates the growth of proteins inside each muscle cell that allow the muscle as a whole to contract.

tensegrity An architectural principle in which compression and tension are used to give a structure its form.

Part 1: BASIC TRAINING IN MM MEDICINE

1. Use of MM medicine

MM medicine is used for diagnostic procedures relating to all painful disorders of somatic function of the human body, especially the locomotor system and in assessment of its optimal function. It is also used for the therapy of all functional disorders, as well as for all painful structural diseases, where at least a part of the function can be restored and in optimizing function within its existing structure.

The MM physician starts his or her diagnostic approach with an extensive precise history followed by functional investigation predominantly executed by his or her hands. Only in cases where an important structural lesion is suspected additional diagnostic approaches like X-ray, CT- or MRI-scans or biochemical investigations are used.

The following therapeutic approach emphasizes the provision of manual treatment with intent to avoid unnecessary medication. But if this approach is not indicated or effective, all medical means, of non-surgical/non-invasive pain therapy, will also be provided. Especially in chronic pain MM techniques will be combined with other therapies in an interdisciplinary multimodal bio-psycho-social approach.

1.1. Administrative and academic considerations

The training of physicians in MM involves certain administrative and academic considerations, for example:

- who could be trained?
- what would be the physician's role and responsibilities?
- what education would be required?
- where would such education be provided, and by whom?
- would suitable programs have to be developed from scratch, or could existing substandard courses be strengthened or modified appropriately?
- are suitably qualified educators in MM medicine available, or would they have to be trained?
- what would be the mechanisms for official recognition of physicians, educators, institutions and programs?

1.2. Scope of practice

The scope of practice for the specially trained physician with the full skill set necessary would include full-spectrum diagnosis and differential diagnosis, treatment with MM techniques including prevention, education, therapeutic and rehabilitation advice. It is presumed that this physician –

specialist or subspecialist – will treat according the scientific principles and the published peer reviewed literature.

After establishing the diagnosis it is nevertheless possible to involve specially trained non-medical personnel (e.g. physiotherapists, occupational therapists etc.) in the application of manual techniques or the education of the patient.

1.3. Examination and Licensing / Registration

For those countries without an established curriculum for training in MM medicine different levels of training and skills are set out in sections 5 to 8 of this document. This provides training for MM medicine at a number of different levels.

All education and training in MM medicine should be completed by an exam, which includes, preferably, both a written and a practical test. This examination needs to be recognized by a licensing body or another authority of the national health care system.

1.4. Supervision, monitoring, accreditation and evaluation

Safe introduction of MM medicine requires training introduced at the undergraduate level with stepwise progression to the level of expertise required and with assessment at each step by examination as described above.

Most countries that regulate the medical profession use national, regional, state or provincial examinations. Alternatively, health authorities may delegate to the chambers of physicians the right to regulate themselves and to ensure the competence of individuals.

As has been the case in a number of countries or regions in the past, prior to the legislative recognition of MM medicine, a government may wish to evaluate both the positive and negative consequences of including it within the health care service.

2. Common competencies shared by MM physicians

All physicians offering MM medicine share common competencies:

- They are trained and experienced in functional testing and analysis of normal and pathological movements of joints and function of muscles.
- They are trained and experienced in manual palpation of all tissues (skin, fascia, muscle, bone and joint capsule).
- They are capable of utilising manual, reliable and reproducible pain provocation tests.
- They are trained and experienced on different levels to provide various manual techniques or other treatments of the locomotor system. These different levels of specialisation are described below.

3. Categories of education in MM medicine

3.1. Category 1, Undergraduate Level

Undergraduate (or pre-doctoral) training in MM medicine must include an understanding of musculoskeletal movements. Biomechanical knowledge is imperative to develop a diagnosis and a management plan in disturbances of the locomotor system. The suggested way of achieving this is by including time for this training in the basic clinical curriculum of every medical student.

This category does not provide any specific diploma or certificate. It involves basic training in biomechanics and functional anatomy.

The basic diagnostic skill set includes inspection, palpation and testing range of motion.

The basic treatment skill set includes knowledge in self-mobilization, strengthening and stabilizing techniques. Some undergraduate programs include training to Facility Level.

This topic should be included specifically in the appropriate undergraduate module (e.g. musculoskeletal, orthopaedic, rheumatology, neurology).

3.2. Category 2, Facility Level

This category is designed to achieve facility at primary care level in prevention, management and functional treatment or rehabilitation of dysfunctional conditions of the locomotor system, which constitute a large proportion of consultations. This is achieved by either intensive courses or a number of short courses sufficient to provide such competence.

This category corresponds in the Bologna concept to a CAS (Certificate of Advanced Studies), which allocates 10 to 15 ECTS (European Credit Transfer System [25] [26]).

The skill set includes clinical expertise relating to axial and appendicular structures, pelvis and the associated soft tissues. This consists of adequate knowledge of anatomy, biomechanics, and physiology of the locomotor system to provide a basic skill set of safe and effective manual techniques to accomplish clinical goals.

This category is usually taught at postgraduate level.

3.3. Category 3, Specialty Level

This category is intended for medical or surgical practitioners with a special interest in MM medicine to practice independently and includes the ability to make a specific diagnosis and design and implement a full management and treatment plan including complete functional rehabilitation.

This category corresponds to a specialty related competency for MM medicine used in the broad base of clinical conditions related to that physician's or surgeon's specialty practice. This corresponds within the Bologna concept to a DAS (Diploma of Advanced Studies), which allocates 30 ECTS.

The skill set includes profound clinical expertise relating to axial and appendicular structures and the associated soft tissues. This consists of clinical reasoning and thorough knowledge of the disorders and treatment techniques, incorporating a complete set of manual techniques related to the physician's or surgeon's specialty.

This category is taught at postgraduate level.

3.4. Category 4, Master or Doctorate Level

Category 4 specialists are fully trained and experienced in diagnosis and management including recognized methods of functional rehabilitation or treatment. This incorporates elements of research and teaching.

These levels correspond in the Bologna concept to a MAS (Master of Advanced Studies), which allocates 60 ECTS.

The skill set includes profound clinical expertise relating to axial and appendicular structures and the associated soft tissues, applying clinical reasoning and thorough knowledge of a wide range of treatment techniques capable of improving the function of the locomotor system and diminishing pain. This also incorporates an extensive knowledge of interpreting musculoskeletal function, a complete set of manual techniques and an understanding of their use in the broad base of musculoskeletal conditions beyond.

These qualifications require the involvement of a university department or hospital offering a suitable training program. The Master or Doctorate Level is based on the category 3 curriculum and add academic knowledge and a masters or doctoral thesis. They require an internship or residency with an appointed supervisor.

Those physicians or surgeons completing training at this level primarily specialise in MM medicine or its equivalent designation.

The curriculum of Category 4 is for example equivalent to the curriculum of the medical specialty of Musculoskeletal Medicine or Neuromusculoskeletal Medicine as far as the non-invasive elements are concerned.

4. Education and Training Category 1 – Undergraduate Level

4.1. Objective

Musculoskeletal conditions account for up to 20% of health costs in many communities. It has been established in a USA survey that graduates are undertrained in musculoskeletal conditions, diagnosis and treatment [27]. The aim of this level of training is to provide a fundamental understanding of the scope and opportunities offered by musculoskeletal concepts, examination and treatment.

4.2. Duration of training

Training should be incorporated in all years of the undergraduate schedule and integrated where possible with relevant specialties including clinical opportunities to experience the practical application of theoretical knowledge and techniques relevant to the locomotor system.

4.3. Core topics and Syllabus

See chapter 8, Core topics and Syllabus.

4.4. Practical supervised clinical experience

Where possible and appropriate exposure to clinical environments where MM medicine is practiced would be expected, with some form of devolved responsibility for the student, to allow basic skills to develop in clinical history taking and examination.

4.5. Examination

As part of the course work and final examination of all students reference questions relating to MM medicine should be included in the relevant papers.

4.6. Continuing professional development

The responsibility always remains with the qualified physician or surgeon to maintain a good working knowledge of all aspects of medicine relevant to their practice. MM medicine makes no exception.

5. Education and Training Category 2 – Facility Level

This refers to the training program for physicians and surgeons undergoing medical professional education in a relevant specialty (General Practice, Orthopaedics, Rheumatology, Neurology, Paediatrics, Rehabilitation Medicine, Accident and Emergency, General Medicine, General Surgery, ENT or Gynaecology for instance), who recognise the need and value for MM medicine skills within their scope of practice.

5.1. Objective

The aim at this level of education and experience is to engender a fundamental understanding of the scope and opportunities offered by concepts, examination and treatment techniques of MM medicine to create a competent practitioner able to provide service safely and effectively with the minimum of supervision.

5.2. Duration of training

After post registration training is completed, a minimal basic program of 100 hrs. of organised tuition, self learning and supervised practice, as well as 12 months of experience in relevant related medical specialties (Orthopaedics, Accident and Emergency, Rheumatology, Neurology, Paediatrics, General Practice, Pain management or Rehabilitation Medicine) will be required before certificate examination can be undertaken.

5.3. Core topics and Syllabus

See chapter 8, Core topics and Syllabus.

5.4. Practical supervised clinical experience

Exposure to clinical environments where MM medicine is practiced at specialty level would be expected, with significant opportunities for devolved responsibility for the trainee, to allow skills to be developed in clinical history taking, examination and treatment techniques. It is anticipated that this training would take no less than 12 months.

5.5. Examination

As part of the Certification course work and final examination of trainees all aspects of MM medicine need to be addressed. The examining body (University or Academy) must satisfy itself that the written papers are of sufficient standard. Direct assessment of clinical skills will require clinical examinations of test patients and oral assessment of examination, diagnostic and treatment planning skills.

5.6. Post-degree training

These Certificate examinations are regarded as post-degree training and require proof of continuing clinical and skills development using all the national criteria relevant at the time.

5.7. Continuing professional development

The responsibility always remains with the qualified physician or surgeon to maintain a good working knowledge of all aspects of medicine relevant to their practice. MM medicine makes no exception.

6. Education and Training Category 3 – Specialty Level

This refers to the training program for physicians or surgeons undergoing further professional education in MM medicine as a specialty related competency wishing to provide unsupervised medical services to patients.

6.1. Objective

The aim at this level is to provide education and experience to create a detailed knowledge and understanding of concepts, examination, treatment and management techniques of MM medicine, to develop a competent practitioner capable of providing extensive MM services safely and effectively in a specialty without supervision.

6.2. Duration of training

After post registration training is completed, a program of 300 hrs. of organised tuition, self-learning and supervised practice will be required before a Diploma exam can be undertaken. A fully completed training of a medical specialty including a Certificate is required (e.q. Orthopaedics, Accident and Emergency, Rheumatology, Neurology, Paediatrics, General Practice, Pain management or Rehabilitation Medicine) is required.

6.3. Core topics and Syllabus

See chapter 8, Core topics and Syllabus.

6.4. Practical supervised clinical experience

Exposure to clinical environments where MM medicine is practiced at specialty level would be expected, with significant opportunities for devolved responsibility for the trainee, to allow skills to be developed in clinical history taking, examination and treatment techniques. It is anticipated that this training would take no less than 24 months.

6.5. Examination

A portfolio of experience and signed off procedures together with a suitable written dissertation or research project will be submitted at the time of the final examination papers and clinical examinations.

As part of the Diploma course work and final examination of trainees all aspects of MM medicine need to be addressed. The examining body (University or Academy) must satisfy itself that the written papers are of sufficient standard. Direct assessment of clinical skills will require clinical examinations of test patients and oral assessment of examination, diagnostic and treatment planning skills.

6.6 Post-degree training

These Diploma examinations are regarded as post-degree training and require proof of continuing clinical and skills development using all the national criteria and/or core competences relevant at the time.

6.7. Continuing professional development

The responsibility always remains with the qualified physician to maintain a good working knowledge of all aspects of medicine relevant to his or her practice. MM medicine makes no exception.

7. Education and Training Category 4 – Master or Doctorate Level

This refers to the training program for persons who have undertaken further medical professional education in MM medicine to specialty related level and wish to develop further skills and expertise to undertake tertiary referrals to provide services usually associated with a MM medicine hospital department. This equates to specialty training at a masters or doctoral level of postgraduate training.

7.1. Objective

The aim at this level is to provide education and experience of a detailed knowledge and understanding concepts, examination and treatment techniques of MM medicine beyond those commonly associated with provision of basic services, to create a competent practitioner capable of providing special services, consultation, and undertaking research and teaching at the very highest level.

7.2. Duration of training

After basic specialty related (Specialty level) training is completed, a minimum of 24 months of experience in MM medicine will be required together with evidence of higher skill training in a range of techniques.

7.3. Core topics an Syllabus

The interests of the developing doctor will determine the core topics and Syllabus. See also chapter 8, Core topics and Syllabus.

7.4. Practical supervised clinical experience

During the prescribed 24 month program evidence will be collected to demonstrate exposure and ability to perform recognised techniques used in MM medicine. A peer reviewed research project will be undertaken in the same time frame.

7.5. Examination

A portfolio of experience and signed off procedures together with a suitable written dissertation or research project will form the basis of the masters or doctoral submission, defined by the awarding institution.

7.6 Post-degree training

These criteria are regarded as post-degree training and require proof of continuing clinical and skills development using all the national criteria and core competences relevant at the time.

7.7. Continuing professional development

The responsibility always remains with the qualified physician or surgeon to maintain a good working knowledge of all aspects of medicine relevant to their practice. MM medicine makes no exception.

8. Core topics and Syllabus[3]

8.1. Basic knowledge

8.1.1. Essential knowledge

	category			
- functional anatomy and biomechanics of the locomotor system	1	2	3	4
- physiology and pathophysiology of the locomotor system	1	2	3	4
- principles of MM medicine and major postulated mechanisms of action	1	2	3	4
- anatomy, physiology and pathophysiology of the nervous system in relation to pain and dysfunction		2	3	4
- specific postulated mechanisms of MM medicine diagnostic and therapeutic techniques		2	3	4
- clinical syndromes and differential diagnostics of the locomotor system			3	4
- relevant ancillary diagnostics (e.g. laboratory, imaging, electro-diagnostics) to MM medicine		2	3	4
- risks and benefits of other relevant therapeutic modalities compared to or in conjunction with manual medicine		2	3	4
- indications and contraindications for different therapeutic options		2	3	4

8.1.2. Essential skills

- informing the patent adequately about their condition in order to obtain informed consent	1	2	3	4
- effectively inform the patient about anticipated benefits and outcomes, potential risks and complications of MM treatments		2	3	4
- applying affective, cognitive, and psychomotor skills to conduct effective history taking and physical examination		2	3	4
- applying affective, cognitive, and psychomotor skills to conduct effective, accurate palpatory diagnosis		2	3	4
- applying knowledge and competence to deliver safe, effective MM medicine treatment in a general population		2	3	4
- applying knowledge and competence to deliver safe, effective MM medicine treatment in complex morbidity or special musculoskeletal complaints			3	4
- to critically self-evaluate personal knowledge, clinical skills and outcomes regarding diagnostic and MM medicine treatment				4
- use of medical informatics to incorporate the evidence base and best available evidence into MM medicine practice				4

[3] Partially developed from the following: FIMM Core Curriculum for Manual Medicine 2005, European core curriculum „Manual Medicine“ ESSOMM 2006, LOCES II final draft 2006, Osteopathic core competences for medical students 2012.

8.2. Anatomy objectives

8.2.1. General anatomy objectives

	category			
- to comprehend and to describe the normal functions of the muscles and joints of the axial and appendicular skeleton, and the function of the nervous system as it pertains to the functions of the locomotor system	1	2	3	4
- to understand the anatomical basis of techniques used to investigate and manage complaints of the locomotor system	1	2	3	4
- to evaluate critically the established and new theories on the pathogenesis, mechanisms and management of complaints regarding the locomotor system			3	4

8.2.2. Specific anatomy objectives

- to describe macrostructure, anatomical relations and surface anatomy of the elements of the locomotor system, including bones, joints, intra-articular inclusions, bursae, ligaments, muscles, tendons, entheses, fasciae, and nerves	1	2	3	4
- to understand the principles of tensegrity	1	2	3	4
- to describe the attachments and actions of muscles related to the main syndromes of the locomotor system		2	3	4
- to describe the course and relation of the peripheral arteries (especially the vertebral arteries) and the effects on these vessels of movements of the associated skeletal structures		2	3	4
- to state the peripheral and segmental nerve supply of muscles and joints related to the main musculoskeletal syndromes			3	4
- to describe and demonstrate the course and distribution of the peripheral and autonomic nerves in a detail appropriate to the interpretation of musculoskeletal complaints and the comprehension of investigations involving these nerves as they pertain to musculoskeletal complaints			3	4
- to describe the disposition and attachments of all the structures within the vertebral canal, and the effects on these structures of movements of the vertebral column, head and limbs			3	4
- to describe the basic neuroanatomy to explaining the motor and sensory mechanisms involved in movements and musculoskeletal complaints			3	4
- to recognize anatomical variants in neural and musculoskeletal structures			3	4
- to describe the anatomical basis of mechanotransduction			3	4

8.3. Physiology objectives

8.3.1. General physiology objectives

	category			
- to understand the physiological basis of the functions and disorders of the locomotor system	1	2	3	4

8.3.2. Specific physiology objectives

- to describe different types of muscular fibres	1	2	3	4
- to describe muscle adaptability	1	2	3	4
- to describe the effects of rest, exercise and ageing on skeletal muscle, in terms of histochemistry and molecular structure		2	3	4
- to describe the neurophysiology, activity and function of reflexes involving the locomotor system including somatovisceral, viscerosomatic, and somatosomatic relationships		2	3	4
- to describe the basic metabolic principles and physiology of bone, muscle, connective tissue and nerves pertaining to the locomotor system			3	4
- to describe the molecular and cellular processes implicated in mechanisms of muscle contraction			3	4
- to describe the molecular and cellular processes involved in the generation and propagation of action potentials in nerve, muscles, and excitatory and inhibitory synapses			3	4
- to describe the effects of rest, exercise and ageing on fascia, in terms of histochemistry and molecular structure			3	4
- to discuss the potential role of proposed physiological mechanisms of action such as interfacial water, nitric oxide and mechanotransduction				4
- to describe the motor and sensory neurophysiological mechanisms in sufficient detail to interpret and explain the symptoms and signs of disorders of the locomotor system				4

8.4. Biomechanics objectives

8.4.1. General biomechanics objective

- to understand certain precepts of biomechanics and apply them to the locomotor system	1	2	3	4
- to recognize and describe the aberrations of function of the locomotor system		2	3	4

8.4.2. Specific biomechanics objectives

	category			
- to define, in biomechanical terms, the following terms as they are applied to joints: hypomobility, hypermobility, and instability	1	2	3	4
- to describe biomechanical differences between capsular and somatic dysfunction and capsular patterns	1	2	3	4
- to demonstrate an ability to apply and interpret the following terms with respect to any of the tissues of the locomotor system: stress, strain, stiffness, toughness, viscoelasticity, creep, hysteresis, and fatigue failure		2	3	4
- to describe the movement of any joint in terms of translation and rotation about biomechanical axes		2	3	4
- to demonstrate an ability to apply precepts of biomechanics to clinical features, posture, the gait cycle, and activities of daily living, including occupational and recreational activities			3	4

8.5. Pain objectives

8.5.1. General pain objective

- to understand the physiology of pain and the pathophysiologic and biopsychosocial implications of pain	1	2	3	4
- to understand the somatic and visceral structures which contain receptors capable of creating pain		2	3	4

8.5.2. Specific pain objectives

- to describe, at an appropriate level, the taxonomy of pain	1	2	3	4
- to differentiate acute and chronic pain and their proposed mechanisms	1	2	3	4
- to describe the anatomy, physiology, pathophysiology, and currently understood mechanisms of pain	1	3	4	4
- to describe the understood patterns of referred pain to and from the locomotor system		2	3	4
- to describe the relationship between psychosocial factors and chronic pain			3	4
- to describe the role of the autonomic nervous system in relation to pain			3	4
- to describe the anatomy, physiology, pathophysiology, and all proposed mechanisms and models of pain				4

8.6. Diagnostic examination

8.6.1. Conventional medical examination

	category		
- to perform a conventional medical examination to understand the condition of the patient with respect to indications, contraindications and therapeutic options	2	3	4
- to perform thorough history and examination with emphasis on biomechanical, occupational, orthopaedic, neurological, biopsychosocial factors, to inspect posture, gait, and gross ranges of motion	2	3	4
- to perform orthopaedic, neurological, systemic and ancillary tests where indicated	2	3	4
- to prioritize diagnostic tests based on sensitivity, specificity and cost-effectiveness		3	4
- to describe practice guidelines or critical pathways in sequencing diagnostic evaluation for the patient		3	4

8.6.2. Examination using MM techniques

- to perform screening examination to identify if there is a problem in the locomotor system that deserves additional evaluation	2	3	4
- to perform a scanning examination to identify which regions and tissues within the region are dysfunctional and of relevance at a level appropriate to the treatment skills	2	3	4
- to conduct regional palpatory examinations of the tissues of the locomotor system to identify dysfunctions	2	3	4
- to conduct palpatory examinations of local tissues to determine the specific dysfunctions considered for MM treatment and the characteristics important in the selection of the treatment modality including indications and contraindications	2	3	4
- to conduct different palpatory examinations in order to look at and record elements of pain provocation, sensory changes, tissue texture changes, examination of range of motion, and characteristics of end-feel barrier	2	3	4
- to document reproducibility and inter-examiner reliability of MM medicine diagnostic tests			4

8.6.3. Recording diagnostic findings

	category			
- to record the patient evaluation and patient progress by using various methods of measurement	1	2	3	4
- to record relevant specific findings in terms of MM medicine	1	2	3	4
- to record pertinent related outcomes measures e.g. visual analogue scale (VAS), dolorimeter, impairment scales, general health scales			3	4
- to interpret and report epidemiologic data from patient populations with musculoskeletal disorders				4

8.7. Treatment modalities

8.7.1. General treatment

- to conduct mobilisation techniques including specific techniques for muscle inhibition or muscle relaxing (muscle energy techniques, techniques based on post isometric relaxation and on reciprocal inhibition, and positioning techniques)	1	2	3	4
- to conduct segmental manipulation techniques of the spine and the peripheral joints		2	3	4
- to supervise or monitor physiotherapy and training for rehabilitation		2	3	4
- to conduct myofascial techniques		2	3	4
- to conduct trigger-point-therapy		2	3	4
- to apply treatment strategies for interlinked functional (chain-reaction) syndromes			3	4
- to integrate the principles of treatment of MM medicine into multimodal treatment concepts			3	4
- to actively teach and promote integration of MM medicine treatment to improve anatomic and physiologic function in patent care				4

8.7.2. Disease prevention and health promotion

- to use all treatment modalities to prevent recurrence of presenting problems in MM medicine		2	3	4
- to maximise biomechanical and physiological functions in activities of daily living, in activities in work and in sports			3	4
- to recommend exercise and sound ergonomic behaviour for rehabilitation and prevention			3	4

8.8. Clinical pictures

8.8.1. Clinical pictures in MM medicine

	category			
- disorders or dysfunctions of axial and appendicular structures:		2	3	4
cranium cranio-cervical junction cervical spine cervico-thoracic junction thoracic spine thoraco-lumbar junction lumbar spine lumbo-sacral junction sacroiliac joints, pelvic girdle peripheral joints				
- visceral organ dysfunction related to biomechanical disorders			3	4
- viscera-somatic, somato-visceral, psycho-somatic and somato-somatic reflexes			3	4

8.8.2. Diseases, disorders and conditions

- to understand the differential diagnosis, relevance and interrelationship to MM medicine of the following:	1	2	3	4
general neurological semiology (signs and symptoms) neurological disorders headache due to metabolic pathologies orthopaedic disorders rheumatologic disorders spinal affections vascular abnormalities paediatric disorders trauma of the spine tumours of the spine				
- to understand special consideration with respect to age and development (esp. paediatrics and geriatrics)	1	2	3	4

Part 2: GUIDELINES ON SAFETY OF MM MEDICINE

1. Introduction

In general MM procedures are safe and effective. Safety is, or should be, the prime concern of all medical practice. *Primum non nocere* – First do no harm.

Harm includes both physical and psychological aspects. It is equally important to support and repair psychological damage as it is to help heal physical damage. This is done by affirming wellness and independence rather than encouraging the concept of disease and creating dependence.

In order to help the patient heal, it is necessary to make a diagnosis or create a working hypothesis (model understandable to the patient) that allows safe application of MM medicine treatment modalities, be they pharmacological, physical or interventional. This requires taking an appropriate history and undertaking adequate examination and investigation.

The focus of this document is in relation to MM medicine and will confine itself to this area.

2. Contraindications

2.1. Direct techniques

For the purposes of this document the term *manipulation* means applying a controlled impulse of sufficient amplitude to a structure in an endeavour to attain normal movement and restore normal function in that structure. This most commonly involves a movement of high velocity but low amplitude (HVLA).

For the purposes of this document the term *mobilization* means applying a controlled movement of sufficient magnitude and duration to attain movement in the joint.

All MM medicine treatment procedures have to follow an assessment of the risk-benefit ratio for the patient and their existing condition.

Contraindications to site-specific manipulation may include local malignancy, spinal or joint infection, severe rheumatoid arthritis, connective tissue disease, and fracture [28]. Anticoagulant therapy, psychotic conditions and severe pain on the other hand, are conditions for special precautions.

Special precautions have to be considered in situations, in which it is recognised that there is some increased risk of harm but where once fully informed, the patient together with the physician decides to proceed with the manipulation.

2.1.1. Contraindications

- lack of consent
- lack of adequate training of the operator
- vertebral fracture
- vertebral dislocation
- vertebral sepsis, including discitis, osteomyelitis, meningitis
- spinal malignancy – both primary and secondary
- carotid and vertebro-basilar insufficiency
- spinal cord compression or irritation (positive Kernig's and Lhermitte's sign)
- myelopathy
- cauda equina syndrome
- neurological diseases causing potential cord compromise e.g. syringomyelia

2.1.2. Precautions

- spondylolysis with spondylolisthesis
- severe instability and marked hypermobility
- aneurysm
- cervico-occipital junction malformation
- spinal stenosis
- osteoporosis
- inflammatory arthritis, rheumatic and connective tissue diseases
- other neurological diseases: spina bifida
- internal fixation/stabilization devices
- pain on positioning prior to manipulation, painful movement in direction of intended manipulation
- patient afraid and fearful of manipulation
- insufficiently skilled operator
- lack of appropriate environment (e.g. therapy bed, privacy, patient support, chaperone, language)

2.2. Indirect and reflex based techniques

Soft tissue, muscle energy, indirect, and myofascial release techniques have few contraindications. Precautions imply the need for extra consideration care, and provision of information to and the chance for discussion with the patient.

It must still be borne in mind, that any untoward event that occurs in relation to the application of a treatment is likely to be blamed on the treatment.

3. Complications and side effects

For the purpose of this document complication and side effect mean any adverse effect occurring during or immediately after application of manual diagnostic or treatment procedures either related to unknown or undetectable inherent conditions of a patient or due to the application itself.

These include dire, serious and those of less consequence.

They are extremely unlikely but do occasionally occur. The incidence is estimated to be less than one serious incident in every 6 million manipulations. Complications are often supposed to be associated with high velocity thrust techniques. Appropriate Training is mandatory before embarking on spinal manipulation particularly in the cervical spine.

Estimates of serious neurovascular accidents range from 1 in 50,000 to 1 in 5 million cervical spinal manipulations [29] [30]. One hundred eighty-five specific major complications following manipulation were identified in a literature review of articles published between 1925 and 1993 on the safety of manipulation. Approximately 66% involved cerebrovascular accidents, 12% disk herniation, 8 % pathologic fracture or dislocations, and 3% generalized increased in pain [31].

3.1. Dire

These include:

- **death** – This can result from brain stem injury as could occur when HVT (high velocity [low amplitude] thrust) treatment is applied to a patient with unrecognized high cervical fracture. It also has been reported as a result of vascular injury, particularly to the vertebro-basilar vascular system again by utilizing HVT treatment in patients with unrecognized vascular injury or disease.
- **spinal injury** – Depending on the level at which the cord is affected, this can range from:
  - quadriplegia in high cervical injury
  - incontinence and sexual impairment in lumbo-sacral injury
  - lower limb injury in lumbar injury.
- **cerebrovascular accident**
  - brainstem level injury – may cause death, lateral medullary syndrome.
  - cerebellum – incoordination.
  - brain substance – stroke.

3.2. Serious

These include:

- fracture
- dislocation
- dissemination of infection
- dissemination of neoplasm
- aggravation of pain
- aggravation of disability

3.3. Complications and side effects of less consequence

These include:

- local discomfort
- numbness
- tingling in upper limbs
- dizziness
- fainting
- light-headedness
- headache

4. Safety [d]

As with all interventions, there are risks associated with spinal manual therapy. Infrequent, but potentially serious side effects, include: vertebrobasilar accidents, strokes, death, spinal disc herniation, vertebral and rib fractures, and cauda equina syndrome [32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67].

4.1. Risks of cervical spine manipulation therapy

4.1.1. General considerations from the literature

The degree of serious risks associated with manipulation of the cervical spine is uncertain, with widely differing results being published [68].

A 1996 Danish chiropractic study confirmed the risk of stroke to be low, and determined that the greatest risk is with manipulation of the first two vertebra of the cervical spine, particularly passive rotation of the neck, known as the "master cervical" or "rotary break" [69].

Serious complications after manipulation of the cervical spine are estimated to be 1 in 4 million manipulations or fewer [70]. A RAND Corporation extensive review estimated "one in a million" [30]. Dvořák, in a survey of 203 practitioners of manual medicine in Switzerland, found a rate of one serious complication per 400,000 cervical manipulations, without any reported deaths, among an estimated 1.5 million cervical manipulations [71].

Jaskoviak reported approximately 5 million cervical manipulations from 1965 to 1980 at The National College of Chiropractic Clinic in Chicago, without a single case of vertebral artery stroke or serious injury [72]. Henderson and Cassidy performed a survey at the Canadian Memorial Chiropractic College outpatient clinic where more than a half-million treatments were given over a nine-year period, again without serious incident[73]. Eder offered a report of 168,000 cervical manipulations over a 28-year period, again without a single significant complication [74]. After an extensive literature review performed to formulate practice guidelines, the authors concurred, "the risk of serious neurological complications (from cervical manual technique) is extremely low, and is approximately one or two per million cervical manipulations" [75].

Understandably, vascular accidents are responsible for the major criticism of spinal manipulative therapy. However, it has been pointed out "critics of manipulative therapy emphasize the possibility of serious injury, especially at the brain stem, due to arterial trauma after cervical manipulation. It has required only the very rare reporting of these accidents to malign a therapeutic procedure that, in experienced hands, gives beneficial results

[d] For the purpose of this paper all reports from literature referring to any kind of manual techniques were revised, also reports concerning the chiropractic profession techniques. Although especially direct HVLA thrust techniques used by the chiropractic profession sometimes differ considerably from indirect HVLA techniques taught in most MM medicine schools, these chiropractic observations needed to be mentioned and discussed as well. Thus the report on complications comprises all the manual techniques used for the treatment of dysfunctional neck pain, including chiropractic HVLA thrust techniques.

with few adverse side effects" [76]. In very rare instances, the manipulative adjustment to the cervical spine of a vulnerable patient becomes the final intrusive act, which results in a very serious consequence [59 77 78 79].

According to an expert opinion HVLA-manipulation of the cervical spine is estimated to have no effectiveness and to be dangerous [80] while this has not been confirmed by others. As it has been revealed this expert opinion does not fulfil the criteria of evidence level III [81].

In a 2007 follow-up report in the Journal of the Royal Society of Medicine, Ernst concluded: "Spinal manipulation, particularly when performed on the upper spine, is frequently associated with mild to moderate adverse effects. It can also result in serious complications such as vertebral artery dissection followed by stroke. Currently, the incidence of such events is not known. In the interest of patient safety we should reconsider our policy towards the routine use of spinal manipulation" [82].

In 2007 the French Medical Society for Manual Medicine and Osteopathy SOFMMOO recommended in a scientific article based on a literature search that for the cervical spine, despite a lack of data in the literature, prudence and medico-legal issues justify the performance of systematic radiography prior to cervical spine manipulation therapy and generally in case of back or neck pain in patients of less than 25 years of age [83].

A paper by Michell et al. published in 2004 reported on an investigation on the effects of cervical spine rotation on vertebral artery blood flow [84]. The question was whether cervical spine rotation, as used in the standard vertebrobasilar insufficiency test, is associated with a measureable change in intracranial vertebral artery blood flow. Transcranial Doppler sono–graphy was used to measure intracranial vertebral artery blood flow in 30 young, healthy, female subjects, with the cervical spine in the neutral position and with sustained, end-of-range rotation. Statistically significant decreases in blood flow were demonstrated with contralateral rotation particularly, in the left and right vertebral arteries. Despite this change in blood flow, signs and symptoms of vertebrobasilar insufficiency were not demonstrated in these subjects. The author concluded that the use of the vertebrobasilar insufficiency test, in the absence of a more specific, sensitive and valid test should be recommended to assess the adequacy of hindbrain blood supply to identify those patients who may be at risk of serious complications post-manipulation.

On the other hand in 1997 a Canadian research group was unable to demonstrate that the extension-rotation test is a valid clinical screening procedure to detect decreased blood flow in the vertebral artery [85]. They concluded that the value of this test for screening patients at risk of stroke after cervical manipulation is questionable. They tested twelve subjects with dizziness reproduced by the extension-rotation test and 30 healthy control subjects using Doppler ultrasonography examination of their vertebral arteries with the neck extended and rotated.

Yet maximal rotation of the cervical spine may significantly affect vertebral artery blood flow, particularly when used in the treatment of patients with underlying vascular pathology. Mitchell [86] investigated in 2003 intracranial

vertebral artery blood flow in normal male subjects and female subjects, aged 20 to 30 years, in neutral and maximally rotated cervical spinal positions using transcranial Doppler sonography. The sample consisted of 60 male subjects and 60 female subjects (240 vertebral arteries). He found a significant decrease (P =.001) in intracranial vertebral artery blood flow following cervical spine rotation, irrespective of side but greater on the contralateral side, in the total sample and in male subjects. Female subjects had a significantly higher blood flow than male subjects.

In 1998 Licht et al. presented a randomized, controlled and observer-blinded study comparing flow velocity in the vertebral artery before and after spinal manipulative therapy using Doppler ultrasound technology [87]. Twenty Danish university students with a "biomechanical dysfunction" in the cervical spine were investigated. The research group found no significant changes in these subjects. They concluded that major changes in peak flow velocity might in theory explain the pathophysiology of cerebrovascular accidents after spinal manipulative therapy. However, in uncomplicated spinal manipulative therapy, this potential risk factor was not prevalent.

4.1.2. Vertebrobasilar accidents and cervical spine manipulation therapy

Haldeman and collaborators reported in 2002 in an extensive paper on vertebrobasilar accidents in relation to cervical spine manual therapy [31 88]. According to them stroke represents an infrequent adverse reaction associated with cervical spine manual therapy. Attempts to identify the patient at risk and the type of manual technique most likely to result in these complications of manual therapy have not been successful. A retrospective review of 64 medical legal cases of stroke temporally associated with cervical manual therapy of the spine was performed to evaluate characteristics of the treatment rendered and the presenting complaints in patients reporting these complications. These files included records from the practitioner who administered the manual therapy, post stroke testing and treatment records usually by a neurologist, and depositions of the patient and the practitioner of manual techniques as well as expert and treating physicians. A retrospective review of the files was carried out by three (2 in 11 cases) researchers, using the same data abstraction instrument, to independently assess each case. These independent reviews were followed by a consensus review, in which all reviewers reached agreement on file content. 92% of cases presented with a history of head and/or neck pain and 16 (25 %) cases presented with sudden onset of new and unusual headache and neck pain often associated with other neurological symptoms that may represent a dissection in progress. The strokes occurred at any point during the course of treatment. Certain patients reporting onset of symptoms immediately after first treatment while in others the dissection occurred after multiple manual treatments. There was no apparent dose-response relationship to these complications. These strokes were noted following any form of standard cervical manipulation technique including rotation, extension, lateral flexion and non-force and manual techniques in neutral position. The

results of this study suggest that stroke, particularly vertebrobasilar dissection, should be considered a random and unpredictable complication of any neck movement including cervical manipulation. They may occur at any point in the course of treatment with virtually any method of cervical manual technique. The sudden onset of acute and unusual neck and/or head pain may represent a dissection in progress and be the reason a patient seeks manual therapy that then serves as the final insult to the vessel leading to ischemia.

Finally the authors conclude that the literature does not assist in the identification of the offending mechanical trauma, neck movement, or type of manual therapy precipitating vertebrobasilar artery dissection or the identification of the patient at risk. Thus, given the current status of the literature, it is impossible to advise patients or physicians about how to avoid vertebrobasilar artery dissection when considering cervical manual therapy or about specific sports or exercises that result in neck movement or trauma.

In another paper Haldeman et al. stated – after analysing 64 cases of cerebrovascular ischemia after manual therapy – that cerebrovascular accidents after such therapy appear to be unpredictable and should be considered an inherent, idiosyncratic, and rare complication of this treatment approach. It seems not to be possible to identify factors from the clinical history and physical examination of the patient that would assist a physician attempting to isolate the patient at risk of cerebral ischemia after cervical manual therapy [79].

Again Haldeman and collaborators studied in 2003 clinical perceptions of the risk of vertebral artery dissection after manual therapy of the cervical spine [89]. The purpose of the study was to assess the effect of referral bias on the differences in perceived incidence of vertebral artery dissection after manual cervical therapy between neurologists and chiropractors in Canada. In a retrospective review, cases where neurological symptoms consistent with cerebrovascular ischemia were reported by chiropractors in Canada for the 10-year period 1988 to 1997, there were 23 cases of vertebral artery dissection after cervical manipulation reported. Based on the survey, an estimated 134,466,765 manual treatments of the cervical spine were performed during this 10-year period. This gave a calculated rate of vertebral artery dissection after manual treatment of the cervical spine of 1:5,846,381 manual cervical spine treatments. Based on the number of practicing chiropractors and neurologists during the period of this study, 1 of every 48 chiropractors and one of every two neurologists would have been made aware of a vascular complication from manual treatment of the cervical spine that was reported during their practice lifetime.

In 2004 the Cochrane Collaboration stated that mobilization and/or manipulation when used with exercise are beneficial for persistent mechanical neck disorders with or without headache. Done alone, manipulation and/or mobilization were not beneficial; when compared to one another, neither was superior [90].

The quite extensive 2005 guidelines of the Canadian Chiropractic profession stated on the basis of a broad analysis for the current evidence that none of the predisposing factors hypothesized in the literature definitively predict a dissection-related "cerebrovascular ischemic event" and, therefore, none is a contraindication to manipulation [91].

Also in 2005 Haneline and Lewkovich analysed the aetiology of cervical artery dissections in the years from 1994 to 2003 [92]. They conducted a literature search of the MEDLINE® database for English-language articles published using the search terms cervical artery dissection (CAD), vertebral artery dissection, and internal carotid artery dissection. Articles were selected for inclusion only if they incorporated a minimum of 5 case reports of CAD and contained sufficient information to ascertain a plausible aetiology. 1014 citations were identified; 20 met the selection criteria. There were 606 CAD cases reported in these studies; 321 (54%) were internal carotid artery dissection and 253 (46%) were vertebral artery dissection, not including cases with both. 371 (61%) were classified as spontaneous, 178 (30%) were associated with trauma/trivial trauma, and 53 (9%) were associated with cervical spinal manipulation. If one apparently biased study was dropped from the data pool, the percentage of CADs related to cervical spinal manipulation dropped to approximately 6%. The authors concluded that this etiologic breakdown of CAD did not differ significantly from what has been portrayed by most other authors.

In a paper presented in 2007 Smith and collaborators demonstrated that cervical spinal manipulation therapy is an independent risk factor for vertebral artery dissection [93]. The data were previously presented in 2003 [94]. They concluded that according their case-controlled study of the influence of cervical spine manipulation therapy and cervical arterial dissection shows that this therapy is independently associated with vertebral arterial dissection, even after controlling for neck pain. Patients undergoing cervical spine manipulation therapy should be consented for risk of stroke or vascular injury from the procedure. A significant increase in neck pain following cervical spine manipulation therapy warrants immediate medical evaluation.

Cassidy et al. investigated in 2008 a 10-years period with 818 stroke cases due to vertebrobasilar artery lesion, hospitalized in a population of more than 100 million person-years. 75% were treated by chiropractors, 25% by general practitioners. They concluded: stroke due to vertebrobasilar artery is a very rare event in the population. The increased risks of vertebro-basilar artery stroke associated with chiropractic and general practitioners visits is likely due to patients with headache and neck pain from vertebrobasilar artery dissection seeking care before their stroke. There is no evidence of excess risk of vertebrobasilar artery stroke associated with chiropractic care compared to primary care [37].

Dittrich and collaborators compared in 2009 47 consecutive patients with cervical artery dissection with 47 consecutive patients of similar age with ischemic stroke due to aetiologies other than cervical artery dissection [95]. They found no association between any single one of the above risk factors

and cervical artery dissection. Recent infections were more frequent in the cervical artery dissection group but failed to reach significance. However, the cumulative analysis of all mechanical trigger factors revealed a significant association of mechanical risk factors as a whole in cervical artery dissection. They concluded that mild mechanical stress, including manual treatment of the cervical spine, plays a role as possible trigger factor in the pathogenesis of cervical artery dissection. Cervical spine manipulation therapy and recent infections alone yet failed to reach significance during the present investigation.

Marx and collaborators evaluated in 2009 all cases with the diagnosis of cervical artery dissection submitted between 1996 and 2005 to the *Schlichtungsstelle für Arzthaftpflichtfragen der Norddeutschen Ärztekammer* for assessment of the accusations brought against the therapists who conducted the cervical spine manipulation therapy [54]. Neither in the 7 carotid nor in the 9 vertebral artery cases could a causal link be made between the dissection and the manipulation. However, in 5 of the 7 carotid and 7 of the 9 vertebral artery dissections there was clear evidence or high probability that the dissection was present prior to the manual therapy, and had caused neck pain, segmental dysfunction and, in some cases, even neurological symptoms. In no case were high velocity thrust techniques the unique cause of such a treatment. Stroke after manual therapy of the cervical spine was mostly due to embolization of thrombotic material from the dissected artery. As both cervical arterial dissection and cervical spine disorder usually cause similar signs and symptoms physicians must differentiate between these two entities prior to any manual treatment of the spine.

In 2010 the relationship between vertebrobasilar dissection stroke (VADS) and cervical manipulative therapy (CMT) was checked from all actual data available. According to actual data the relationship between vertebro-basilar artery dissection stroke and manipulation of the cervical spine is not causal, but patients with VADS often have initial symptoms which cause them to seek care from a chiropractic physician and have a stroke some time after, independent of the chiropractic visit. This new understanding has shifted the focus for the chiropractic physician from one of attempting to “screen” for “risk of complication to manipulation” to one of recognizing the patient who may be having VADS so that early diagnosis and intervention can be pursued [96].

Finally a prospective national survey in the U.K. to estimate the risk of serious and relatively minor adverse events following cervical spine manipulation therapy conducted by Haymo and collaborators [97] in 2007 dealt with data obtained from 28,807 treatment consultations and 50,276 cervical spine manipulations. There were no reports of serious adverse events. This translates to an estimated risk of a serious adverse event of, at worse, approximately 1 per 10,000 treatment consultations immediately after cervical spine manipulation therapy, approximately 2 per 10,000 treatment consultations up to 7 days after treatment and approximately 6 per 100,000 cervical spine manipulations. Minor side effects with a possible neurologic involvement were more common. The highest risk

immediately after treatment was fainting/dizziness/light-headedness in, at worse approximately 16 per 1000 treatment consultations. Up to 7 days after treatment, these risks were headache, in at worse approximately 4 per 100, numbness/tingling in upper limbs, in at worse approximately 15 per 1000 and fainting/dizziness/light-headedness, in at worse approximately 13 per 1000 treatment consultations. The study group concluded consistent with an Italian group [98] that although minor side effects following cervical spine manipulation treatment were relatively common, the risk of a serious adverse event, immediately or up to 7 days after treatment, was low to very low.

By conclusion and in agreement with *Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders* the best available evidence suggests initial assessment for neck pain should focus on triage and those with common neck pain might be offered primarily non-invasive treatments if short-term relief is desired before the evaluation of cervical spine manipulation therapy [99].

The effectiveness of thrust-manipulation for neck pain has been examined in many high quality systematic reviews as well as in evidence based clinical guidelines and health technology assessment reports. When combined with recent randomized trial results, this evidence supports including manipulation as a treatment option for neck pain, along with other interventions such as advice to stay active and exercises. However, when risk, benefit, and patient preference are considered, there is currently no preferred first line therapy, and no evidence that mobilization is safer or more effective than manipulation [100].

4.2. Risks of lumbar spine manipulation therapy

In a 1993 study J.D. Cassidy and co-workers concluded that the treatment of lumbar intervertebral disk herniation by side posture manipulation is "both safe and effective" [101].

Oliphant in 2004 graded prospective and retrospective studies and review papers according to quality, and results and conclusions were tabulated[102]. From the data published, an estimate of the risk of lumbar spine manipulation therapy causing a clinically worsened disk herniation or cauda equina syndrome in patients presenting with lumbar disk herniation was calculated. This was compared with estimates of the safety of nonsteroidal anti-inflammatory drugs and surgery in the treatment of lumbar disk herniation. As a result an estimate of the risk of lumbar spine manipulation therapy causing a clinically worsened disk herniation or cauda equina syndrome in a patient presenting with lumbar disk herniation is calculated from published data to be less than 1 in 3.7 million. The author concluded the apparent safety of spinal manipulation, especially when compared with other medically accepted treatments for lumbar disk herniation, should stimulate its use in the conservative treatment plan of lumbar disk herniation.

In 2005 Oppenheim and collaborators reviewed medical records and radiographic studies of appropriate subjects to better clarify the spectrum of nonvascular complications following lumbar spine manipulation therapy, and to help define the risks of lumbar spine manipulation therapy. Eighteen patients were identified who had received lumbar spine manipulation therapy and whose neurological condition immediately worsened. Injuries were sustained to the cervical, thoracic, and lumbar spine and resulted, variously, in myelopathy, paraparesis, cauda equina syndrome, and radiculopathy. 89% required surgery. Outcome was excellent in 50% and good in 37.5%. Three patients died from unrecognized malignancies. The authors concluded that spinal manipulation can be associated with significant complications, often requiring surgical intervention. Pre-treatment scanning may help identify patients with significant risk factors, such as substantial disc herniation or occult malignancies. Prompt evaluation and intervention is necessary when symptoms worsen or neurological deficits develop [103].

Dvořák and collaborators in 1999 published a survey among the Swiss Medical Association for Manual Medicine. Based upon this survey among the members of the Swiss Medical Association for Manual Medicine, the low back pain problems are approached by the means of manual therapy on average 805 times per year and physician. On average each case with low back pain is treated 1.4 times by a general practitioner with experience in manual medicine, while specialists who are dealing with more complex cases on average 4 to 5 times. Based upon the survey side effects and complications, due to lumbar spine manipulation therapy, are extremely rare [104].

In 1993 Dvořák's research group published from the same survey under-taken 1989. Informative data were given by 425 respondents on the frequency of complications of spine manipulation therapy. The number of thoraco-lumbar manipulations during 1989 was 805 for each respondent, and the number manipulations of the cervical spine 354. Thus, the total number of thoraco-lumbar manipulations was 342,125, and the total number of cervical manipulations was 150,450. The overall incidence of side effects of transient complications due to cervical spine manipulation such as disturbance of consciousness or radicular signs was 1:16,716. Seventeen patients (ratio 1:20,125) showed after lumbar spine manipulation therapy, in addition to increased pain, a transient sensorimotor deficit with precise radicular distribution. Nine of the 17 patients (ratio 1:38,013) developed a progressive radicular syndrome with sensorimotor deficit and radiologicaly verified disc herniation and had to be referred for surgery. Side effects and complications of cervical and lumbar spine manipulation are rare. Taking in to account the yearly number of manipulations performed by a single physician in Switzerland and the rate of complications, it can be calculated that a physician practicing manual medicine will encounter one complication due to manipulation of the cervical spine in 47 years and one complication due to lumbar spine manipulation in 38 years of practice [105].

By conclusion the evidence of today suggests that consistent with a randomized placebo-controlled double-blinded trial [106], after an initial assessment excluding patients with contraindications, lumbar spine manipulation therapy is safe compared to other non-invasive treatment modalities.

4.3. Risks of thoracic spine and rib manipulation therapy

There is very little literature available on specific risks of thoracic spine or rib manipulation therapy. Out of the last 20 years there are only four case-reports on epidural thoracic hematoma (partially combined with leakage of cerebrospinal fluid) [63] [107] [108] [109] and one case-report of esophageal rupture [110] following not classified, but presumably direct chiropractic manipulations. In addition there is one case-report on rib fractures in an infant following chiropractic manipulations for the treatment of a colic [111]. The overall data from the literature available in terms of lumbar spine manipulation therapy suggests the assumption that, after an initial assessment excluding patients with contraindications, medical thoracic spine or rib manipulation therapy is safe compared to other non-invasive treatment modalities.

4.4. Risks of manipulation therapy of the pelvic ring (sacroiliac joints)

There is no literature available on specific risks of manipulation therapy of the pelvic ring or the sacroiliac joints. The data from the literature available in terms of lumbar spine manipulation therapy suggests the assumption that, after an initial assessment excluding patients with contraindications, manipulation therapy of the pelvic ring or the sacroiliac joints is safe compared to other non-invasive treatment modalities.

ANNEXES

1. Examples of Curricula for post-graduate education and training

1.1. Curriculum of the Swiss Medical Society for Manual Medicine

The Swiss Chamber of Physicians and the Swiss Institute of Medical Postgraduate and Continued Medical Education SIWF approved the Curriculum of the Swiss Medical Society for Manuel Medicine SAMM in 2012.

Manual Medicine CAS – DAS – MAS
Description of the modules

1. Short summary and conception
The Certificate of Advanced studies (CAS) "Basics in Manual Medicine" and the Diploma of Advanced Studies (DAS) "Manual Medicine" are part time educational programmes, which conclude with a title of a Certificate respectively a Diploma of Advanced Studies. The CAS "Basics in Manual Medicine" is part of the DAS "Manual Medicine". The CAS is an introduction in Manual Medicine (diagnostics and introduction in therapeutic procedures). The DAS "Manual Medicine" contains the complete curriculum of the Proficiency of Manual Medicine SAMM according to the Education Programme of the Swiss Federation of Physicians FMH. The Master of Advanced Studies (MAS) represents expertise level and addresses the specialists of Musculoskeletal Medicine and will be acquired for future teachers in Manual Medicine.

1.1. Description of the field
Manual Medicine is a medical discipline performed by physicians of different medical specialties, which covers diagnostic, prevention, therapeutic and rehabilitation procedures applying manual techniques focussed on functional disorders of the locomotor system including myofascial and neuro-meningeal structures[e]. Manual Medicine is performed holistically and respecting the individual needs of patients be it in a hospital or outpatient setting. Diagnostic or therapeutic procedures are based on biomechanical or neurophysiological principles.

Manual Medicine is applied as a multimodular therapeutic concept and includes an interdisciplinary diagnostic approach in order to identify and treat dysfunctions of the locomotor system and associated complaints. Complex dysfunctional disorders of the locomotor system, vertebra-visceral, viscera-vertebral and psychosocial impacts including chronicity processes are taken care of appropriately.

1.2. Short description of the structure of education and training

A) Certificate of Advanced Studies (CAS) "Basics in Manual Medicine"
The curriculum of this Certificate offers advanced knowledge in anatomy, biomechanics and pathophysiology of the locomotor system. This is the base for learning targeted manual diagnostic procedures of the locomotor system. Graduates of the CAS will reach competences to investigate the spine, the peripheral joints, the most important muscles and to perform pain analyses in order to develop a targeted therapeutic action plan. The principles of the manual therapeutic procedures and some of the most frequent and elementary therapeutic techniques of mobilisation and manipulations are instructed. This title is the precondition for billing manual medicine diagnostic techniques (in combination with a medical specialty).

[e] Chiropractic (Chiropractic according to the Swiss Medical legislation) and [parietal] Osteopathy (Osteopathy according to the *Conférence suisse des directrices et directeurs cantonaux de la santé*) are non-medical professions, which are similarly defined in terms of contain with different names doe to historical circumstances. Exclusively physicians perform Manual Medicine. Therefore in Switzerland Manual Medicine differs from non-medical professions such as Swiss Chiropractors or Swiss Osteopaths, although their representatives present themselves frequently equivalently.

B) Diploma of Advanced Studies (DAS) "Manual Medicine"
The Certificate of Advanced Studies CAS is together with further modules of education and training part of the DAS "Manual Medicine". Graduates learn a complete set of diagnostic and therapeutic procedures of the locomotor system including techniques of mobilization, neuro-muscular inhibition and soft tissue-techniques as well as specific HVLA techniques. Diagnostic and therapeutic procedures of the different regional pain syndromes of the body resp. the locomotor system including the muscles will be presented. This postgraduate education and training module will be concluded by a theoretical and practical exam. This exam will be certified by a title delivered by the Swiss Chamber of Physicians called "Manual Medicine SAMM". This title is the precondition for billing manual medicine diagnostics and treatment techniques (in combination with a medical specialty). In respects to time and contents the DAS diploma corresponds to the Core Curriculum "Manual Medicine" of the European Scientific Society of Manual Medicine (ESSOMM) as it is presented and accepted by the European Medical Specialists Union (UEMS).

C) Master of Advanced Studies (MAS) "Professional Manual Medicine"
The Diploma of Advanced Studies (DAS) is together with further modules of education and training part of the MAS "Professional in Manual Medicine". This includes many advanced techniques in diagnostic and therapeutic procedures. At the end of this professional training course the graduate holds a lot of expertise in all aspects of his profession based on experience in publishing scientific papers, clinical reasoning, clinical auditing in national and international organizations of education and training as well as supervised treatment of outpatients and supervised teaching in courses of Manual Medicine.

Who shall achieve this education and training; and what are the aims?
The basic training course "Basics in Manual Medicine" CAS is proposed to all physicians dealing with dysfunction or pain conditions of the locomotor system during or after their specialty training. Graduates of the training course "Basics of Manual Medicine" (CAS) will be able to perform an elaborated examination of the whole locomotor system with respect to clinical function; he or she is able to analyse pain syndromes of the locomotor system and is able to detect indications for manual therapeutic procedures. He or she is able to perform mobilizing techniques of all regions of the spine except high velocity low amplitude thrust techniques.

The *complete education and training to become a sub-specialist according to the DAS "Manual Medicine"* is designed for physicians who want to treat often and with high expertise and competency patients with problems of the total locomotor system including dysfunction and pain of the cervical spine and the head. This education course is aimed at general practitioners with special interest in this field as well as at specialists for rheumatology and rehabilitation and other specialists of the locomotor system. Graduates of this diploma know all regional or peripheral pain syndromes of the locomotor system and are able to apply Manual Medicine in any respect of diagnostics and therapy, including HVLA-manipulation.

A physician having achieved the level of a DAS "Manual Medicine" is particularly able to apply:

- All commonly used diagnostic procedures of the locomotor system,
- Anatomy, biomechanics, pathophysiology and concepts of development of pain of the locomotor system,
- Clinical pain analysis and planning competently further diagnostic procedures,
- Planning the therapy of neuromuscular dysfunctions and pathologies also in cooperation with physiotherapists,
- A broad scheme of treatment techniques and options for soft tissues, joints, muscles and nerves of the vertebral spine and the extremities,
- Therapeutic techniques with HVLA-thrust as well as recognizing risks, contraindication and so called "red flags".

The future level of a MAS "Manual Medicine"
The future *master degree of postgraduate education MAS "Professional Manual Medicine"* represents profound specialist knowledge on the level of an expert. The MAS will become the precondition to be accepted as a teacher. This degree is designed predominantly for especially interested experts who are specialists for rheumatology as well as for general practitioners who want to become teachers in Manual Medicine.

Aims and contents provided to achieve the MAS "Professional Manual Medicine":

- Profound knowledge in all aspects of Manual Medicine and skills in all techniques of manual therapy

- Concise knowledge of similar specialties such as chiropractic, concepts of medical osteopathy and schools of Manual Medicine and seminars of other European countries
- Use of techniques and methods of treatment individually adapted to the patient in the scheme of clinical thinking and according to an evidence based approach; knowledge of present references concerning the field of Manual Medicine
- Knowledge of the present evidence in Manual Medicine and of guidelines describing the diagnostic and treatment procedures of dysfunctions of the locomotor system
- Profound knowledge of the scientific neuro-anatomical and neuro-physiological basics of manual diagnostics and therapy
- Profound knowledge in training therapy, planning of out-patient rehabilitation for musculoskeletal diseases and pain chronicity processes
- Knowledge of and ability to explain neuro-musculoskeletal diseases in the field of dysfunctions of the locomotor system
- Didactic skills for presentations and practical training in courses in manual medicine (teaching)
- Research in Manual Medicine

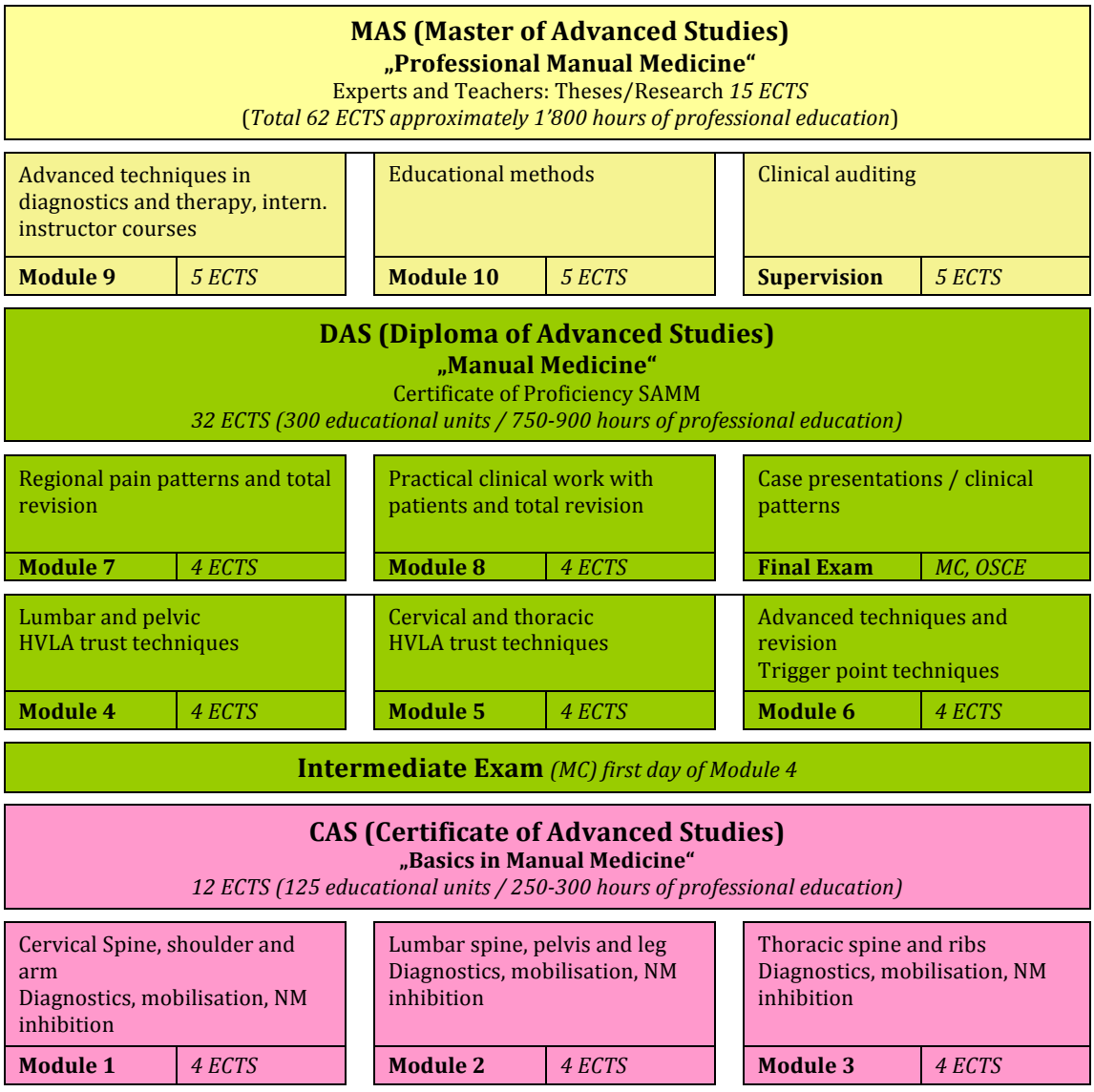

Fig. A: Curriculum of the Swiss Medical Society for Manuel Medicine SAMM in 2012

1.2. Guidelines of the German Federal Chamber of Physicians

Guidelines for the core curriculum for Manual Medicine / *Chirotherapy*

Methodical recommendations and contents for teaching and training in postgraduate professional training classes for the additional postgraduate qualification „Manual Medicine / Chirotherapy"

According to the guidelines of the continuing medical education regulations (*Muster-Weiterbildungsordnung* [WBO]) of the German Federal Chamber of Physicians (*Bundesärztekammer*)

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1. Introduction

The additional postgraduate title *Chirotherapy* was complemented with the title *Manual Medicine* during the Deutscher Ärztetag (Annual General Assembly of German Physicians) in 2003. The designations ‚Manual Medicine' or ‚Chirotherapy' can be used optionally or interchangeably. This course book will use the term ‚Manual Medicine' throughout.

Manual Medicine is the medical discipline of enhanced knowledge and skills , that by the use of theoretic basis, knowledge and conventional medical techniques of further medical specialities, carries out on one hand the manual diagnostic examination of the locomotor system, the head, the visceral and the connective tissue structures, and adds on the other hand manual techniques to the treatment of functional reversible disorders aiming to prevention, cure and rehabilitation of the latter. Diagnostic and therapeutic procedures are based on scientific biomechanical and neurophysiological principles.

Within the framework of a multimodal therapeutic concept, Manual Medicine encompasses the interdisciplinary application of its diagnostic and therapeutic techniques for the diagnosis and treatment of reversible dysfunctions of the locomotor system and the resulting ailments. In addition chain reactions – vertebrovisceral, viscerovertebral and viscerocutaneous – within the locomotor system and psychosomatic influences are also adequately considered.

The practice of Manual Medicine requires theoretical knowledge, competencies and enhanced skills, which are taught in structured courses by specially qualified teachers. Confirmations of the recognition/acceptance of the course as well as its teacher are to be obtained from the responsible chamber of physicians prior to taking the course. The structure of the course as laid out in this course manual is binding. Within the framework of the restructuring of the postgraduate medical training regulation law (Muster-Weiterbildungsordnung (WBO)), the Annual General Assembly of German Physicians (Deutscher Ärztetag) in 2003 has also extended the requirements for the additional title ‚Manual Medicine'. Precondition for the acquirement of the additional title is the recognition of a medical specialty ("Facharztanerkennung"). The primary goal of the additional title is the acquisition of specialist's competence and skills in Manual Medicine by way of the completion of the time and contents as well as the courses prescribed for the professional training module.

Postgraduate professional training in this field is affected through a course system. The legal regulations for this higher medical training (WBO) are requesting a total volume of 320 hours. The professional training module is therefore divided into a:

1. Basic course (120 hours) in which the basic knowledge and the basic skills of Manual Medicine are taught

2. Advanced course (200 hours) which teaches the advanced competencies and skills of MM.

The courses are carried out in a structured and predefined order that creates a modular setup of the course contents leading from the simplest to the most complicated subject matter.

The professional training course "Manual Medicine" is designed to provide doctors in private practice and in hospitals who are concerned with the diagnosis and treatment of reversible dysfunctions of the locomotor system and with pain therapy with the best tools and to expand their diagnostic and therapeutic skills with the possibilities offered by the discipline of MM.

2. Implementation of the course

The professional training facilities for this course have to provide appropriate rooms for the theoretical class as well as exercise rooms with height- adjustable treatment tables. A maximum of three students should be planned for per treatment table.

The instruction consists of:

- theoretical lectures
- practical demonstrations
- and exercise sessions

Following the theoretical introductions and the clarification of indication and contraindication, which set off each section, special emphasis is placed on the practical instructions of the previously taught manual examination and treatment techniques. Before the students begin to practice these techniques, they are being demonstrated by the course manager or the teacher who will then also supervise them during the exercises.

No more than fifteen course participants per teacher should be placed in a course, and, as a matter of principle, each course should be evaluated by its participants. The course manager and the teacher must have advanced experience in manual medicine practices. They are obliged to regularly participate in especially designated continuing education courses for teachers. The

"recommendations for the continuing medical education of physicians" by the Chamber of Physicians are to be observed.

3. Main emphasis of the course's contents

The following content is being emphasised in the course:

- Functional analysis of the locomotor system
- Neurophysiology of pain
- Pain as consequence and as cause of dysfunction
- Functional chain-linking within and between the organs of the locomotor system (spine, extremity joints, muscles, ligaments, fascia) as well as with dysfunctions of the inner organs
- Psychosocial influences
- Manual and functional diagnostics of the locomotor system with special consideration of pain reactive signs
- Evaluation of the results of diagnostic imaging
- Evaluation of findings of neurophysiological examination
- Manual techniques for the treatment of the organs of the locomotor system and other tissues involved in the pathology:
  - Mobilisations
  - HVLA-Manipulations
  - Neuromuscular techniques
  - Techniques for the soft tissue
  - Positioning techniques
  - Relaxation techniques
  - Instruction for independent patient self exercises (Eigenübungen)
  - Integration of manual medicine techniques in a multimodal therapy concept
  - Documentation and quality assurance

4. Diagnostic and therapeutic principles

In designing the course, the following diagnostic and therapeutic principles are to be considered:

Diagnostic principles

- Anamnesis
- Examination of normal functions and their disorders
- Painless examination of the functionality of the joints
- Holistic approach in the framework of medical diagnostic methods
- The course of the examination is guided by starting from general orientation leading to locally concentrated, specialised manual examination
- Dysfunctions are to be identified in consideration of structure and complaints

Therapeutic principles

- Therapeutic strategy: reduction of irritation or placement of stimulus
- Treatment of dysfunctions within the concept of parietal and visceral components
- Mobilisation, HVLA-manipulation, neuromuscular and myofascial techniques as well as soft tissue techniques in accordance to the type and degree of the dysfunction and the complaints
- Primary treatment of the superior dysfunction (diagnostics of pathogenic predominance)
- Application of a concept of multimodal intervention

5. Structure of the course

Both the basic and the advanced course are administered in blocks. The blocks' contents and order are to be determined by the institution offering the training. The length of the individual blocks may be between 30 and 60 hours. For didactic reasons, no more than eight teaching units (of 45 minutes each) should be conducted per day (see the "Recommendations for the continuing medical education of physicians" by the chamber of physicians).

The emphasis is on the teaching of practical competencies, skills and knowledge. The theoretical course units can be integrated into the practical instruction. The individual blocks should be scheduled at least three months apart from each other so that the time between the blocks can be used to exercise and solidify the learned competencies and skills.

120 hours of the basic course are organised in:
- 40 hours theory
- 80 hours practical experience

200 hours of the advanced course are organised in:
- 40 hours theory
- 160 hours practical experience

This professional training course is completed with a final examination at the regional medical association (i.e. in Germany: Regional Chamber of Physicians).

6. Contents of the course
(The term ‚hour' is designating a course unit of 45 minutes.)

Basic course: (120 hours)
Acquisition of basic knowledge and basic skills (40 hours)

Theoretical principles of: ➢ Functionality, neural control and functional pathology of the locomotor system ➢ Vertebrovisceral interactions ➢ Nociception, pain formation and nocireaction ➢ Biomechanical principles of the locomotor system as well as of dysfunction of the locomotor system ➢ Principles of agency of the different manual medicine techniques, also in regard to vertebrovisceral and viscerovertebral interactions and chain reactions	10 hours
Functional anatomy of the peripheral joints, the spine and the joints of the head	10 hours
Structure of fascia, physiological and neurophysiological features of the connective tissue	1 hour
Fundamental knowledge of imaging diagnostics under special consideration of MM and radiographic anatomy	10 hours
Pain of the locomotor system	2 hours
Psyche and locomotor system	1 hour
Phenomenology of muscle tension and its significance in Manual Medicine	1 hour
Specific Manual Medicine anamnesis	1 hour
Clinical signs that can be influenced by Manual Medicine	1 hour
Indication and contraindication for Manual Medicine treatment	1 hour
Guidelines for documentation and patient's information	2 hours

Practical experience (80 hours)

Examination in Manual Medicine of: ➢ the peripheral joints ➢ scanning examination of the spine ➢ the articular connections of the head ➢ the muscles of the extremities, the torso, the spine and the head	40 hours
Evaluation of the results of examination	10 hours

Basic techniques of Manual Medicine for the treatment of dysfunctions of the joints and of soft tissue of: ➢ the spine ➢ the head ➢ the extremities	30 hours

Advanced course (200 hours)

Acquisition of specific competencies and skills

Theory (40 hours):

Differential diagnosis of: ➢ dysfunctions und structural diseases (locomotor system / internal disease) ➢ radicular und pseudo- radicular pain syndromes ➢ lumbar and pelvic-leg pain ➢ cervicocranial and cervicobrachial pain ➢ dysfunctions of the balance and vertigo	14 hours (2) (4) (2) (4) (2)
Control of the locomotor system: movement patterns, their composition and plasticity	6 hours
Chain reactions of dysfunctions in the locomotor system	10 hours
Importance of MM for infants and babies	10 hours

Practical experience (160 hours):

Segmental specific manipulation techniques of the spine and the joints of the extremities	40 hours
Expansion of mobilisation techniques in consideration of specific techniques for muscle blocking or muscle relaxing (muscle energy techniques, techniques based on post isometric relaxation, positioning techniques)	30 hours

Evaluation of examinations with imaging techniques, especially functional radiology	10 hours
Treatment strategies for chain reaction syndromes	10 hours
Differential diagnosis of dysfunctions of motor functions on their varying regulation and control levels	12 hours
Indications for physiotherapy and training for rehabilitation	5 hours
Fundamentals of myofascial und visceral techniques	30 hours
Fundamentals of the manual examination and treatment of children	8 hours
Integration of the manual medical treatment in a multimodal treatment concept	15 hours

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1.3. Syllabus of the Musculoskeletal Medicine by the Australasian Faculty of Musculoskeletal Medicine

A SYLLABUS OF MUSCULOSKELETAL MEDICINE
published by the Australasian Faculty of Musculoskeletal Medicine
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PREFACE

Musculoskeletal medicine is a branch of medical science concerned with the functions and disorders of the musculoskeletal system, including the muscles, aponeuroses, joints and bones of the axial and appendicular skeletons and those parts of the nervous system associated with them.

Various parts of this global field are addressed by basic scientists, orthopaedic surgeons, rheumatologists, and musculoskeletal physicians.

Basic scientists provide the essential elements of anatomy, biomechanics, physiology, pathology and pharmacology on which the clinical disciplines depend.

Orthopaedic surgeons provide diagnostic and therapeutic resources for patients with conditions that require surgical management.

Rheumatologists provide resources for the management of patients with diseases that affect the joints, such as inflammatory arthropathies and systemic conditions with joint involvement.

Musculoskeletal physicians combine a core knowledge of musculoskeletal science with a practical ability to integrate this knowledge with particular clinical skills, to orchestrate a comprehensive approach to the diagnosis and treatment of patients with disorders of the musculoskeletal system.

The objectives of this syllabus are designed to outline the body of knowledge necessary for musculoskeletal physicians and other medical practitioners wishing to achieve expertise in the management of musculoskeletal disorders. To this end, behaviours required may be considered in three domains, termed cognitive, affective, and psychomotor.

The cognitive domain includes firstly the large and important category of knowledge, which ranks highly in any field of medicine. Secondly, the cognitive domain includes the intellectual skills and abilities that can be described as comprehension, application, analysis, synthesis, and evaluation.

The affective domain is concerned with behaviour, including attitudes, interests, values, emotional sets and biases and the individual's philosophies of life. The practitioner should have appropriate attitudes towards patients and should relate effectively to other health professionals, so that a cohesive co-operative working relationship can exist within the health care team. The practitioner should also exhibit a sense of responsibility both to the medical profession and to the community at large. He or she should demonstrate interest in professional, educational and research organisations, which aim to improve the health of the community (such as the Faculty and the Associations).

The psychomotor domain deals with perceptual abilities and motor skills requiring neuromuscular co-ordination. Such skills are essential for the processes of patient assessment and management. The degree of their development is proportional to the practitioner's level of clinical competence.

The objectives of the syllabus have been set out as clauses introduced by transitive verbs such as "understand", "describes", "demonstrates", "evaluates", justifies" etc. These verbs signify the requirements of each objective. For example, if a clause begins "to understand", a practitioner working through the syllabus should endeavour to understand the matters forming the object of that verb; when he or she can, that objective will have been satisfied. If the introductory verb is "describes" or "demonstrates", he or she should be able to perform those functions to the satisfaction of an informed listener or observer.

The order in which the objectives are arranged provides a logical approach to the materia medica of the discipline. The section on critical reasoning and biostatistics is deliberately placed first. The precepts it outlines are essential to the rational interpretation of all that follows. The other basic science sections provide guides to current knowledge in the relevant fields of human biology. The sections on diagnosis and management outline the principles of a comprehensive approach to patient care and the modalities employed in contemporary practice.

CONTENTS

(see original document)

A. BASIC SCIENCES

A.1 CRITICAL REASONING AND BIOSTATISTICS

General Objective

Demonstrates an ability to undertake critical evaluation of published literature and practical procedures with respect to their reliability, validity, utility, and effectiveness.

Specific Objectives

A.1.1 Demonstrates competence in the application and interpretation, with particular reference to musculoskeletal health care, of the following elements of biostatistics:
A.1.1.1 Descriptive Statistics:
A.1.1.1.1 mean
A.1.1.1.2 standard deviation
A.1.1.1.3 standard error of the mean
A.1.1.1.4 median
A.1.1.1.5 interquartile range
A.1.1.1.6 confidence interval of a mean
A.1.1.1.7 confidence interval of a proportion
A.1.1.1.8 coefficient of variation.
A.1.1.2 Inferential Statistics:
A.1.1.2.1 tests of difference
A.1.1.2.1.1 t-test
A.1.1.2.1.2 rank tests
A.1.1.2.1.3 analysis of variance
A.1.1.2.1.4 power analysis
A.1.1.2.1.5 survival analysis.
A.1.1.2.2 tests of association
A.1.1.2.2.1 chi-squared test
A.1.1.2.2.2 Fisher's exact test.
A.1.1.2.3 tests of correlation:
A.1.1.2.3.1 regression
A.1.1.2.3.2 Spearman's coefficient
A.1.1.2.3.3 Pearson's coefficient.
A.1.1.2.4 tests of agreement:
A.1.1.2.4.1 kappa.
A.1.2 Demonstrates competence in the application and interpretation, with respect to musculoskeletal diagnosis, of the following epidemiological concepts:
A.1.2.1 sensitivity
A.1.2.2 specificity
A.1.2.3 predictive value
A.1.2.4 likelihood ratio
A.1.2.5 prevalence
A.1.2.6 pre-test probability
A.1.2.7 pre-test odds
A.1.2.8 post-test probability
A.1.2.9 post-test odds
A.1.2.10 reliability
A.1.2.11 validity.
A.1.3 Demonstrates competence in constructing, explaining and interpreting decision analysis trees.
A.1.4 Outlines a cogent approach to evaluating medical literature.
A.1.5 Demonstrates a capacity to plan and interpret trials of diagnostic tests for musculoskeletal problems.
A.1.6 Demonstrates a capacity to plan and interpret trials of therapeutic interventions for musculoskeletal problems, including the concept of placebo.
A.1.6.1 Demonstrates an ability to determine the effect-size of a treatment, in particular to be able to calculate and explain Number Needed to Treat.
A.1.7 Discusses the relative merits of different types of clinical trials that might be conducted for the study of musculoskeletal problems.

A.1.8 Demonstrates a capacity to understand evidence-based medicine (EBM) as it pertains to musculoskeletal medicine.

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A.2 ANATOMY

General Objective

To attain a knowledge of anatomy appropriate and sufficient to:

comprehend and describe the normal functions of the muscles and joints of the axial and appendicular skeletons, and the function of the nervous system as it pertains to musculoskeletal function;

comprehend the aberrations of function of the musculoskeletal systems;

understand the anatomical basis of techniques used to investigate and manage musculoskeletal complaints;

evaluate critically the established and new theories on the pathogenesis, mechanisms and management of musculoskeletal complaints.

Specific Objectives

A.2.1 Describes, in sufficient detail to satisfy specific objects A.2.2 to A.2.5 the biochemistry and microstructure of:

A.2.1.1 collagen

A.2.1.2 elastin

A.2.1.3 proteoglycans.

A.2.2 Describes the biochemistry and microstructure of cartilage in sufficient detail to satisfy specific objects A.2.3 to A.2.5.

A.2.3 Describes the biochemistry and microstructure of:

A.2.3.1 bones
A.2.3.2 joints
A.2.3.3 intra-articular inclusions
A.2.3.4 bursae
A.2.3.5 ligaments
A.2.3.6 muscles
A.2.3.7 tendons
A.2.3.8 entheses
A.2.3.9 fasciae
A.2.3.10 nerves

A.2.4 Describes the morphology, anatomical relations and surface markings of the following components of the musculoskeletal and nervous systems:

A.2.4.1 bones
A.2.4.2 joints and intra-articular inclusions
A.2.4.3 bursae
A.2.4.4 ligaments
A.2.4.5 muscles including the attachments and actions
A.2.4.6 tendons and entheses
A.2.4.7 fasciae
A.2.4.8 nerves including the peripheral and segmental nerve supply of every muscle and joint of the mobile skeleton.
A.2.4.9 autonomic nerves including their course and distribution in a detail appropriate to:
a) the interpretation of musculoskeletal complaints;
b) the comprehension of investigations involving these nerves as they pertain to musculoskeletal complaints;
c) the safe execution of diagnostic and therapeutic procedures that may involve these nerves directly or inadvertently.
A.2.4.10 vertebral canal structures including the disposition and attachments of these structures and the effects on these structures of movements of the vertebral column, head and limbs.
A.2.4.11 central nervous system including the topography and internal structure of the central nervous system in terms of the disposition within it of tracts and nuclei and their connections, in sufficient detail to explain mechanisms of motor function and pain perception, and to evaluate theories of the pathogenesis of musculoskeletal complaints involving these processes.
A.2.4.12 peripheral arteries and the effects on these vessels of movements of the associated skeletal structures.

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A.3 BIOMECHANICS

General Objective

To understand certain precepts of biomechanics and apply them to the musculoskeletal system.

Specific Objectives

A.3.1 Demonstrates an ability to apply and interpret the following terms, with respect to any of the tissues of the musculoskeletal system:

A.3.1.1 stress
A.3.1.2 strain
A.3.1.3 stiffness
A.3.1.4 toughness
A.3.1.5 viscoelasticity
A.3.1.6 creep
A.3.1.7 hysteresis
A.3.1.8 fatigue failure

A.3.2 Describes the twelve degrees of freedom of movement of any joint in terms of translation and rotation about the biomechanical axes.

A.3.3 Demonstrates the qualitative and quantitative applications of the following terms to the description and interpretation of joint movement and analysis of equilibrium of any joint.

A.3.3.1 force
A.3.3.2 vector
A.3.3.3 moment
A.3.3.4 instant centre of rotation
A.3.3.5 screw axis

A.3.4 Defines, in biomechanical terms, the following terms as they are applied to joints:

A.3.4.1 hypomobility and stiffness
A.3.4.2 hypermobility and instability.

A.3.5 Demonstrates a familiarity with the concept of moment of inertia and its application to the study of joint kinetics.

A.3.6 Demonstrates an ability to apply precepts of biomechanics to:

A.3.6.1 clinical features
A.3.6.2 posture
A.3.6.3 the gait cycle
A.3.6.4 activities of daily living, including occupational and recreational activities.

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A.4 PHYSIOLOGY

General Objective

To understand the physiological basis of the functions and disorders of the musculoskeletal system.

Specific Objectives

A.4.1	Describes the distribution and metabolism of calcium in the musculoskeletal system and their control.
A.4.2	Describes the molecular and cellular processes involved in the growth, development and homeostasis of bone.
A.4.3	Describes the biology of fibrous connective tissues.
A.4.4	Describes the biology of joints.
A.4.5	Describes the molecular and cellular processes involved in the growth, development and homeostasis of skeletal muscle.
A.4.6	Describes the generation and propagation of action potentials in muscle.
A.4.7	Describes the molecular and cellular processes implicated in mechanisms of muscle contraction.
A.4.8	Describes different types of muscle fibre.
A.4.9	Describes the effects of rest, exercise and ageing on skeletal muscle, in terms of histochemistry and molecular structure.
A.4.10	Describes the molecular and cellular processes involved in:
A.4.10.1	the generation and propagation of action potentials in nerve
A.4.10.2	excitatory and inhibitory synapsis
A.4.10.3	the neuromuscular junction
A.4.10.4	axonal transport.
A.4.11	Describes the activity and function of reflexes, including:
A.4.11.1	myotatic reflexes
A.4.11.2	flexion-withdrawal reflexes
A.4.11.3	crossed extensor reflexes
A.4.11.4	tonic-neck reflexes
A.4.11.5	the reflex behaviour of animals subjected to spinal, brainstem and supracollicular transection.
A.4.12	Describes the role in motor activities of the following entities, in sufficient detail to interpret and explain the symptoms and signs of disorders of the motor system and to evaluate theories of musculoskeletal conditions:
A.4.12.1	motor units
A.4.12.2	motor neurone pools
A.4.12.3	spinal cord tracts
A.4.12.4	the cerebellum
A.4.12.5	the reticular formation
A.4.12.6	the brainstem
A.4.12.7	the thalamus
A.4.12.8	the basal ganglia
A.4.12.9	the cerebral cortex.
A.4.13	Describes the principles of electromyography and the use of EMG in research.
A.4.14	Describes the physiological properties of sensory neurones and the systems used to classify these neurones.
A.4.15	Describes the properties and behaviour of peripheral afferent neurones
A.4.16	Describes the properties and behaviour of afferent fibres from muscles and joints.
A.4.17	Describes the physiological properties of the pathways in the central nervous system that are involved in nociception,
A.4.18	Understands the peripheral and central nervous system mechanisms that subserve proprioception in sufficient detail to assess, interpret and investigate impairments of proprioception.
A.4.19	Describes the phenomenon of referred pain, its clinical manifestations and contemporary theories of its physiological and anatomical bases.
A.4.20	Describes the effects of the sympathetic nervous system on the cardio-vascular system and on visceral and musculoskeletal structures.

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A.5 PATHOLOGY

General Objective

To express a command of current knowledge of the pathology and pathogenesis of the more common disorders of the musculoskeletal system and the mechanisms of their clinical features.

Specific Objectives

A.5.1 Lists in a systematic fashion all the disorders that may affect any region of the musculoskeletal system.

A.5.2 Highlights the cardinal, distinguishing clinical, radiological or other diagnostic features of those disorders that may require other specialist management and identifies the particular specialist or specialists to whom the patient would most appropriately be referred.

A.5.3 Describes the biomechanical consequences and clinical features of congenital, developmental and acquired deformities of the musculoskeletal system.

A.5.4 Describes in detail the theories and established facts relating to the aetiology, pathogenesis, pathology, the biomechanical and functional consequences, clinical expression and diagnostic features of age related and so-called degenerative joint diseases of the musculoskeletal system.

A.5.5 Describes the pathology of:
acute injuries of:
fatigue failure of:
delayed or aberrant repair of injuries of:
long term sequelae of injuries that do not resolve of:

A.5.5.1 bones
A.5.5.2 joints
A.5.5.3 intra-articular inclusions
A.5.5.4 bursae
A.5.5.5 intervertebral discs
A.5.5.6 ligaments
A.5.5.7 muscles
A.5.5.8 tendons
A.5.5.9 entheses
A.5.5.10 fasciae.
A.5.5.11 nerves, nerve roots and the spinal cord

A.5.6 Describes the pathological and pathogenetic processes that underlie the cardinal features of inflammatory conditions of the following structures and the basis of clinical, laboratory and imaging techniques used for their diagnosis.

A.5.6.1 joints
A.5.6.2 bursae
A.5.6.3 synovial sheaths
A.5.6.4 intervertebral discs
A.5.6.5 muscles.

A.5.7 Outlines and evaluates contemporary theories and emergent ideas concerning the mechanisms and pathology of spinal pain.

A.5.8 Demonstrates an awareness of and an ability critically to access unconventional novel conjectures concerning the pathophysiological basis of chronic pain conditions.

A.5.9 Describes the biochemical, pathological and biomechanical consequences of joint immobilisation.

A.5.10 Synthesises the available data and viewpoints on the pathophysiology of fibromyalgia and chronic fatigue syndrome.

A.5.11 Describes the pathology and pathophysiology of complex regional pain syndromes.

A.5.12 Describes the pathology of:

A.5.12.1 radiculopathies
A.5.12.2 entrapment neuropathies
A.5.12.3 nerve injuries
A.5.12.4 peripheral neuropathies.

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A.6 PHARMACOLOGY

(see original document)

B. PATIENT ASSESSMENT

B.1 HISTORY

General Objective

To understand the role of medical history-taking in the assessment of a patient with a musculoskeletal complaint and to describe the steps in taking a history appropriate for the diagnosis of a musculoskeletal disorder.

Specific Objectives

B.1.1 Describes the recording of the patient's identification and social history including name, sex, age, laterality, address, domestic circumstances, dependants, present occupation (with work description), previous occupations, employment status, employer, source of income, sporting activities, hobbies and other leisure interests.

B.1.2 Describes the recording of the patient's present symptoms, including pains, altered sensations, stiffness, deformity and loss of function, with particular reference to site, radiation, quality, periodicity, duration, mode of onset, aggravating and relieving factors, effects on lifestyle (in terms of activities of daily living) and treatment to date.

B.1.3 Describes the recording of previous episodes of similar symptoms and the effects of management on them.

B.1.4 Describes the recording of other previous musculoskeletal problems.

B.1.5 Describes the recording of the patient's general medical history, including intercurrent and past medical problems.

B.1.6 Describes the recording of the patient's history of drug intake, including tobacco, alcohol and all current medications, whether prescribed or otherwise.

B.1.7 Describes the recording of any known allergies.

B.1.8 Describes the recording of the patient's family medical history with particular reference to inheritable disorders.

B.1.9 Identifies biological and psychosocial risk factors that may be deleterious to the musculoskeletal system or that might compromise management or recovery from musculoskeletal impairment.

B.2 PHYSICAL EXAMINATION

General Objective

To describe and demonstrate the elements of physical examination of a patient for the purposes of:

i) making a differential diagnosis of any musculoskeletal disorders.

ii) identifying non-musculoskeletal disorders that may mimic musculoskeletal disorders.

Specific Objectives

B.2.1	Describes the anatomical, biomechanical, physiological and pathological bases for physical signs elicited in musculoskeletal examination.
B.2.2	Describes the physical signs attributed to specific musculoskeletal conditions, and demonstrates a knowledge of the reliability and validity of these signs.
B.2.3	Demonstrates those elements of physical examination pertinent to the assessment of a patient with any particular musculoskeletal complaint, and describes their interpretation in terms of the anatomical, biomechanical, physiological and pathological bases of that complaint.
B.2.4	Describes the examination of static and dynamic posture, including gait.
B.2.5	Describes and demonstrates the physical examination, with reference to landmarks, tenderness, position, length and integrity, of:
B.2.5.1	bones
B.2.5.2	joints
B.2.5.3	intra-articular inclusions
B.2.5.4	bursae
B.2.5.5	ligaments.
B.2.6	Demonstrates the examination of joint mobility, in terms of the twelve degrees of freedom, as:
B.2.6.1	active movements
B.2.6.2	passive movements
B.2.6.3	accessory movements.
B.2.7	Demonstrates the examination, with reference to length, strength, tenderness, consistency and association with pain on loading, of:
B.2.7.1	muscles
B.2.7.2	tendons
B.2.7.3	entheses
B.2.7.4	fasciae.
B.2.8	Describes and demonstrates the examination of the peripheral and central nervous systems as it pertains to musculoskeletal disorders.
B.2.9	Describes and demonstrates the non-organic features that may be elicited on examination, and discusses the validity of these features.

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B.3 ANCILLARY INVESTIGATIONS

(see original document)

B.4 ERGONOMICS

General Objective

To understand the general principles of interactions between man and work, with specific emphases on the musculoskeletal demands of work activity, and on the musculoskeletal injuries that may result.

Specific Objectives

B.4.1	Describes the basic anthropometric measurements relevant to the evaluation of human function in the work place and the individual variability that may affect work performance.
B.4.2	Describes the basic biomechanical principles that apply to human performance at work, including body parts as levers and the determinants of torque at joints.
B.4.3	Outlines the physical environmental factors that impact upon musculoskeletal function.

B.4.4 Describes the particular musculoskeletal demands of specific work postures and activities.
B.4.5 Describes basic concepts of neuromuscular and psychological fatigue, and their relationship to specific work activities.
B.4.6 Demonstrates the assessment of ergonomic factors in cases of suspected work-related injury.

B.5 ASSESSMENT TOOLS

B.5.1 Describes the various aspects of pain evaluation, including use of pain drawings, different pain measurement scales and their respective advantages and disadvantages, pain descriptors and the use of affective pain questionnaires in the evaluation process.
B.5.2 Describes an understanding of disability questionnaires in clinical assessment, including design, implementation and interpretation of results.
B.5.3 Describes an understanding of the use of psychological questionnaires in clinical assessment

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C. DIAGNOSIS

General Objective

To understand the principles of diagnosis, evidence-based diagnostic formulation and contemporary diagnostic taxonomy, with an appreciation of ideal diagnostic criteria, the limitations of diagnostic methods and the statistical methods for quantifying them.

Specific Objectives

C.1	Describes the principles of diagnosis as the process of determining the nature and circumstances of a medical condition by following a rational strategy.
C.1.1	integration of structural and functional information during assessment to determine which further steps are needed.
C.1.2	appraisal of positive and negative findings resulting from history-taking, clinical examination and ancillary investigations
C.1.3	relation of assessment findings to anatomical and pathological axes
C.1.4	correlation of postulated structural and functional impairments with known pathological entities and possible psychosocial sequelae.
C.2	Demonstrates an awareness of different approaches to diagnostic formulation and the advantages and disadvantages of:
C.2.1	the *gestalt* or "heuristic" approach
C.2.2	the hypothetico-deductive approach
C.2.3	the exhaustive approach.
C.2.4	the "decision-tree" or algorithm approach.
C.3	Demonstrates an ability to recognise features used to discriminate between specific musculoskeletal conditions and to evaluate the evidence on which they are based.
C.4	Exhibits an appreciation of the limitations of contemporary diagnostic methods in satisfying ideal diagnostic criteria of reliability and validity.
C.5	Demonstrates an ability to apply to the process of diagnosis the elements of critical reasoning and clinical epidemiology outlined in specific objectives A.1.1 - A.1.6 and the evidence on which they are based.
C.6	Demonstrates ability to express musculoskeletal diagnoses in terms consistent with contemporary taxonomy, and with reference to anatomical and pathological axes, and the precepts of impairment, disability and handicap.
C.7	Demonstrates critical evaluation of the accuracy and ambiguity of diagnostic terms and statements found in literature pertaining to musculoskeletal conditions.

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D. PREVENTION

General Objective

To understand and apply the general principles of prevention as they pertain to musculoskeletal medicine.

Specific Objectives

D.1	Demonstrates judicious use of a knowledge of anatomy, physiology, biomechanics, and pathology to formulate and/or critically evaluate putative relationships between habits, postures, activities of daily living, diet, lifestyle, recreational and work activities and the genesis of musculoskeletal disorders and complaints.
D.2	In terms of theories described in D.1, outlines rational measures that could be taken to prevent the genesis of musculoskeletal disorders and evaluates the reliability of such measures to achieve these aims.
D.3	Describes the design of research projects that would be required to vindicate actions described in D.2.

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E. PATIENT MANAGEMENT

General Objective

To be able to develop, implement, explain and justify a plan of evidence-based management for a patient's musculoskeletal problems.

Specific Objectives

E1 To appreciate and be able to describe the alleged, putative, and proven mechanisms of action of the therapeutic interventions listed below, their indications, contraindications and complications, and the current evidence concerning their effectiveness:

- E.1.1 Activity and Rest
- E.1.2 Patient Education, Reassurance and Motivation
- E.1.3 Therapeutic Exercise
- E.1.4 Supports And Aids
- E.1.5 Thermo-, Hydro- And Electro-Therapies
- E.1.6 Manual Therapy
- E.1.7 Traction
- E.1.8 Medication
- E.1.9 Neuromodulation
- E.1.10 Injection Techniques
- E.1.11 Surgery
- E.1.12 Psycho-Social Management
- E.1.13 Rehabilitation

E.2 To be able to develop, implement, explain and justify an evidence-based plan of management for acute and chronic pain problems ascribed to:

- E.2.1 the lumbar spine
- E.2.2 the thoracic spine
- E.2.3 the cervical spine
- E.2.4 the shoulder girdle
- E.2.5 the shoulder
- E.2.6 the elbow
- E.2.7 the wrist
- E.2.8 the hand
- E.2.9 the upper limb as a whole
- E.2.10 the arm or forearm as a region
- E.2.11 the pelvic girdle
- E.2.12 the hip
- E.2.13 the knee
- E.2.14 the ankle
- E.2.15 the lower limb as a whole
- E.2.16 the thigh or leg as a region

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E.1.1 REST and ACTIVITY

General Objective

To understand the physiological and pathological effects of rest / activity and the principles of their use in the management of musculoskeletal disorders.

Specific Objectives

E 1.1.1	Describes the effects of rest on the physiological and biomechanical functions of musculoskeletal tissues.
E 1.1.2	Describes the effects of activity on the physiological and biomechanical functions of musculoskeletal tissues.
E 1.1.3	Describes the relationships between rest and pathological processes.
E 1.1.4	Describes the place of rest / activity in regimes for the treatment and prophylaxis of musculoskeletal disorders.
E 1.1.5	Describes types of rest / activity and the principles of their application, in particular:
E.1.1.5.1	general rest, including bed rest and modified activities.
E.1.1.5.2	specific rest of an injured part.
E 1.1.6	Describes the role of specific forms of rest in musculoskeletal management including their indications for particular conditions, their contraindications and means of monitoring their effects.
E 1.1.7	Describes the prescription of rest and activity as a treatment modality.

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E.1.2 PATIENT EDUCATION, REASSURANCE AND MOTIVATION

(see original document)

E 1.3 THERAPEUTIC EXERCISE

(see original document)

E.1.4 SUPPORTS AND AIDS

(see original document)

E 1.5 THERMO-, HYDRO- AND ELECTRO-THERAPY

(see original document)

E.1.6 MANUAL THERAPY

E.1.6.1 Describes manual therapy in terms of:
E.1.6.1.1 high velocity thrust manipulation
E.1.6.1.2 mobilisation
E.1.6.1.3 soft tissue techniques

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E 1.7 TRACTION

(see original document)

E 1.8 MEDICATION

(see original document)

E.1.9 NEUROMODULATION

(see original document)

E 1.10 INJECTION TECHNIQUES

(see original document)

E 1.11 SURGERY

(see original document)

E.1.12 PSYCHO-SOCIAL MANAGEMENT

(see original document)

E.1.13 REHABILITATION

(see original document)

F. PRACTICE CONDUCT

General Objective

Describes the equipment, personnel and record systems necessary for the safe and efficient conduct of a musculoskeletal practice.

Specific Objectives

F.1 Describes how the architectural design of practice rooms may facilitate or compromise the safe and efficient conduct of musculoskeletal practice.

F.2 Lists the equipment and other ancillary facilities required for the safe conduct of musculoskeletal practice.

F.3 Describes when and where the presence of other personnel may be necessary.

F.4 Describes and demonstrates a system of recording musculoskeletal information and maintaining patient records, recognising the advantages and disadvantages of any preferred technique.

F.5 Describes the format and content of written reports of suitable standards for communications to:

F.5.1 patients

F.5.2 other medical practitioners

F.5.3 paramedical health professionals

F.5.4 members of the legal profession

F.5.5 government and statutory bodies.

G. SCIENTIFIC DEVELOPMENTS

General Objective

To develop awareness of new developments in the science of musculoskeletal medicine and in scientific methods of managing patients with musculoskeletal impairment.

Specific Objectives

G.1 To appreciate evolving scientific developments such as gene therapy that may become applicable to the management of patients with musculoskeletal impairment and be able to describe the alleged, putative, and proven mechanisms of action of therapeutic interventions based on those developments, their indications, contraindications and complications, and the current evidence concerning their effectiveness.

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