GUIDELINES ON
TRAINING, SAFETY, EVIDENCE AND QUALITY

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Short contents

Contents

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Members of the FIMM Health Policy Board

Prof Olavi Airaksinen, Finland
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Invited contributors

Prof Lothar Beyer, Germany
Dr Miki Ishizuka, Japan
Dr Carlo Mariconda, Italy
Prof Sergei Nikonov, Russian Federation
Dr Peter Skew, UK
Dr Kazuyoshi Sumita, Japan
Dr James Watt, New Zealand
Dr Wolfgang von Heymann †, Germany

Invited advisors

Dr Craig E Appleyard, Canada
Dr Maxim Bakhtadze, Russian Federation
Dr Marc-Henri Gauchat, Switzerland
Dr Niels Jensen, Denmark
Dr Kirill O Kuzminov, Russian Federation

SECTION I: GENERAL CONSIDERATIONS

1. Introduction

1.1. 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 or Orthopaedic surgery, Physical and Rehabilitation Medicine, Rheumatology and Family Medicine resp. General Practice. In some countries Manual Medicine may also be an integrated component of the curriculum of those specialties [1].

1.2. 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 practiced 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].

1.3. Osteopathic Manipulative Medicine and Treatment

Osteopathic Manipulative Medicine (OMM) is defined as "the application of osteopathic philosophy, structural diagnosis and use of osteopathic manipulative treatment (OMT) in the diagnosis and management of the patient". *Osteopathic Manipulative Treatment (OMT)* is the therapeutic application of manually guided forces by an osteopathic physician [b] (U.S: usage) to improve physiologic function and/or support homeostasis that has been altered by somatic dysfunction. The training for the Doctor of Osteopathic Medicine (DO) degree in the USA uniquely includes comprehensive education in Manual Medicine competencies spread across four years of predoctoral education [3]. All US DOs graduate with a capacity-level to potentially practice *Osteopathic Manipulative Medicine* (see: SECTION I, Chapter 5.2.).

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

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

1.4. Osteopathic Neuromusculoskeltal Medicine

Osteopathic Neuromusculoskeletal Medicine (ONMM) is a nationally-recognized physician-only specialty in the USA that emphasizes the incorporation of osteopathic manual diagnosis and osteopathic manipulative treatment into the evaluation and treatment of the nervous, muscular, and skeletal systems in their relationships to other systems of the body as well as the whole person. ONMM specialty training requires a 36-month, full-time, supervised competency-based residency program, which is open to both MD and DO graduates [4, 5].

1.5. Manual Therapy

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

1.6. 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 approaches of Manual Medicine.

1.7. Chuna Manual Medicine

Chuna is a therapeutic modality that addresses biomechanical function, pathology, diagnostics, and theories related to treatment in order to create a balance in orthopedic structure and function; Chuna states that both function and structure are systemically correlated [10].

1.8. MM medicine

In this document the acronym *MM medicine* defines all scopes of Manual Medicine *and* the non-operating part of Musculoskeletal Medicine as exemplified above (also including Osteopathic Neuromusculoskeletal Medicine, Manual Therapy, Arthrokinematics and others).

2. 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 and professional 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.

3. How to use this document

SECTION I of the Guidelines deals with *general considerations* of MM medicine.

SECTION II of the Guidelines 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* (www.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.

SECTION III of the guidelines deals with contraindications, complications and side effects of MM medicine.

SECTION IV deals with safety in MM medicine.

SECTION V deals with the known *evidence* of MM medicine.

SECTION VI deals with *quality* aspects in MM medicine.

SECTION VII deals with the Glossary.

4. The value of MM medicine

4.1. Different models of MM medicine

Thus, these guidelines cover both the *manual* as well as the *non-invasive part of the musculoskeletal approach*. They deal exclusively with the training, the contraindications, the complications, the side effects, the safety, the known evidence and the quality of these approaches practiced either as a *capacity* or as a *component* (see **Fig. 1a-4b** below). In summary MM medicine is practiced worldwide mainly in two different models:

- MM medicine as a subspecialty or capacity in relation with any medical specialty dealing with clinical medicine.
- MM medicine is an integrated component of the curriculum of any in SECTION I, Chapters 1.1. - 1.8. mentioned medical specialties or another medical branch 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 or surpass the requirements of Level 3, Specialty level (see SECTION II, Chapter 6).

4.2. Cost-effective management of MM medicine

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 are based on physician's skills in biomechanics, anatomy, neurophysiology, and psychosocial analysis and is usually done in the ambulatory care setting. The medical 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, a MM medicine 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 [11]. 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 [12]. 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 [13]. 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 [14, 15]. 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 [16]. In 1998, total U.S. health care expenditures for low back pain were estimated at 90 billion U.S. Dollars [17]. 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% [18]. 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 [19].

4.3. Mismatch between problems of the locomotor system and those providing assistance

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 [20]. 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 [21].

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 or accrediting authorities to implement and maintain safe and effective training of physicians in diagnosis and therapy in MM medicine as delineated in this document.

4.4. Different regulations

Regulations for physicians who practice MM medicine vary considerably from country to country. In some countries, e.g. the USA, New Zealand and Russia have specialty status as mentioned (component or masters/doctoral models). 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 practiced.

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

4.5. Training programs on different educational level

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 safely integrate MM medicine approaches or 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.

4.6. Minimum of educational requirements

FIMM through its Health Policy and Education Boards has delineated what the members of its Federation of 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.

5. Educational pathways (examples)

5.1. Europe, Australia, New Zealand, Israel, South America

The acronym *MM medicine* defines all scopes of Manual Medicine and the non-operating part of Musculoskeletal Medicine, also including Osteopathihc Neuromusculoskeletal Medicine, Manual Therapy, Arthrokinematics and others.

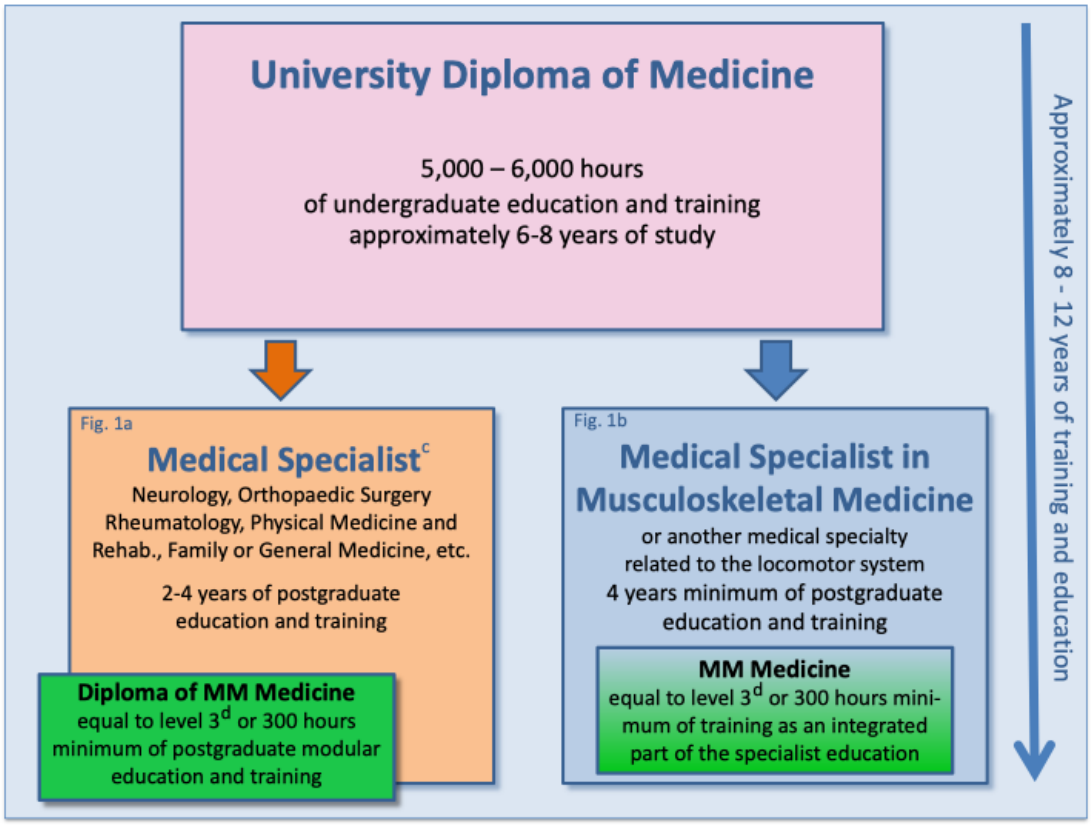

Fig. 1a: The *capacity model*. Manual Medicine is a subspecialty or a capacity in relation to any medical or surgical specialty dealing with clinical medicine.

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

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

[d] See SECTION II, Chapter 3: Levels of training in MM medicine.

5.2. USA, Canada: Doctors of Osteopathic Medicine (DO) and US-trained DOs in Canada

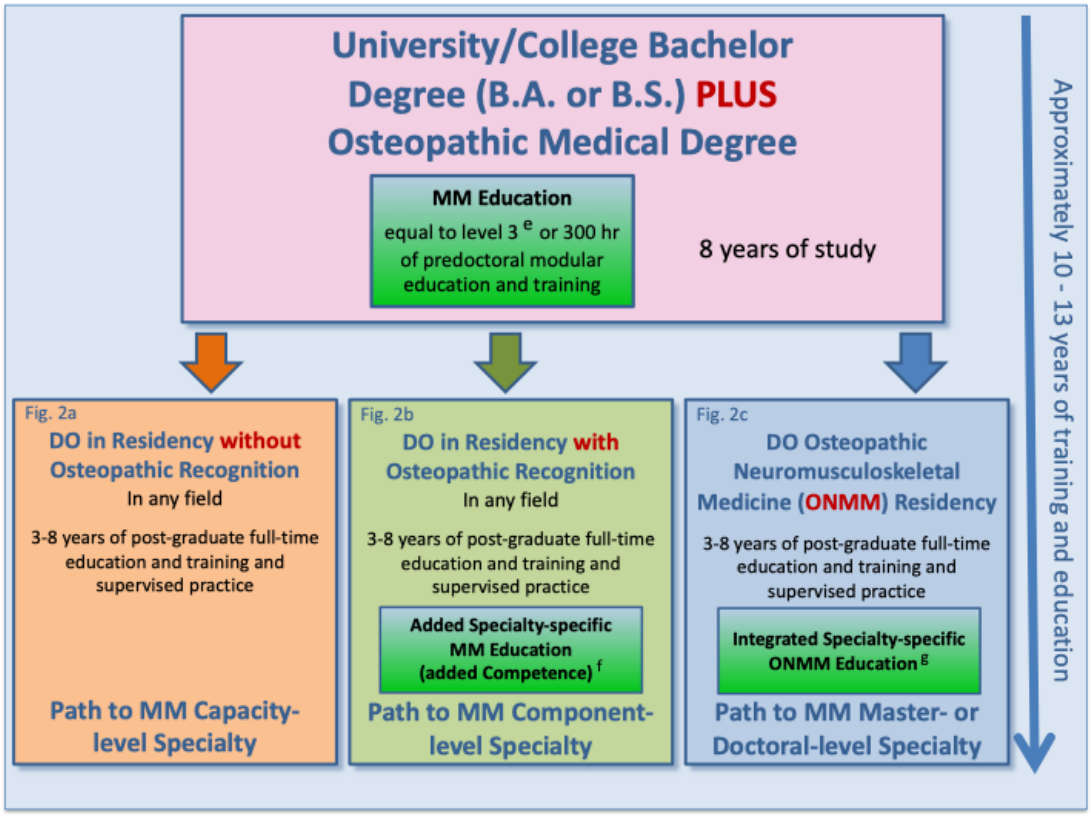

Fig. 2a: *A capacity model.* Osteopathic Manipulative Medicine and Osteopathic Manipulative Treatments are integrated components of the predoctoral curriculum of all US-graduated DO physicians. Such DOs in the USA qualify as MM Capacity-level specialists in any medical or surgical discipline.

Fig. 2b: *A component model.* An allopathic graduate (MD) or US-graduated DO who completes a residency with an "osteopathic recognition" curriculum within a given specialty field may qualify as MM Capacity- or MM Component-level specialists depending on the discipline. (For example, capacity-level Family Practice with OMT specialists).

Fig. 2c: *Master- or Doctoral-level model.* An allopathic graduate (MD) or US-graduated DO who completes an Osteopathic Neuromusculoskeletal Medicine (ONMM) residency or completes qualifications including a thesis defense to obtain an FAAO (Fellow of the American Academy of Osteopathy) award may qualify as a MM Master- or Doctoral-level specialist.

[e] See SECTION II, Chapter 3: Levels of training in MM medicine.

[f] Competency-based requirements in Osteopathic-Recognition Residency Programs.

[g] Competency-based requirements (>1200 hr) in Residency Programs +/- Thesis.

All US-trained DO specialists in any field first satisfied the competence of the MM-specialist level or Specialty level (Level 3[h]) prior to their post-graduate training (**Fig. 2a-c**). They then have the choice to choose an osteopathic recognition residency program with specialty-specific MM-integration with regard to an application for an additional competence (**Fig. 2b**). DOs trained and certified in the US in the specialty field of Osteopathic Neuromusculoskeletal Medicine (ONMM) or Osteopathic Manipulative Medicine (OMM) fulfill the Master level or Doctorate level (Level 4[h]) of MM-education. In the US, they constitute the bulk of the MM-educators, MM-researchers, and MM-consultants for other physicians' patients (**Fig. 2c**).

See also ANNEXES Chapter 3.1.

B.A. : The Bachelor of Arts is the designation for the Bachelor's degree awarded primarily in the fields of humanities, linguistics and cultural studies, media and communication as well as social and societal sciences. Arts does not stand for arts, but for humanities.

B.S. : The Bachelor of Science is a highly professionally qualifying degree. This degree can be obtained in various branches of science, including economics, natural sciences and engineering.

[h] See SECTION II, Chapter 3: Levels of training in MM medicine.

5.3. USA, Canada: Medical Doctors (MD)

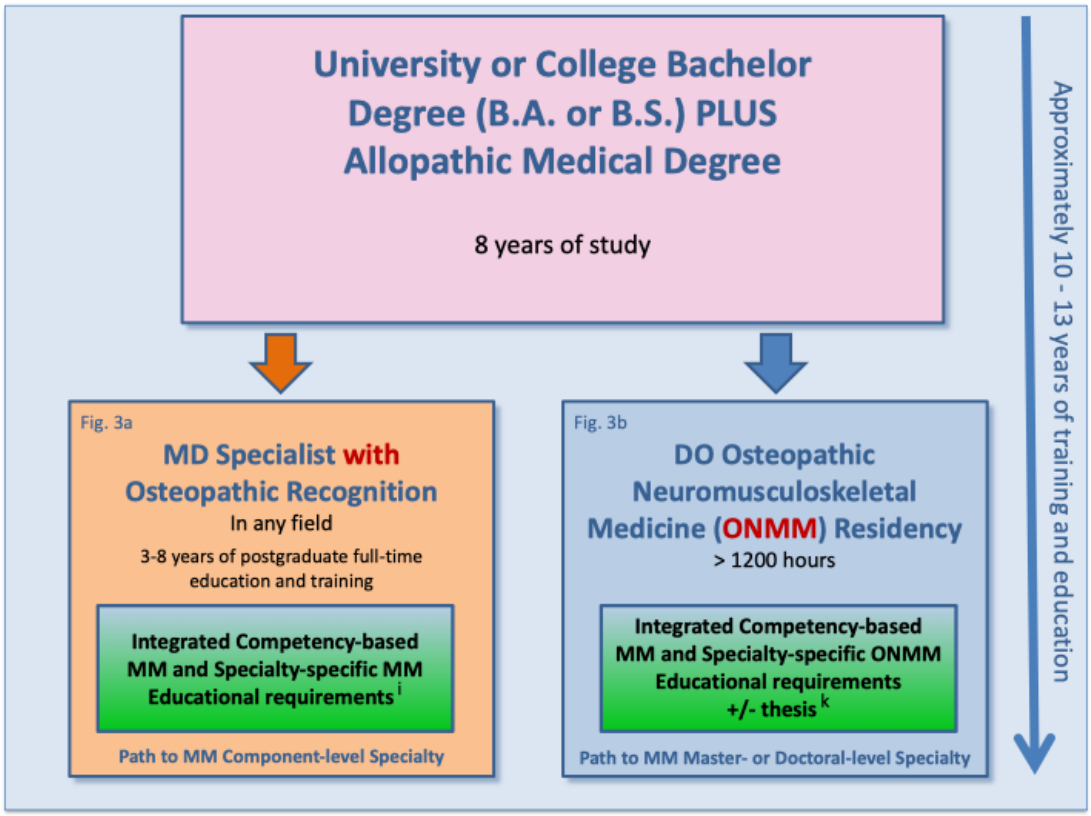

Fig. 3a: MDs educated within a specialty field with osteopathic recognition qualifiy as a MM *Component*-level Specialist (equal to level 3 [l]).

Fig. 3b: MDs educated in the Osteopathic Neuromusculoskeletal Medicine specialty with osteopathic recognition qualify as a MM *Master*- or *Doctorate-level* Specialist (equal to level 4 [l]).

[i] Equal to level 3 or 300 hours minimum of training (see SECTION II, Chapter 3: Levels of training in MM medicine).

[k] Equal to level 4 (see SECTION II, Chapter 3: Levels of training in MM medicine).

[l] See SECTION II, Chapter 3: Levels of training in MM medicine.

5.4. Republic of Korea

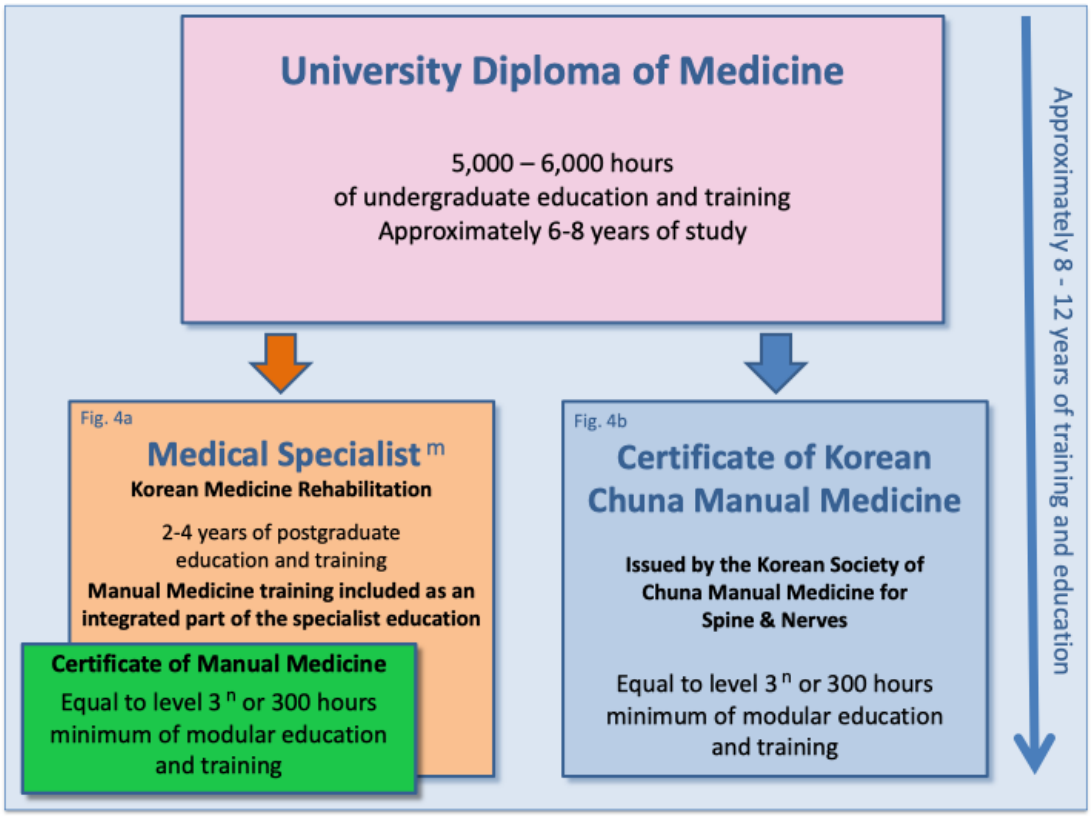

Fig. 4a: *Korean capacity model.* Specialists in Korean Medical Rehabilitation receive basic training in Manual Medicine. They can complete this with a Certificate on level 3 [n] or a 300 hour Certificate of Manual Medicine.

Fig. 4b: Holders of the Certificate of Korean Chuna Manual Medicine receive training at level 3 [n] or at least 300 hours of training in Manual Chuna Medicine.

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

[n] See SECTION II, Chapter 3: Levels of training in MM medicine.

6. History and principles

6.1. 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. Apart from Ayurveda Medicine, the roots of East Asian manual medicine can be traced back to *Huangdi's Internal Classic* (黄帝內經), a book written by Chinese medicine doctors in the Warring States Period (475 to appr. 221 B.C.E.). Although spinal manipulation in the West dates back to Hippocrates (460 to 375 B.C.E.) and the ancient Greek physicians [22] 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 East Asia, the first records containing the term Chuna (推拿) were such pediatric medicine classics of the Ming Dynasty (1368 to 1644 C.E.) as *Encyclopedia of pediatric Chuna, formulas, pulse and rescuing* (小兒推拿方脈活秘旨全書) and *Secret tips in pediatric Chuna* (小兒推拿秘訣). In 1599, the Spaniard Luis de Mercado (1525-1611) published instructions in his book *Institutiones para el aprovechamiento y examen de los Algebristas* on the proper use of manual treatments, especially for algebristas who were not doctors [23]. The Spanish kings Philip II and Philip III also benefited from such treatments.In the middle of the 19th century the American physician Andrew Taylor Still (1828-1917) 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 his book *Nervenleiden und Nervenschmerzen, ihre Behandlung und Heilung durch Handgriffe (Nerve Diseases and Nerve* Pain*, Their Treatment and Healing by Hand Grips*) towards the end of the 19th century, the Swiss physician Otto Naegeli (1871-1938) described hand grips for treating illnesses, which are often regarded as early manifestations of manual medicine [24, 25]. However, Naegeli's attachment to the theoretical approaches of classical naturopathy prevented the development of a comprehensive therapeutic concept. It was not until the emergence of osteopathy and chiropractic therapy that the theoretical basis was expanded, opening the way to today's manual medicine.

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.

6.2. 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 neurophysiological 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 single 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 pain-reactive and painful dysfunction of segmentally related tissues. MM specialists describe these findings as segmental or somatic dysfunction or as painful minor intervertebral dysfunction.

SECTION II: TRAINING IN MM MEDICINE

1. Use of MM medicine

1.1. Introduction

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 are additional diagnostic approaches like X-ray, CT- or MRI-scans or biochemical investigations 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.

1.2. 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?

1.3. 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, best practices 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.

1.4. 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 chapter 3 and 4 of SECTION II 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 assessment, which includes, preferably, both written and practical tests. Such assessment needs to be recognized by a licensing body or another authority of the national health care system.

1.5. Supervision, Monitoring, Accreditation and Evaluation

Safe introduction of MM medicine would best introduce its recognition and training at the predoctoral 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 and surgeons

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. Levels of Education in MM medicine

3.1. Structure- and process-based versus competency-based educational programs

For graduates of training and further training programs in MM medicine, their level of training or skills and abilities can be checked and tested using various methods. The methods can complement each other, but not necessarily. Depending on the customs or rules of the respective health care systems, elements of this or that method have become established in medical education in different countries or are in a state of flux. In the context of these Guidelines, we will discuss the key values of both the *structure- and process-based* and the *competency-based* variants. In one method, the focus is on the assessment of time spent and the credits awarded for this (for example 300 hours and 30 credits) and in the other, the focus is on the assessment of professional competences and how the trainee deals with them (for example the assessment of knowledge, skills and attitude). Both methods have their advantages and disadvantages. These can be derived from the following table.

Variables	**Educational Program**	
	Structure- and process-based	**Competency-based**
Driving force for curriculum	Content – knowledge aquisition	Outcome – knowledge application
Driving force for process	Teacher	Learner
Path of learning	Hierarchical	Non-hierarchical
Responsibility for content	Teacher	Student and teacher
Goal of educational encounter	Knowledge acquisition	Knowledge application
Typical assessment tool	Single subjective measure	Multiple objective measures (evaluation portfolio)
Assessment tool	Proxy	Authentic (mimics real tasks of profession)
Setting of evaluation	Removed	In the trenches (direct observation)
Evaluation	Norm-referenced	Criterion-referenced
Timing of assessment	Emphasis on summative	Emphasis on formative
Program	Fixed time	Variable time

Tab. 1: A comparison of the elements of structure- and process-based versus competency-based educational programs, adapted from Hanyang Medical Reviews [26].

FIMM members choose from the methods according to their needs and are free to design their own educational programs. FIMM considers the significance of structure- and process-based training as equivalent to competency-based training.

3.2. Overview of the training levels

In the regions and countries where MM medicine has been established for a long time and where its ongoing development can be observed, the following training levels have been established and proven:

1	Level 1	Medical school level or predoctoral level
2	Level 2	MM-recognition level or facility level
3	Level 3	MM-specialist level or specialty level
4	Level 4	Master level or doctorate level

Tab. 2: Categories of education in MM medicine.

3.3. Level 1: Medical school level or predoctoral level

Predoctoral training in MM medicine must include an understanding of Musculo-skeletal 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 education in the basic anatomy and physiology of the locomotor system of every medical student.

This level does not typically provide any specific diploma or certificate [o].

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 predoctoral module or modules (e.g. musculoskeletal, orthopaedic, rheumatology, neurology).

3.4. Level 2: MM-recognition level or facility level

This level 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 typically achieved by either intensive courses or a number of short courses sufficient to provide such competence.

3.4.1. Competence-based definition

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.

[o] By the end of their second predoctoral coursework, students of US Colleges of Osteopathic Medicine (COMs) have had supervised training and assessments to facility level. COM Graduates of these COMs receive the degree of Doctor of Osteopathic Medicine certifying completion at the capacity-level.

3.4.2. Structure and process-based definition

This level corresponds for example in the European Bologna concept [27] to a CAS (Certificate of Advanced Studies), which allocates 10 to 15 ECTS (European Credit Transfer System [28]).

3.5. Level 3: MM-specialist level or specialty level

This level 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.

3.5.1. Competence-based definition

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.

3.5.2. Structure and process-based definition

This level 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 [27, 28] (Diploma of Advanced Studies), which allocates 30 ECTS.

Specialists in a clinical field educated to integrate MM skills specific to patient care in that field can manage with less than 30 ECTS (30-) and with limited scope. Physician or surgeons educated to integrate MM skills specific to patient care in primary care or as foundation for other specialties are dependent on more than 30 ECTS (30+) and a broader scope.

3.6. Level 4: Master level or doctorate level

Level 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 qualifications require the involvement of a university department or hospital offering a suitable training program. The Master or Doctorate Level is based on the level 3 curriculum and add academic knowledge and a masters or doctoral thesis or its equivalent. 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 level 4 is for example equivalent to the curriculum of the medical specialties of Musculoskeletal Medicine or Osteopathic Neuromusculoskeletal Medicine as far as the non-invasive elements of these medical specialties are concerned.

3.6.1. Competence-based definition

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.

3.6.2. Structure and process-based definition

To gain the extensive knowledge needed to interpret musculoskeletal function and a complete set of manual techniques, this level corresponds (for example in the European Bologna concept [27]) to a MAS (Master of Advanced Studies), which allocates 60 ECTS [28].

4. Education and training level 1: Medical school or Predoctoral 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 medical school graduates are undertrained in musculoskeletal conditions, diagnosis and treatment [29]. 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 is best incorporated in all years of the predoctoral schedule and integrated where possible with relevant specialties including clinical opportunities to experience the practical application of theoretical knowledge and techniques relevant to the neuromusculoskeletal 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. Assessment

As part of the course work and final assessment of all students, reference questions relating to MM medicine should be included in the relevant papers. If MM psychomotor skills in palpatory diagnosis of somatic dysfunction and/or MM therapeutic techniques are taught, both formative and summative practical assessments should be included.

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 level 2: MM-recognition or Facility level

This refers to the training program for physicians and surgeons undergoing medical professional education in general healthcare or a relevant specialty (Family 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 MM Medicine care safely and effectively with the minimum of supervision.

5.2. Duration of training

A a basic program of approximately 100 hrs. of organised tuition, self-learning and supervised practice, as well as approximately 12 months of experience in relevant related medical specialties (Orthopaedics, Accident and Emergency, Rheumatology, Neurology, Paediatrics, General/Family Practice, Pain management or Rehabilitation Medicine) is recommended before certificate assessment should be undertaken.

5.3. Core topics and Syllabus

See Chapter 8, Core topics and Syllabus.

5.4. Practical supervised clinical experience

Exposure to clinically relevant environments where MM medicine is practiced under supervision would be expected, with significant opportunities for devolved responsibility for the trainee, to allow skills to be developed in clinical history taking, palpatory examination for somatic dysfunction and MM treatment techniques. Direct formative feedback regarding clinical, palpatory and MM treatment technique performance is expected. It is anticipated that this training would take no less than approximately 12 months.

5.5. Assessment

As part of the Certification course work and final assessment of trainees all aspects of MM medicine need to be addressed. Direct assessment of clinical skills will require formative and/or summative practical examinations of test patients and oral assessment of examination, diagnostic and treatment planning skills.

5.6. Post-degree training

Typically, these Certificate assessments are regarded as post-degree training and require proof of continuing clinical and skills development using all the national and other credentialing 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 level 3: MM-specialist level or 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 approximately 300 hrs. of organised tuition, self-learning and supervised practice will be required before a Diploma assessment can be undertaken. A fully completed training of a medical specialty including a Certificate is required (e.g. Orthopaedics, Accident and Emergency, Rheumatology, Neurology, Paediatrics, General Practice, Pain management or Rehabilitation Medicine).

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 approximately 24 months.

6.5. Assessment

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

As part of the course work and final assessment of trainees that lead to a Diploma, Certificate of Added Qualification or an equivalent credential, 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 formative and/or summative practical palpatory and treatment skills, clinical assessment of test patients and oral assessment of examination, diagnostic and treatment planning skills.

6.6. Post-degree training

These Diploma assessments 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 or surgeon 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 level 4: Master level 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 master 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 approximately 24 months of experience in MM medicine will be required together with evidence of higher skill training in a wide range of MM 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 (approximately) program, evidence will be collected to demonstrate exposure and ability to perform palpatory diagnosis of somatic dysfunction and recognised techniques used in MM medicine. A peer reviewed research project or suitable written dissertation will be undertaken in a prescribed time frame.

7.5. Assessment

A portfolio of experience and signed off procedures together with a suitable written dissertation or research project will form the basis of the masters-level or doctoral-level submission, defined by the awarding institution or accrediting body. One or more summative written and practical examinations should be satisfactorily passed prior to credentialing at either level.

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 competencies 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 [o]

8.1. Basic knowledge

8.1.1. Essential knowledge

	Level			
- 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 MM 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 musculo-skeletal 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

[o] Developed in part 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

	Level			
- 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

	Level			
- 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

	Level			
- 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

	Level		
- 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

	Level			
- 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

	Level			
- Recognise disorders or dysfunctions of axial and appendicular structures: 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		2	3	4
- Recognise visceral organ dysfunction related to biomechanical disorders			3	4
- Recognise 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: 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	1	2	3	4
- To understand special consideration with respect to age and development (esp. paediatrics and geriatrics)	1	2	3	4

SECTION III: CONTRAINDICATIONS, COMPLICATIONS, AND SIDE EFFECTS

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 in MM medicine

2.1. Direct techniques

For the purposes of this document the term *manipulation* stands for 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). It is important when reading the literature, that in most countries the word “manipulation” most commonly refers to as HVLA thrust techniques; however, in some countries (most notably the USA), the term “manipulation” by a MM physician refers to *any* manual medicine technique using the hands.

For the purposes of this document the term *mobilization* stands for 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 [30]. 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 with the intention of spinal treatment

- Lack of consent
- Lack of adequate training of the operator
- Acute or subacute vertebral fracture
- Acute or subacute 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 with the intention of spinal treatment

- Spondylolysis with spondylolisthesis
- Severe instability and marked hypermobility
- Aneurysm of the aorta
- Cervico-occipital junction malformation
- Spinal stenosis
- Osteoporosis
- Inflammatory arthritis, rheumatic and connective tissue diseases
- Other neurological diseases as 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 in MM Medicine

3.1. Introduction

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. 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 [31, 32]. 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 [33].

In a study of 2018 by Degenhardt et al. 887 patients were followed after osteopathic manipulative treatment (OMT) and provided data at 1847 office visits. Patients reported they felt worse or much worse immediately after OMT at 45 office visits; the incidence rate for adverse events was 2.5%. Pain or discomfort was the most commonly identified type of adverse event. Women reported adverse events more frequently than men [34].

3.2. Most severe complications

These include:

- **Death**
  - This can result from brain stem injury as could occur when HVT (high velocity 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 [35].
- **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.

3.3. Serious complications

These include:

- Fracture
- Fislocation
- Dissemination of infection
- Dissemination of neoplasm
- Aggravation of pain
- Aggravation of disability

3.4. Complications and side effects of less consequence

These include:

- Local discomfort
- Numbness
- Tingling in upper limbs
- Dizziness
- Fainting
- Light-headedness
- Headache

SECTION IV: SAFETY IN MM MEDICINE

In coordination with the European core curriculum and principles of Manual Medicine of ESSOMM [36].

A review on the existing literature [p].

The subject safety of spinal manipulations has been extensively discussed in many publications [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, 68, 69, 70, 71, 72, 73, 74,, 75, 76, 77, 78, 79].

1. Risks of cervical spine high velocity thrust treatments therapy

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 [80].

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 [81].

Serious complications after manipulation of the cervical spine are estimated to be 1 in 4 million manipulations or fewer [82]. A Rand Corporation extensive review estimated *one in a million* [83]. 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 [84].

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 [85]. 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 [86]. Eder offered a report of 168,000 cervical manipulations over a 28-year period, again without a single significant complication [87]. 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* [88].

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 with few adverse side effects* [89]. In very rare instances, the

[p] 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 cervical HVLA thrust techniques used by the chiropractic profession sometimes differ considerably from HVLA techniques taught in most MM medicine seminaries, 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.

manipulative adjustment to the cervical spine of a vulnerable patient becomes the final intrusive act, which results in a very serious consequence [90, 91, 92].

According to an expert opinion HVLA-manipulation of the cervical spine is estimated to have no effectiveness and to be dangerous [93] 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 [94].

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 [95].

In 2007 the French Society for Orthopaedic Manual Medicine and Medical Osteopathy SOFMMOOM 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 [96].

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 [97]. The question was whether cervical spine rotation, as used in the standard vertebrobasilar insufficiency test, is associated with a measurable change in intracranial vertebral artery blood flow. Transcranial Doppler sonography 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 [98]. 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. They concluded that the value of this test for screening patients at risk of stroke after cervical manipulation is questionable.

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 [99] 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 [100]. 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.

1.2. Vertebrobasilar accidents and cervical spine high velocity thrust therapy

Haldeman and collaborators reported in 2002 in an extensive paper on vertebrobasilar accidents in relation to cervical spine manual therapy [101]. 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 analyzing 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.

Again Haldeman and collaborators studied in 2003 clinical perceptions of the risk of vertebral artery dissection after manual therapy of the cervical spine [102]. 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 [103].

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 [104].

Also in 2005 Haneline and Lewkovich analyzed the etiology of cervical artery dissections in the years from 1994 to 2003 [105]. 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 etiology. 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 [106]. The data were previously presented in 2003 [107]. 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 vertebrobasilar 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.

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 etiologies other than cervical artery dissection [108]. 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. 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 vertebrobasilar 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 sometime 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 [109].

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 [110] 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 [111] 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 [112].

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 [113].

In a policy statement the American Osteopathic Association discusses varying conclusions on the harms of spinal manipulative treatment (SMT) [114]. In a 2017 review of risks associated with spinal manipulation, 46% percent of the studies reviewed found spinal manipulation to be safe, 42% percent were neutral (did not find harm/benefit); and the remaining 12% percent concluded that spinal manipulation was unsafe because of the possibility of serious adverse events. Nevertheless, the existence of any adverse effect should not be trivialized. The argue that studies have noted that there are two types of adverse effects as a result of SMT. The first type is considered to be mild adverse events that are short-term and non-serious such as dizziness, fatigue, and muscle soreness/ discomfort. These side effects occur in 23-83% of patients. The second type of adverse events is more serious and includes cervical artery dissection, stroke, spinal cord injuries, and other serious conditions outcomes related to vertebrobasilar accidents (VBAs). Currently, much of the literature discusses vertebrobasilar insufficiency or vertebralbasilar ischemia (VBI) which is a type of VBA and is often determined to be the link to the more serious adverse events. Nonetheless, serious adverse events are seen as a rarity, and it is estimated that they occur in the range of every 20,000 to 250,000,000 manipulation

performed. Most of the reported cases of adverse outcomes have involved thrust or High Velocity Low Amplitude (HVLA) types of manipulative treatment. Unfortunately, many of the reported cases do not distinguish the type of manipulative treatment provided.

2. Risks of lumbar spine manipulation therapy

In a 1993 study Cassidy and co-workers concluded that the treatment of lumbar intervertebral disk herniation by side posture manipulation is *both safe and effective* [115].

Oliphant in 2004 graded prospective and retrospective studies and review papers according to quality, and results and conclusions were tabulated [116]. 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 [117].

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 SAMM, 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 [118].

In 1993 Dvořák's research group published from the same survey undertaken 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 radiologically 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 [119].

By conclusion the evidence of today suggests that consistent with a randomized placebo-controlled double-blinded trial, after an initial assessment excluding patients with contraindications, lumbar spine manipulation therapy is safe compared to other non-invasive treatment modalities [120].

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 30 years there are only four case-reports on epidural thoracic hematoma (partially combined with leakage of cerebrospinal fluid) [121, 122, 123] and one case-report of esophageal rupture [124] 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 [125]. 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. Risks of manipulation therapy of the pelvic ring (sacroiliac and pubic symphysis joints)

In a recent study of Hansel et al. [126] the applied techniques were safe and when using high-risk status and labor and delivery outcomes as an index for safety, no greater risk in the OMT group was found. Rather, there was a trend toward a mild protective effect of the OMT protocol on the development of high-risk status. This trend would indicate that the OMT protocol as applied in the PROMOTE study is a safe intervention during the third trimester. Otherwise, there is no literature available on specific risks of manipulation therapy of the pelvic ring or the sacroiliac and/or pubic symphysis 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.

5. Risks of dry needling

Dry needling stands as an effective and relatively safe technique when administered by adequately trained clinicians to address myofascial trigger points. The majority of associated adverse effects are minor, typically manifesting as local pain and hematoma, with vasovagal reactions being rare. However, the primary serious complication remains pneumothorax.

A study conducted within the Israel Defense Forces offers valuable insights, covering over 47,000 dry needling treatments administered to the chest area by physio-therapists between 2011 and 2017. Remarkably, only two instances of pneumothorax resulting from dry needling treatment were documented, illustrating a minimal risk of 1 in 23,500 sessions (0.004%) [127]. See also a study conducted by Padel et al. [128].

6. Risks of prolotherapy

Some societies of manual or musculoskeletal medicine promote prolotherpy. Prolotherapy is an injection-based medical therapy for chronic musculoskeletal pain [129]. It has been used for for many years, however, its modern applications can be traced to the 1950s when the prolotherapy injection protocols were formalized by George Hackett [130], a general surgeon in the U.S.A. While prolotherapy techniques and injected solutions vary by condition, clinical severity, and practitioner preferences, a core principle is that a relatively small volume of an irritant or sclerosing solution is injected at sites on painful ligament and tendon insertions, and in adjacent joint space over the course of several treatment sessions. While anecdotal clinical success guides the use of prolotherapy for many conditions, clinical trial literature supporting evidence-based decision-making for the use of prolotherapy exists for low back pain [131], several tendinopathies [132] and osteoarthritis [133].

The main risk of prolotherapy is pain and mild bleeding as a result of needle trauma. Patients frequently report pain, a sense of fullness and occasional numbness at the injection site at the time of injections. These side effects are typically self-limited. A post-injection pain flare during the first 72 hours after the injections is common clinically but its incidence has not been well documented. An ongoing study of prolotherapy for knee OA pain has noted that 10–20% of subjects experience such flares [134].

Risks of prolotherapy injections include lightheadedness, allergic reaction, infection or neurological (nerve) damage. Dextrose is extremely safe; in the USA it is FDA (Food and Drug Administration) approved for intravenous treatment of hypogylcemia and for caloric supplementation. As of 1998, FDA records for intravenous 25% dextrose solution reported no adverse events to Abbott Labs in 60 years. Morrhuate sodium is a vascular sclerosant, used in gastrointestinal procedures and vein sclerosing. Allergic reactions to morrhuate sodium are rare. Although P2G is not FDA approved for any indication, it has not been reported in clinical trials to cause significant side effects or adverse events.

According to Rabago et al. (2010), a small number of significant, prolotherapy-related complications have been reported. They were associated with perispinal injections for back or neck pain, using very concentrated solutions, and included 5 cases of neurological impairment from spinal cord irritation and 1 death in 1959 following prolotherapy with zinc sulfate for low back pain. Neither zinc sulfate nor concentrated prolotherapy solutions are currently in general use. In a survey of 95 clinicians using

prolotherapy, there were 29 reports of pneumothoraces after prolotherapy for back and neck pain, two of which required hospitalization for a chest tube, and 14 cases of allergic reactions, although none classified as serious [135]. A more recent survey of practicing prolotherapists yielded similar results for spinal prolotherapy: spinal headache, pneumothoraces, nerve damage and non-severe spinal cord insult and disc injury were reported [136]. The authors concluded these events were no more common in prolotherapy than for other spinal injection procedures. No serious side effects or adverse events were reported for prolotherapy when used for peripheral joint indications.

Further literature on safety in MM medicine

137, 138, 139, 140, 141, 142, 143

SECTION V: EVIDENCE IN MM MEDICINE

Evidence-based MM medicine (EBM) is not different from evidence-based medicine in other medical specialties.

"*Evidence-based medicine is the conscientious, explicit, judicious and reasonable use of modern, best evidence in making decisions about the care of individual patients. EBM integrates clinical experience and patient values with the best available research information. […] The practice of evidence based medicine is a process of lifelong, self-directed, problem-based learning in which caring for one's own patients creates the need for clinically important information about diagnosis, prognosis, therapy and other clinical and health care issues. It is not 'cookbook' with recipes, but its good application brings cost-effective and better health care. The key difference between evidence-based medicine and traditional medicine is not that EBM considers the evidence while the latter does not. Both take evidence into account; however, EBM demands better evidence than has traditionally been used*" (by Masic et al. [144]).

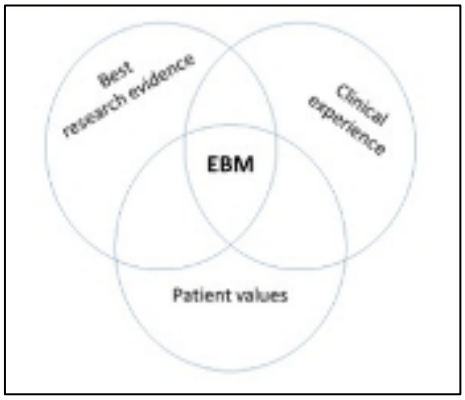

Fig. 5: EBM modified from Haneline (2007) [145].

The complexity of EBM described above is reflected in the development of MM medicine since the middle of the 20th century.

During this period, a complex system of national and transnational scientific societies has developed from the activities of individual MM therapists and individual seminaries of small groups of doctors, which have ensured that the criteria of an EBM in clinic, teaching and research are met.

In an earlier publication from 2004, FIMM and its exponents Dr R. Palmer and Prof J. Patijn already commented on EBM [146].

In regular meetings of the MM societies, academies, teachers and expert commissions, opinions and convictions from clinical experience are agreed and published in relevant international journals. This corresponds to level IV of the evidence classes according to the recommendations of the Agency for Healthcare Research and Quality (AHRQ) [147]. A higher level of evidence is dependent on methodologically high-quality non-experimental studies such as comparative studies, correlation studies or case-control studies (level III) and high-quality studies without randomization (level IIb) as well as sufficiently large, methodologically high-quality randomized controlled studies (RCT) (level Ib).

EBM is not limited to randomized controlled trials (RCTs) and meta-analyzes. Nevertheless, these are to be regarded as the gold standard in the great majority of those questions that are about evaluating the benefits and risks of therapies.

A prerequisite for evidence-based diagnostics in MM are good reproducibility, validity, sensitivity and specificity studies of the diagnostic procedures. To ensure the quality of such studies, the former *Scientific Committee* of FIMM has developed a *Reproducibility protocol for diagnostic procedures in MM* [148] in recent years. The protocol can be used as a kind of cookbook format to perform reproducibility studies with kappa statistics. It makes it feasible to perform reproducibility studies in MM Medicine clinics and by Educational Boards of the MM Societies [149].

On behalf of the *European Scientific Society of Manual Medicine* ESSOMM, the Research Advisory Center of the GSMM in 2019 carried out a literature search on current study results (2009-2019) on diagnostics and therapy in MM Medicine. Items for search: ("Manual Medicine" OR "Manual Therapy") AND (“functional” OR "musculoskeletal" OR "disorder"). The search identified 1,499 unique citations limited to humans. After screening titles and abstracts, 482 full text manuscripts were retrieved for further assessment, 216 of them were systematic reviews. The individual publications were subdivided by hand according to their target content: diagnostics (n=85), specific therapy (n=119), basics and safety (n=39).

In a recent systematic review, Beyer et al. including 67 publications conclude based on the available scientific material that a general evidence-based medicine level III is available, with individual studies reaching level II or Ib, which creates the prerequisite and the ability to fulfil tasks for a satisfactory or expected verification (validity) of MM diagnostic and therapeutic procedures [150]. Two studies are mentioned here as examples for good quality studies (level Ib), first focused on functional disorders and pain in the lower spine, the other on functional disorders of the head joints in babies:

The first is demonstrating a clear difference between patients with low back pain and subjects without back pain regarding their ability (in 5 of 6 tests) to actively control the movements of the low back [151]. The second used a setting with 202 infants at the age of 14-24 weeks with postural and movement findings, examined in four study centers using a standardized 4-item symmetry-score. Result: The single manual medicine treatment significantly improves postural and motor asymmetries in infants with articular and segmental dysfunctions tonic causing asymmetric positions [152].

A large systematic review, searching prognostic factors for musculoskeletal (MSK) pain in primary care, involves more than 48.000 participants with 18 different outcome domains. 51 studies were on spinal pain/back pain/low back pain, 12 on neck/shoulder/arm pain, 3 on knee pain, 3 on hip pain and 9 on multisite pain/widespread pain – total quality scores ranged from 5 to 14 (mean 11) and 65 studies (83%) scored 9 or more – provides new evidence for generic prognostic factors for MSK conditions in primary care. Such factors include pain intensity, widespread pain, high functional disability, somatization and movement restriction. This information can be used to screen and select patients for targeted treatment in clinical research as well as to inform the management of MSK conditions in primary care [153].

Recently, a literature search from the *European Scientific Society for Manuel Medicine* ESSOMM found 24 relevant systematic reviews or meta-analyzes related to manual therapy. The individual reviews are aimed at different therapy goals for different complaints in different parts of the body. The search results have not yet been evaluated coherently.

An update of the Bone and Joint Decade Task Force on Neck Pain and its Associated Disorders by the OPTIMa collaboration [154] concluded: Our review adds new evidence to the

Neck Pain Task Force and suggests that mobilization, manipulation (HVLA), and clinical massage are effective interventions for the management of neck pain. It also suggests that electroacupuncture, strain-counterstrain, relaxation massage, and some passive physical modalities (heat, cold, diathermy, hydrotherapy, and ultrasound) are not effective and should not be used to manage neck pain.

A double-blinded randomized controlled trial concerning spinal high-velocity low amplitude manipulation in acute nonspecific low back pain [155] where 47 subjects received spinal manipulation, showed in a subgroup of patients with acute nonspecific low back pain: *Spinal manipulation was significantly better than nonsteroidal anti-inflammatory drug diclofenac and clinically superior to placebo*.

Other reviews are dedicated to:

- Low back pain [156, 157]
- Neck pain and/or low back pain [158, 159]
- Upper limb pain [160]
- Knee pain [161, 162]
- Function of the temporomantibular joint [163, 164]

In practically all studies, there are limiting factors that limit the informative value. For example, one of the limiting factors is that there is often no distinction between manipulation and mobilization.

The results of this systematic review showed:

- Spinal manipulation, and mobilization, acupuncture, massage treatments were significantly more efficacious for neck or low-back pain than no treatment, placebo, physical therapy, or usual care in reducing pain.
- Spinal high velocity low amplitude procedures are cost-effective treatments to manage spinal pain when used alone or in combination with general practitioner care or advice and exercise compared to general practitioner care alone, exercise or any combination of these.
- Spinal high velocity low amplitude procedures have a statistically significant association with improvements in function and pain improvement in patients with acute low back pain.
- Preliminary evidence that sub-group specific manual therapy may produce a greater reduction in pain and increase in activity in people with low back pain when compared with other treatments. Individual trials with low risk of bias found large and significant effect sizes in favour of specific manual therapy.
- Upper cervical manipulation or mobilisation, and protocols of mixed manual therapy techniques presented the strongest evidence for symptom control and improvement of maximum mouth opening.
- Musculoskeletal manipulations are effective for the treatment of temporomandibular joint disorders and there is a greater effect for musculoskeletal manual approaches compared to other conservative treatments for temporomandibular joint disorders.
- The results of the available reviews and the evidence found on the effect of manual medical treatment form the basis for the inclusion of manual therapy in guidelines for the treatment of acute and chronic pain in the musculoskeletal system, especially in the spine, joints and muscles.

Further literature on evidence in MM medicine

165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192

SECTION VI: QUALITY IN EDUCATIONAL AND TRAINING IN MM MEDICINE

1. Initial situation

MM medicine has developed from empiric medical experience that in history has never been exactly defined. This might explain why education and training of physicians and surgeons in MM Medicine is quite variable all over the world. This was one of the reasons why in 2013 FIMM published the first edition of *the Guidelines on Basic Training and Safety* [193]. Since then, the quality of outcomes of many FIMM member societies has improved significantly. However, a common standard of training in MM medicine has not yet been realised. Nevertheless, the aim will not be to strive for a complete *unitée de doctrine* (doctrinal unity), as diversity is the prerequisite for further discussions and thus also for an improvement in quality. Nevertheless the need for some kind of standardisation also on quality in MM medicine remains evident [194]. The European Scientific Society for Manual Medicine (ESSOMM) addressed this issue in detail in 2015 in its submission to the European Union for Medical Specialists (UEMS) entitled *Training Requirements for the Additional Competence Manual Medicine for European Medical Specialists* [195].

2. Quality objectives

According to the World Health Organisation (WHO) quality of care is the degree to which health services for individuals and populations increase the likelihood of desired health outcomes [196]. It is based on evidence-based professional knowledge and is critical for achieving universal health coverage. As countries commit to achieving *health for all*, it is imperative to carefully consider the quality of care and health services. Quality health care can be defined in many ways but there is growing acknowledgement that quality health services should be:

- **effective** – providing evidence-based healthcare services to those who need them,
- **safe** – avoiding harm to people for whom the care is intended, and
- **people-centred** – providing care that responds to individual preferences, needs and values.

One of the intentions of these Guidelines is to provide support within the framework of MM Medicine that serves these objectives. The various and graduated contents of training and education in MM medicine will not be discussed in this chapter. These contents can be looked up in the previous chapters. There, the content qualities are discussed in detail.

One of the quality gaps in the concepts currently practiced in MM Medicine must nevertheless be addressed. Only a few countries have *educational programs* in MM medicine that are university-based. This affects research and teaching there where this has not yet been achieved yet.

3. Different aspects of quality

Three aspects of quality can be identified. They may be called quality of structure, process and outcome [197]. Quality standards in education are especially required for:

3.1. Personal qualification of trainers

3.1.1. Requested qualification of a trainer

A *trainer* would be a registered medical specialist recognized and registered to having additional MM competence at a minimum of a level 3 (specialist level or specialty level). They will have satisfied any relevant national requirements as regards accreditation, appraisal, or training to be a trainer. A *program (or course) director* would be someone who has been or is a trainer and who has considerable knowledge and experience of training physicians or surgeons. Trainers and program or course directors should preferably be in active clinical practice and engaged in training in a training centre or network.

Their work would be reviewed within the training centre or network on a regular basis at staff appraisals or equivalent procedures but in any case, it would be a requirement that their training activities are reviewed regularly.

3.1.2. Core competencies for trainers

A trainer shall be:

- Familiar with all aspects of the overall MM curriculum as it relates to practice within their country or their society.
- Experienced in teaching and in supporting learners.
- Skilled in identifying the learning needs of their trainees and in guiding the trainees to achieve their educational and clinical goals.
- Able to recognize trainees whose professional behaviours are unsatisfactory and initiate supportive measures as needed.
- Trained in the principles and practice of medical education.

3.1.3. Quality management for trainers

It is presumed that trainers and program or course directors will have their job description agreed with their employer which will allow them sufficient time for support of trainees and in the case of program or course directors, sufficient time for their work with trainers.

It would be unusual for a single trainer to have more than 14 trainees in a course; more trainees would warrant more trainers to maintain this ratio. The number of trainees would determine the amount of time each day that would be allocated to their individual support.

Trainers and program or course directors will collaborate with trainees, the program or course director and their Institution to ensure that the delivery of training is optimal. Feedback from trainees will assist in this regard.

3.2. Quality of the organisation or institution providing the education

In order to guarantee structural quality, a number of requirements must be met.

- Definition of participants to be accepted.
- Selection of teachers.
- Presentation of a educational program.
- Providing of room facilities, treatment-tables, time-schedules, media etc.
- Controlling of presence of participants, the time schedules for lectures, evaluate the individual training and provide the discussion of the participant's questions during the courses.
- Providing methods to check the outcome and to accomplish the results for the participants (multiple-choice questionnaires, verbal or written assessments).
- Standardised evaluation of every course, with information to the teacher.
- Producing certificates of participation with all necessary information.
- Transparency of all external sponsoring – sponsoring may not influence the contents of teaching in any respect.
- On-demand presentation of all information regarding the teaching towards the governmental health care institutions or towards external quality organisations.

A *training centre* is a place or a number of places where trainees are able to develop their MM competence in courses. Such provision may include sites that are condition specific and thus not offer a wide clinical experience such as that provided by a large centre. Thus, MM training may take place in a single institution or in a network of institutions working together, to provide training in the full spectrum of clinical conditions and skills detailed in the curriculum. This should preferably include a hospital or institution that provides academic activity and is recognized for training with favour in rehabilitation or orthopaedics.

It would be disadvantageous for a trainee to have only one trainer during their entire training period. It would be more usual for a trainee to have a number of named trainers with whom they work in the different courses. It is not a requirement that a training centre is also an academic centre but it is desirable that a training centre would have strong academic links and contribute to research.

4. Quality tools in MM medicine [q]

4.1. Quality tools in MM medicine training

Within the framework of the tools available for promoting quality in MM training, 3 levels can be identified.

4.1.1. Quality level 1: Postgraduate education

- Multi-modular structure with continuous learning progress checks.
- Teaching of textbook-based techniques.
- Participant surveys after every module.
- Ongoing further development of the educational program.
- Continuous further development of learning content and quality monitoring.
- Compulsory learning group activities and logging.
- Two assessments to be passed (written and practical).
- Top trainers as lecturers and self-checking of competences.

4.1.2. Quality level 2: Re-certification

- High-quality educational program: tutorials, training circles, updates, and congresses.
- Multi-stage reminder system to remind title holders of their educational obligations.
- Quality monitoring.
- Recognition guidelines for external educational courses.
- Compulsory continuing education, which is monitored.

4.1.3. Quality level 3: Teacher education

- Control of skills and abilities.
- Periodic performance appraisal.
- Multi-level teaching skills (level 1 and level 2).

The quality tools in MM medicine training described here are reflected in **Fig. 6** below.

[q] In 2019, the Executive Board of the Swiss Medical Association for Manual Medicine (SAMM) dealt extensively with quality in MM medicine in an internal document. The following tables and charts are taken from this work and have been adapted here.

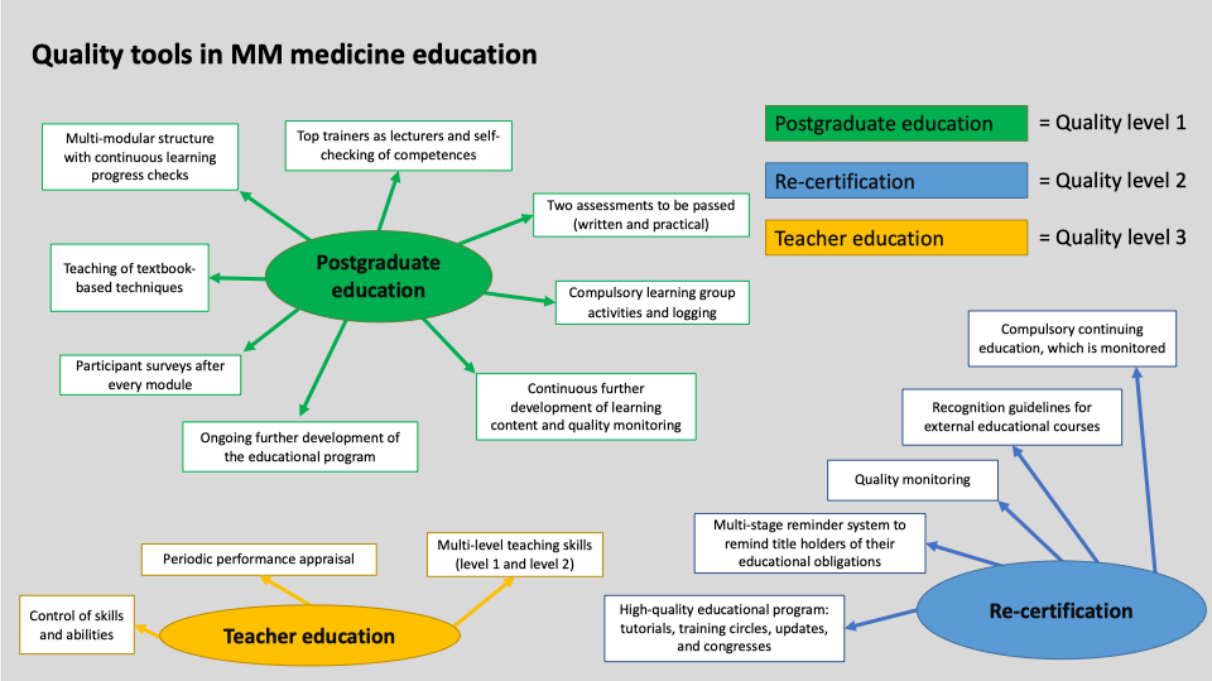

Fig. 6: Quality tools in MM medicine education.

4.2. Quality tools of providers of MM training

4.2.1. Executive Board

- Quality and progress controls in the strategic path.
- Professional policy positioning on MM medicine issues.
- Exchange with expert networks, universities and medical associations.
- Responsibility towards continuing and postgraduate education, re-certification and the awarding of titles.
- Selection of the best performing teachers.
- Expansion of the partner network.
- Implementation of a status-appropriate concept fo exams.
- Regular meetings and dialogue with the specialised boards.
- Election proposal of the members of the specialised boards.

4.2.2. Continuing Education Board

- Evaluation and recognition of educational courses.
- Re-certification.
- Assessment of the claim for re-certification.
- Assessment of externally acquired credits.
- Recognition of foreign continuing education diplomas.
- Regular meetings and dialogue with the Executive Board and the Postgraduate Education Board.

4.2.3. Postgraduate Education Board

- Preparation, evaluation and documentation of the assessments.
- Quality controls for postgraduate and continuing education.
- Congress organisation and scientific programs.
- Teacher education with multi-level control system.
- Definition of teaching and learning content in MM medicine.
- Taking Quality measures and monitoring.
- Organisation of further education for teachers.
- Regular meetings and dialogue with the Executive Board and the Continuing Education Board.

The quality tools of providers of MM medicine training described here are reflected in **Fig. 7** below.

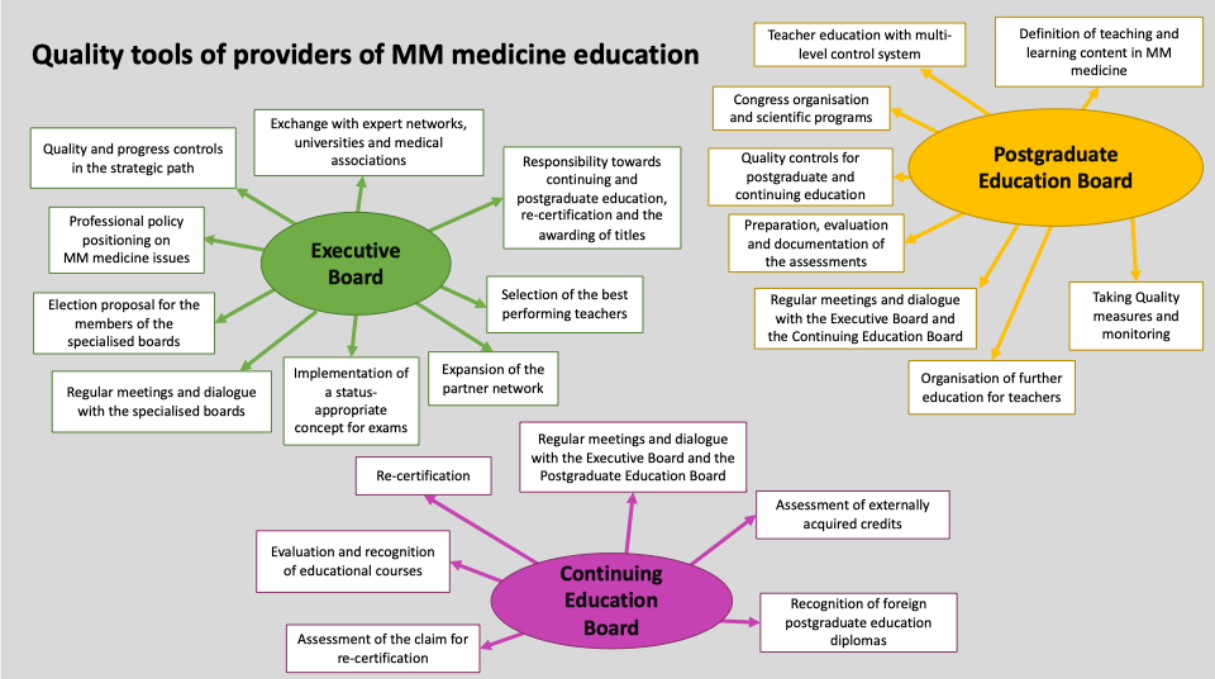

Fig. 7: Quality tools of providers of MM medicine education.

4.3. Further quality tools

- Co-operation and exchange between expert networks, universities and medical associations.
- Co-operation with international umbrella societies in MM medicine.
- Clearly structured education in MM medicine.
- Regularly organised congresses or conventions.

- Co-operation with a journal on MM medicine and developments in medical science.
- Publishing on MM medicine.
- Creation and evaluation of surveys on training, congress and lecturer services.
- Maintaining a directory for referring clinics and practices specialising in MM medicine.
- Regular information on offers and innovations via newsletter.
- Provision of congress documents, lectures and presentations on the society's website.

Further quality tools in MM medicine described here are reflected in **Fig. 8** below.

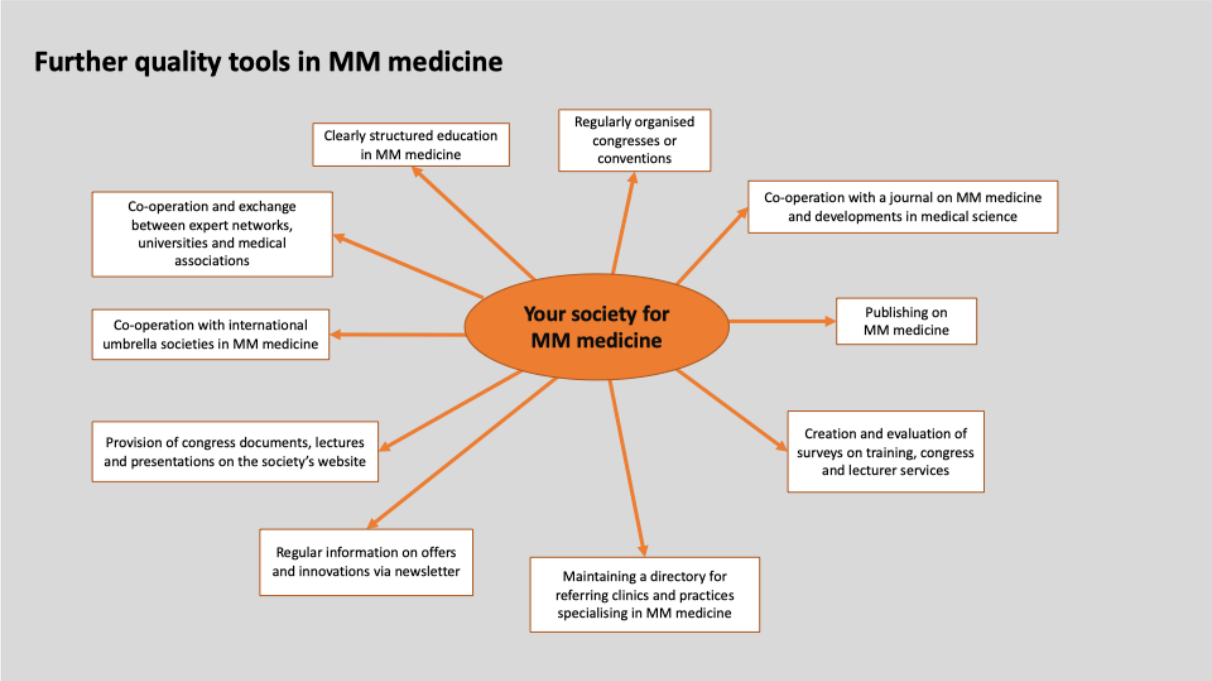

Fig. 8: Further quality tools in MM medicine.

5. Competent and independent quality institution

Every university, institute or organisation that wants to become involved in medical education in the future needs accreditation and audit-based certification or certification for this task. Accreditation or audit-process for certification will be provided only by independent organisations that are in the usual rule authorised by the national health care authorities which are in charge of the respective legal government. Thus any organisational or fiscal link between the *external quality assurance provider* and the one to be investigated threatens the accreditation or certification up to the loss of the same.

To avoid being checked by *non-medical technicians* who are not able to define evidence-based indicators for medical education, it is necessary for the international MM community to have an independent, but nevertheless competent scientific external quality assurance partner. This organisation must be formally recognized by the stakeholders of the health care system to be competent to independently check the regulated procedures. After a positive audit-process, it is enabled to give accreditation or certification.

Such an international institution has not yet been established for MM Medicine.

SECTION VII: GLOSSARY

The glossary contains only expressions of this document.

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 [198].

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 assessment based on specialty level.

Competency-based educational training | Training method that focuses on the assessment of professional competences and how the apprentice deals with them (e.g. the assessment of knowledge, skills and attitudes).

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.

Convergence | In the neural system: Afferents of different tissues converge to dorsal horn neurons in the spinal cord and in the medulla oblongata. In biomechanics: position of the facet joints (convergence resp. divergence).

Counternutation | Counternutation is the minimal movement of the sacrum. The base of the sacrum shifts backwards and upwards, the tip frontwards and slightly downwards (0.5°-1.5°). The countermovement is called nutation.

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 neurophysiological principles. In particular, reversible somatic dysfunction and its differential diagnosis related to reversible dysfunction is sought by MM medicine practitioners.

Dry needling | Intramuscular application of acupuncture needles in order to release contracted muscle areas (myofascial trigger points) by mechanical micro-stimulation and microtraumatization.

Free direction | Free direction is the direction of movement in an articular system in which the intensity of nociceptive afference is not enhanced. It is also the direction of “ease” which is the relative palpable freedom of motion of an articulation or tissue. Opposite: The direction of movement provoking increase of nociception (direction of painful movement) or of “bind” which is palpable resistance to motion of an articulation or tissue.

Global range of motion | See range of motion.

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.

Joint play | All passive movements of a joint such as roll, glide, distraction and spin combinations which are independent of voluntary muscle contraction [199].

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 while in the USA, it is a generic term for any MM technique.

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 FIMM General Assembly adopted this definition in 2005. According to the country and the different linguistic customs the terms *Musculoskeletal Medicine*, *Myoskeletal Medicine*, *Neuromusculoskeletal Medicine*, *Orthopaedic Medicine*, *Osteopathic Manipulative Medicine* in the USA*, Manual Therapy* in the Russian Federation and others are used interchangeably with the term *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 [200].

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 or Traumatology, prior to the Manual Medicine Training.

MM medicine | The term defines all scopes of Manual Medicine and the non-invasive part of Musculoskeletal Medicine (including Osteopathic Manipulative Treatment [USA] and Manual Therapy [Russian Federation]).

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 seminary 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.

Multi-receptive dorsal horn neuron | Is a dorsal horn neuron especially represented in lamina V to which a variety of afferents with different qualities and from different organ systems (joints, muscles, skin, viscera, etc.) converge [201, 202, 203, 204, 205, 206]. This results in the first summary of information of the dorsal horn. Synonym: Spinothalamic projection neuron. Synonym: WDR Neuron.

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 [207]. 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 [208].

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

Neuromusculoskeletal Medicine (NMM) | A specialty field in the United States that emphasizes the incorporation of osteopathic manual diagnosis and osteopathic manipulative treatment into the evaluation and treatment of the nervous, muscular, and skeletal systems in their relationships to other systems of the body as well as the whole person. It requires a primary Osteopathic Neuromusculoskeletal Medicine (ONMM) residency disciplined in the neuromusculoskeletal system, its comprehensive relationship to other organ systems, and its dynamic function of locomotion.

NMM | See: Neuromusculoskeletal Medicine.

NMT | See: Neuromuscular techniques.

Noci-generator | Noci-generator (pain generator) is an organ or anatomical region that contains C-fibres. It gives information to the central nervous system that there are ongoing activities threatening the body, e.g. tissue damage inflammation, mechanical irritation etc.

Noci-reaction | Noci-reaction (pain reaction) is the response of connective tissue, sympathetic and parasympathetic system, endocrine system, motor system and spinal, subcortical and cortical structures to noci-afferent input to the body (hurt, heat, acid mechano-trauma).

Nutation | Nutation is the minimal movement of the sacrum. The base of the sacrum shifts forwards and downwards, the tip backwards and slightly upwards (0.5-1.5 °). The countermovement is called counternutation.

OMT | See: Osteopathic Manipulative Treatment.

ONMM | See: Neuromusculoskeletal Medicine.

Osteopathic Manipulative Treatment (OMT) | The therapeutic application of manually guided forces by an osteopathic physician to improve physiologic function and/or support homeostasis that has been altered by somatic dysfunction. OMT employs a variety of techniques.

Osteopathic principles and practice | A concept of health care supported by expanding scientific knowledge that embraces the concept of the unity of the living organism's structure (anatomy) and function (physiology). Osteopathic philosophy emphasizes the following principles: (1) The human being is a dynamic unit of function; (2) The body possesses self-regulatory mechanisms that are self-healing in nature; (3) Structure and function are interrelated at all levels; and (4) Rational treatment is based on these principles [209].

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

Painful minor intervertebral dysfunction | A term used in some European countries to describe the nature of painful dysfunction.

Pre-tensioning | Is part of the preparation of an articular structure in order to perform HVLA thrust.

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 two different end-phase movement 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. See also somatic dysfunction.

Segmental cellulo-periosteal-myalgic syndrome | Painful minor intervertebral Dysfunction causes reflex reactions within the same metamer leading to spinal somatic dysfunction (french: *syndrome cellulo-périosto-myalgique segmentaire*).

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.

Segmental irritation | Activation of afferent neurons followed by noci-reaction.

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.

Sensitization | The receptive fields are enlarged, the threshold in the first (peripheral) or second (central) neuron is lowered leading to hyperalgesia.

Soft tissue treatment techniques | A group of direct techniques that usually involve lateral stretching, linear stretching, myofascial release, visceral technique, deep pressure, traction and/or separation of muscle origin and insertion while monitoring tissue response and motion changes by palpation.. Historically considered a form of myofascial treatment.

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 responsive to MM techniques.

Spinothalamic projection neuron | See: multi-receptive dorsal horn neuron.

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.

Structure- and process-based educational training | Training method that focuses on the assessment of time spent and credits awarded (e.g. 300 hours and 30 credits).

Tender point | Small, hypersensitive points in the myofascial tissues of the body that do not have a pattern of pain radiation. These points are a manifestation of somatic dysfunction and are used as diagnostic criteria and for monitoring treatment.

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

Trial mobilization | A testing maneuver to predict possible adverse reactions of MM treatments.

Trial tensioning | See: trial mobilization.

Trigger point, myofascial | A small hypersensitive site that, when stimulated, consistently produces a reflex mechanism that gives rise to referred pain and/or other manifestations in a consistent reference zone that is consistent from person to person [210].

Undirected movement dysfunction | The presence of more than one movement direction in an articular system causing pain-reaction.

WDR neuron | Wide dynamic range neuron, special kind of dorsal horn multi-receptive neuron predominantly found in lamina V (see convergence). Synonym: Spinothalamic projection neuron. Synonym: Multi-receptive dorsal horn neuron.

ANNEXES

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

1.1. Curriculum of the Swiss Society for Manual Medicine (SAMM)

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 programs, 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 Program 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. 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).

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. The Master's programme is in the concept phase and has not yet been implemented so far.

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 approaches 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

MAS (Master of Advanced Studies)
„Professional Manual Medicine“
Experts and Teachers: Theses/Research *15 ECTS*
(*Total 62 ECTS approximately 1’800 hours of professional education*)

Advanced techniques in diagnostics and therapy, internal instructor course		Educational methods		Clinical auditing	
Module 9	*5 ECTS*	**Module 10**	*5 ECTS*	**Supervision**	*5 ECTS*

DAS (Diploma of Advanced Studies)
„Manual Medicine“
Certificate of Proficiency SAMM
32 ECTS (300 educational units / 750-900 hours of professional education)

Regional pain patterns and total revision		Practical clinical work with patients and total revision		Case presentations / clinical patterns	
Module 7	*4 ECTS*	**Module 8**	*4 ECTS*	**Final Exam**	*MC, OSCE*
Lumbar and pelvic HVLA thrust techniques		Cervical and thoracic HVLA thrust techniques		Advanced techniques and revision Trigger point techniques	
Module 4	*4 ECTS*	**Module 5**	*4 ECTS*	**Module 6**	*4 ECTS*

Intermediate Exam *(MC) first day of Module 4*

CAS (Certificate of Advanced Studies)
„Basics in Manual Medicine“
12 ECTS (125 educational units / 250-300 hours of professional education)

Cervical Spine, shoulder and arm Diagnostics, mobilisation, NM inhibition		Lumbar spine, pelvis and leg Diagnostics, mobilisation, NM inhibition		Thoracic spine and ribs Diagnostics, mobilisation, NM inhibition	
Module 1	*4 ECTS*	**Module 2**	*4 ECTS*	**Module 3**	*4 ECTS*

Fig. A: Curriculum of the Swiss Medical Society for Manual Medicine SAMM in 2012. The Master's programme is in the concept phase and has not yet been implemented so far.

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-Weiterbildungs-ordnung* [WBO]) of the German Federal Chamber of Physicians (*Bundesärztekammer*)

April 2005

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Editorial team “Course manual for Manual Medicine / Chirotherapy”
Dr. med. Peter Bischoff
Dr. Karl-Sell-Ärzteseminar Neutrauchburg (MWE) e.V.
Riedstraße 5
D-88316 Isny-Neutrauchburg
Germany

Prof. Dr. med. habil. Lothar Beyer
Deutsche Gesellschaft für Manuelle Medizin DGMM) e.V.
Geschäftsstelle im Ärztehaus Mitte
Westbahnhofstraße 2
D-07745 Jena
Germany

Other contributors
Dr. med. Karla Schildt-Rudloff
Ärztevereinigung für Manuelle Medizin (ÄMM) e.V.
Frankfurter Allee 263
D-10317 Berlin
Germany

Dr. med. Matthias Psczolla
Ärzteseminar Hamm-Boppard (FAC) e.V.
Obere Rheingasse 3
D-56154 Boppard
Germany

Dr. med. Hermann Tlusteck
Schleesener Straße 23
D-06844 Dessau
Germany

Dr. med. Michael Graf
Gardenfeldstraße 6
D-54295 Trier
Germany

Dr. med. Alfred Möhrle
Königsteiner Str. 68
D-65812 Bad Soden
Germany

For the German Federal Chamber of Physicians (Bundesärztekammer)
Dr. med. Annette Güntert
Dr. med. Heike Ebeling
Anke Gabler

English translation
Caroline Mavergames

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, visceroverteb ral 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 pain-reaction ♦ 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

7. References

Basic literature

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Janda V (2000) Manuelle Muskelfunktionsdiagnostik, 4. Aufl. Urban & Fischer, München

Sachse J (2001) Extremitätengelenke - Manuelle Untersuchung und Mobilisationsbehandlung für Ärzte und Physiotherapeuten, 6 Aufl. Urban & Fischer, München

Sachse J, Schildt-Rudloff K (2000) Manuelle Untersuchung und Mobilisationsbehandlung der Wirbelsäule. 3. Aufl. Urban & Fischer, München

Simons DG, Travell JG, Simons LS (1999) Myofascial Pain and Dysfunction. The Trigger Point Manual. Volume 1. Upper Half and Body, Philadelphia, Williams & Wilkins

Simons DG, Travell JG, Simons LS (1999) Myofascial Pain and Dysfunction. The Trigger Point Manual. Volume 2. The Lower Extremities, Philadelphia, Williams & Wilkins

1.3. Inter-university diploma (DIU) in manual medicine and osteopathic medicine in France

THEORETICAL INSTRUCTION

1. FUNDAMENTALS OF ANATOMY, BIOMECHANICS AND CINESIOLOGY

- Notion of Biomechanics (mobile segment)
- Upper cervical spine and occipito-cervical hinge
- Lower cervical spine and cervicothoracic hinge
- Thoracic spine and thoraco-lumbar hinge and thoracic parietum (ribs, sternum)
- Lumbar spine
- Sacroiliac joint
- Scapular belt
- Pelvic girdle
- Elbow, wrist, hand
- Knee
- Ankle and foot
- Segmental and truncal innervation of the limbs and trunk
- Spinal and peripheral musculature, Diaphragm (list of muscles) Orthostatism – Posture

2. FUNDAMENTALS OF PHYSIOLOGY AND NEUROLOGY

- Physiology of pain
- Physiology of the neuromuscular spindle
- Skin, muscle and joint receptors
- Basic neurological semiology: sensitivities, motor skills, postural tone
- Balance disorders, dizziness and accouphenes
- Myofacial pain and trigger points
- Experimentally induced pain of vertebral origin Neurophysiological data on vertebral manipulation
- Human walking (basic concepts)
- Electromyography (basic concepts)

3. FUNDAMENTALS OF MANUAL MEDICINE

- Osteopathy, chiropractic, history and philosophy
- History of manual medicine and osteopathy in France
- Osteopathy in France, Europe (UEMMOO) and the rest of the world (FIMM, IAMMM etc.)
- Osteopathic legislation
- The different types of manual therapy and osteopathy
- Definition of manipulations, mechanisms of action
- Principles of segmental vertebral examination, star diagram (Maigne - Lesage)
- The concept of Minor Intervertebral Disruption (DIM) (R. Maigne)
- The cellulo-teno-periosto-myalgic reflex syndrome of vertebral origin (SCTM) (R. Maigne)
- Myofascial pain and disorders (Travell and Simons)

4. BASICS OF BONE AND JOINT MANIPULATION

- Indications for handling
- Contraindications of manipulations
- Handling accidents
- Different types of handling
- Application rules for handling Handling equipment
- Assessment of manipulations Regulations – Medical liability

5. CLINIC

- Questioning
- Palpatory anatomy
- Spinal and peripheral clinical examination Neurological examination
- Chiropody examinationPostural examination
- Orthoptic and dental examination

6. MECHANICAL PATHOLOGIES OF THE MUSCULOSKELETAL SYSTEM

- Common low back pain
- Non-common low back pain
- Thoracolumbar junction syndrome (R. Maigne)
- Sciatica and sciaticalgia L5 and S1
- L3 and L4 crural neuralgia and cruralgia
- Femorocutaneous and abdominogenital nerve neuralgia
- Residual pain after disc surgery, nucleolysis or nucleotomy Pathologies of the lumbopelvic-femoral complex
- Narrow spinal canal
- Lumbar instabilityHyperlordosis – Spondylolisthesis – Spondylolysis
- Cauda equina syndrome – Myelopathies
- Sacral pain, coccygodynia
- Common thoracic spinal pain
- Thoracic spinal pain of cervical origin
- Thoracic spinal pain of visceral origin
- Parieto-thoracic syndromes
- Headaches of cervical origin
- Acute cervical pain
- Whiplash injuries and post-traumatic cervical syndromes
- Cervicobrachial neuralgia
- Headaches, migraines
- Dizziness, balance disorders
- Vertebrobasilar insufficiency
- Scapular elevator syndrome
- Scoliosis
- Thoracic kyphosis, hypercyphosis in children
- Spinal growth dystrophy

- Inflammatory rheumatism
- Non-mechanical spinal diseases
- Piriformis muscle syndrome
- Sacroiliac derangements
- Inequality of lower limb length
- Transitional zone pain syndrome
- After-effects of spinal trauma and fractures
- Pathologies of the temporomandibular joint
- Algo-dysfunctional syndrome of the manducatory apparatus or Costen's syndrome
- Diagnosis and treatment of hip and buttock pain
- Osteoarthritis
- Joint stiffness and hyperlaxity

7. TRAUMATIC MECHANICAL DISORDERS OF THE MUSCULOSKELETAL SYSTEM

- Knee sprains and sprain sequelae
- Sprains and sequelae of tibiofibular and ankle sprains
- Tendinopathies and bursitis
- Anterior tibial syndrome – Periostitis – Fatigue fracture
- Foot pathologies
- Shoulder dislocations and trauma and their sequelae
- Chronic tendon damage of the shoulder
- Wrist sprain and carpal pathology
- Medial and lateral epicondylalgia
- Pubalgia
- Periostosis and bone fatigue fracture
- Osteochondrosis of growth
- Anterior hip impingement, Iliotibial band syndrome
- Patellar syndrome
- Sub-acromial conflicts
- Rotator cuff injuries
- Pathologies of the carpus
- Pathology of the thumb and fingers
- Compartment syndrome

8. PARACLINIC

- Osteoarticular imaging (spine, upper and lower limbs): ultrasound, X-rays, CT, MRI, scintigraphy
- Biological tests: routine, specialised, etc.
- Electromyography

9. NON-MECHANICAL PATHOLOGIES OF THE MUSCULOSKELETAL SYSTEM

- Inflammatory rheumatism (basic concepts)
- Bone demineralisation
- Compression syndromes of the upper limbs

- Compression syndromes of the lower limbs
- Complex regional pain syndrome type I (Algoneurodystrophies)
- Fibromyalgia, polyalgic syndrome, spasmophilia, hysteria, depression, chronic fatigue
- Walking disorders
- Thoracic outlet syndrome
- Elhers Danlos syndrome
- Superior fibular tibial Syndrome (SFTS)

10. THERAPIES COMBINED WITH MANUAL MEDICINE

- Analgesics and NSAIDs
- Local medical treatments: infiltrations, ultrasound-guided infiltrations, mesotherapy, topical gels
- Spinal traction
- Spinal and limb orthoses
- Balneotherapy
- Massokinesitherapy: techniques, application, prescribing, follow-up
- Physiotherapy: electrotherapy, techniques, indications, validation
- Spinal physiotherapy
- Disc surgery, nucleolysis, nucleotomy
- Arthodesis, disc prosthesis
- Thai Chi
- Botulinum toxin
- Infiltrations

PRACTICAL INSTRUCTION

1. SEMIOLOGY AND CLINICAL EXAMINATION

- Orthopaedic clinical examination, manual medicine and osteopathy
- Static and dynamic spine, complete examination, posture
- Lumbar and lumbosacral spine
- Cervical and cervicothoracic spine
- Thoracic spine
- Sacroiliac hips
- Knees
- Ankle and foot
- Shoulder
- Elbow, wrist, hand
- Muscle Testing
- Neurological examination
- Vascular tests

2. SOFT TISSUE TECHNIQUES

- Massages, various techniques
- The skin rolling
- Neuromuscular facilitation techniques
- Myofascial techniques: resting, stretching, contracted-released, neuromuscular, untwisting, inhibition: applied to the trunk and limbs
- List of muscles you need to know

3. MOBILISATION OF THE SPINE – GENERAL OSTEOPATHIC TREATMENT

- Lumbar and lumbopelvic
- Dorsal and dorsolumbar
- Cervical and cervico-dorsal

4. BASIC SPINAL MANIPULATIONS

- Lumbar in kyphosis
- Lumbar lordosis
- Thoracic epigastric
- Thoracic rotation while seated at end of table
- Thoracic in supine position (unwound)
- Upper thoracic in sternal support Cervical in latero-flexion
- Cervical in rotation
- Cervicothoracic junction in latero-flexion, seated
- Cervicothoracic junction with chin pivot
- Cervical in rotation, seated (anterior hand)
- Thoraco-lumbar at the knees (with stool)
- Direct thoracic manipulations (recoil)
- Parieto-thoracic (rib) manipulations
- Manipulation of the sacroiliac joints

5. MOBILISATIONS – GENERAL OSTEOPATHIC TREATMENT AND LIMB MANIPULATIONS

- Sternoclavicular and acromioclavicular
- Shoulder
- Elbow
- Wrist, hand, thumb and fingers
- Hip
- Knee and superior tibiofibular syndesmosis, ankle and foot, toes

TREATMENT OF MAJOR SYNDROMES

- Lumbopelvic-femoral syndrome
- Craniocervical syndrome
- Parieto-thoracic syndrome
- Scapular and upper limb pathologies
- Pelvic and lower limb pathologies
- Related pathologies

2. Examples of Master programs in MM medicine

2.1. Master Degree in Manual Musculoskeletal Medicine of the University of Valencia

In co-operation with the Spanisch Society for Orthopedic and Manual Medicine SEMOYM

FIRST EDITION

TYPE OF DEGREE: Master of Advanced Studies (MAS). 60 ECTS in 2 years. 360 on-site teaching hours. 240 home study hours of provided material. Remaining hours: self-study.

ADDRESSED TO: Physicians. Specially specialists and residents in Rehabilitation, Orthopaedic Surgery, Anaesthetics, Obstetrics & Gynaecology, Urology, Rheumatology, Neurology, General Practitioners, Sports Medicine and any physician aiming for a deeper and more integrative approach to pain.

TIMETABLE: 19 three-day weekends.

VENUE: Valencia (Spain)

DIRECTORS:

Javier Miranda Alonso, MD PhD. Professor and Chair of Physiology, University of Valencia.

Pedro Castells Ayuso, MD. Consultant in Rehabilitation, Quirón and IMKSE Clinics, Valencia. Trainer in MM. Member of SEMOYM Education Board

Francisco Javier Martínez Romero, MD. Consultant Orthopaedic Surgeon, Valdepeñas General Hospital, Ciudad Real. Trainer in MM. Member of Education Board.

Lourdes Ruiz Jareño, MD PhD. Head of Department of Rehabilitation, Sagunto University Hospital, Valencia. Trainer in MM. Director of SEMOYM SEMOYM Education Board.

Victoria Sotos Borrás, MD. Head of Department of Rehabilitation, Vinalopó University Hospitals, Elche, Alicante. Professor of Anatomy and Physiology at CEU University Elche. Trainer in MM. Member of SEMOYM Education Board.

SUBJECTS:

INTRODUCTION TO MANUAL MEDICINE
LUMBAR SPINE AND LOWER LIMBS
CERVICAL SPINE AND UPPER LIMBS
MISCELLANEA

FIRST YEAR

SEMINAR #1: INTRODUCTION TO MANUAL MEDICINE (Part 1)

1 weekend in December

- Introduction to Manual Medicine: historical context and approaches.
- Medical utility of MOM: diagnosis and modalities of treatment. Mechanisms of action.Indications. Contraindications.
- Definition of Painful Minor Intervertebral Dysfunction (PMID).
- Main painful syndromes of vertebral origin.

WORKSHOPS:

- Segmental examination.
- Cellulo-teno-myalgic syndrome.
- Patient's clinical history in MM.

SEMINAR #2: INTRODUCTION TO MANUAL MEDICINE (Part 2)

1 weekend in January

- Pain in musculoskeletal system: pathways and types. Referred pain. Psyche and locomotor system.
- Physiology of tone and muscle contraction and its meaning in manual medicine. Types of muscle fibres. Muscular adaptability.
- The skin and fascia. Bio tensegrity.

WORKSHOPS:

- Development of palpatory skills. Muscle tone.
- Basic mobilizations.
- Muscular energy techniques: post isometric relaxation, reciprocal inhibition and correction spontaneous by position.

SEMINAR 3: INTRODUCTION TO MANUAL MEDICINE (Part 3)

1 weekend in February

- Physiological and pathophysiological concepts in bone tissue.
- Musculoskeletal system: red flags.
- Complementary examinations in MM. Basic concepts in diagnostic imaging.
- Anatomy and biomechanics of the thoracic spine and ribs.

WORKSHOPS:

- Segmental diagnosis.
- Basic manipulations of the thoracic spine and ribs.
- Patient's consent form in MM.

SEMINAR #4: LUMBAR SPINE AND LOWER LIMBS (Part 1)

1 weekend in March

- Anatomy and biomechanics of thoracolumbar junction, lumbar spine, sacral and coccygeal spine and sacroiliac joints.
- Types of low back pain. Clinical pictures and differential diagnosis. Low back pain of lumbar, thoracolumbar and sacroiliac origins.

WORKSHOPS:

- Diagnostic tests in lumbar pathology.
- Basic diagnostic tests in sacroiliac pathology.
- Muscular and soft tissue techniques of the lumbosacral spine and sacroiliac joints
- Non-forced techniques of the lumbosacral and sacroiliac spine
- Basic manipulations of the lumbar spine and sacroiliac joints.

SEMINAR #5: LUMBAR SPINE AND LOWER LIMBS (Part 2)

1 weekend in April

- Anatomy and biomechanics of the lower limb.
- Types of manual techniques in lower limbs.
- The Kaltenborn concept.
- Diagnosis and treatment of main dysfunctions in the lower limbs.

WORKSHOPS:

- Mobilizations, neuromuscular techniques and basic manipulations of the lower limb.

SEMINAR #6: CERVICAL SPINE AND UPPER LIMBS (Part 1)

1 weekend in May

- Anatomy and biomechanics of the craneo-cervical junction, cervical spine and cervical-thoracic junction.
- Headache of cervical origin, cervical pain, shoulder pain of cervical origin, dysfunction of the first rib and thoracic back pain of cervical origin. Clinical pictures and differential diagnosis.

WORKSHOPS:

- Cervical and dorsal spine diagnostic tests. First rib.
- Muscular and soft tissue techniques for cervical and thoracic spine.
- Non-forced techniques for the cervical spine.

SEMINAR #7: CERVICAL SPINE AND UPPER LIMBS (Part 2)

1 weekend in June

- Anatomy and biomechanics of the upper limb.
- Clinical examination of the upper limb.
- Diagnosis and treatment of the main dysfunctions of the upper limb.

PRACTICES:

- Mobilizations and manipulations of the shoulder: sternoclavicular, acromioclavicular, scapulo-thoracic and gleno-humeral joints.
- Mobilizations and manipulations of the elbow.
- Mobilizations and manipulations of the wrist and hand.

SEMINAR #8: INTRODUCTION TO MANUAL MEDICINE (Part 4)

1 weekend in September

- Body posture and its importance.
- Chain reactions in musculoskeletal system.
- Myofascial syndrome: definition and clinical diagnosis. Nature and biochemistry of the myofascial trigger point. Dry needling Fascia treatment.
- Prescription of physical exercise and physiotherapy in affections of the musculoskeletal system.

WORKSHOPS:

- Palpation and infiltration of myofascial trigger points. Dry needling.
- Neuromuscular and fascial techniques.
- Assessment and diagnosis of postural disorders and muscular chains.

SEMINAR #9: MISCELLANEA (Part 1)

1 weekend in October

- Research in Manual Medicine.
- How to orientate an end-of-Master's project?
- Clinical integration.

SECOND YEAR

SEMINAR #1: LUMBAR SPINE AND LOWER LIMBS (Part 3)

1 weekend in November

- Spondylogenic syndromes: concept and application in the lumbar spine.
- Differential diagnosis between painful radicular and pseudo radicular syndrome.
- Concepts for advanced spinal manipulation.

PRACTICES:

- Manipulations of the lumbar spine and thoracolumbar junction.
- Review of mobilizations and soft tissue techniques in the thoracic and lumbar spine.

SEMINAR #2: LUMBAR SPINE AND LOWER LIMBS (Part 4)

1 weekend in December

- Lumbo-pelvic-femoral complex.
- Dysfunction of the sacroiliac joint and coccyx.
- Pelvic pain.

WORKSHOPS:

- Diagnostic tests in sacroiliac dysfunction.
- Manipulations of the sacroiliac joint and coccyx.
- Review of mobilizations and soft tissue techniques.

SEMINAR #3: LUMBAR SPINE AND LOWER LIMBS (Part 5)

1 weekend in January

- Deepening in the diagnosis and treatment of the main dysfunctions of the lower limb: femoro-acetabular impingement, iliotibial band syndrome, meniscal block, tibio-talar impaction syndrome, etc .
- Lower limb clinical integration seminar.

WORKSHOPS:

- Advanced mobilizations and neuromuscular techniques in the lower limbs.
- Advanced manipulations of the lower limbs.

SEMINAR #4: CERVICAL SPINE AND UPPER LIMBS (Part 3)

1 weekend in February

- Anatomy and biomechanics of the upper cervical region, including craneo-cervical junction
- Differential diagnosis of craneo-cervical pain: vertebral dysfunction, headache, dysfunction of the temporomandibular joint (TMJ).
- Differential diagnosis of balance dysfunctions and vertigo.

WORKSHOPS:

- Mobilization and soft tissue techniques in cranio-cervical junction and upper cervical segments.
- Manipulations of cranio-cervical junction and upper cervical segments.

SEMINAR #5: CERVICAL SPINE AND UPPER LIMBS (Part 4)

1 weekend in March

- Anatomy and biomechanics of the mid-cervical region and cervical-thoracic junction.
- Differential diagnosis of cervical and dorsal pain. Cervical spondylogenic syndromes.
- Dysfunction of the first rib.

WORKSHOPS:

- Non-forced and soft tissue techniques in mid and lower cervical spine.
- Manipulations of the mid and lower cervical spine.
- Manipulations of the cervical-thoracic junction.
- Manipulations of the first rib.

SEMINAR #6: CERVICAL SPINE AND UPPER LIMBS (Part 5)

1 weekend in April

- Differential diagnosis between cervico-brachialgia, referred pain in the upper limb and pain with origin in the upper limb itself.
- Diaphragm and rib cage.
- Chain reactions in the musculoskeletal system. Janda concept. Lewitt concept.
- Interrelation between PMID and visceral pain.
- Medicine of the autonomic nervous system. The autonomic nervous system (ANS). Extracellular matrix and Pischinger basic system. Interference fields.

WORKSHOPS:

- Review of cervical and thoracic manipulations and rest of manual techniques in upper limbs.
- Treatment of chain reactions.
- Patient history taking in medicine of the ANS.
- Ways of treating interference fields.

SEMINAR #7: MISCELLANEA (Part 2)

1 weekend in May

- Miofascial pain. Trigger points: histologic, EMG.
- Dry needling.
- Regional syndromes with summatory myofascial patterns: cervico-thoracic, lumbosacral upper limbs, lower limbs. Headaches.
- Chronic pain: Spinal and central sensitization.

WORKSHOPS:

- Examination of myofascial pain.
- Dry Needling: Hong, Baldry, screwing in-and-out.
- Local twitch response echo-guided.

SEMINAR #8: MISCELLANEA (Part 3)

1 weekend in June

- Spinal and peripheral infiltrations using anatomical references.
- Spinal and peripheral infiltrations using ultrasound guidance.
- Indication of physiotherapy and rehabilitation in patients with somatic dysfunction.
- Clinical integration.

WORKSHOPS:

- Search for anatomical references for infiltrations.
- Search for ultrasound references for infiltrations.
- Clinical cases: diagnosis; manual treatment and prescription of infiltrations; physiotherapy.

SEMINAR #9: MISCELLANEA (Part 4)

1 weekend in June

- Review of the second year: vertebral and peripheral manipulations. Infiltrations. Other treatments.
- Presentation of clinical cases. Clinical integration.
- Exam 2º course.

END-OF-MASTER'S PROJECT

1 weekend in September

- Individual presentation of the end-of-Master's project.

2.2. Master of Science Manual Medicine University for Digital Technologies in Medicine & Dentistry (DTMD), Luxembourg

Developed in accordance with the guidelines of the German Medical Association, the recommendations of the ESSOMM European core curriculum and principles of manual medicine and initiated by the Dr Karl Sell Medical Seminar Neutrauchburg (MWE) e.V.

1. Overview of the modules

No.	Module name	Semester	ECTS
1	Introduction, Basis	1	5
2	Diagnosis and mobilization: spine	1	9
3	Diagnosis and mobilization: extremities	1	9
4	Manipulation (HVLA), spine and extremities	2	10
5	Linkages at head, neck, shoulder, and arm	2	9
6	Linkages at lower back, pelvis, and leg	2	9
7	Linkages at the thoracic region	3	9
8	Temporomandibular system	3	5
9	Parietal osteopathic medicine	3	9
10	Visceral osteopathic medicine and the cranial field	4	10
11	Infants, children, and adolescents	4	9
	Master thesis	4	27
	Colloquium	4	
	Entire master study		120

Tab. B: Master of Science Manual Medicine, University for Digital Technologies in Medicine & Dentistry (DTMD), Luxembourg

2. Study schedule

Semester 1	**Modul 1** Introduction, Basics	
	Module 2 Diagnosis and mobilization: spine Examination of practical contents	**Module 3** Diagnosis and mobilization: extremities Examination of practical contents
	Online examination of theoretical contents of module 1 to 3	
Semester 2	**Module 4** Manipulation (HVLA): spine and extremities Oral and practical examination	
	Module 5 Linkages at head, neck, shoulder, and arm Oral and practical examination	**Module 6** Linkages at low back, pelvis, and leg Oral and practical examination
	Submission of one elaborated case study on each of the topics of modules 4 to 6	
Semester 3	**Module 7** Linkages at the thoracic region Oral and practical examination Presentation of one of the case studies from module 4 to 6	
	Module 8 Temporomandibular system	**Module 9** Parietal osteopathic medicine Oral and practical examination
	Online examination of theoretical contents of modules 8 and 9 **Submission of an elaborated case study on the topic of module 7**	
Semester 4	**Module 10** Visceral osteopathic medicine and the cranial field Oral and practical examination	**Module 11** Infants, children, and adolecents
	Online examination of theoretical contents of modules 10 and 11	
	Master theses	**Colloquium**

Tab. C: Master of Science Manual Medicine, University for Digital Technologies in Medicine & Dentistry (DTMD), Luxembourg

3. Examples of competency-based programs in MM medicine in the USA

3.1. Summary of MM educational pathways in the USA

In the United States, manual medicine (MM) treatment by physicians and surgeons is designated as "osteopathic manipulative treatment (OMT)" and for more than a century, the most prevalent MM school of practice in the USA has incorporated "osteopathic principles and practices (OPP)" [r].

Several educational pathways are approved to obtain the palpatory and treatment skills needed if U.S. physicians and surgeons doctors wish to safely integrate MM medicine in their practices. These are offered in predoctoral colleges, postdoctoral-residencies and postdoctoral-CME programs at multiple sites. All degree or certification program curricular elements are competency-based (as opposed to strictly hour-based) while continuing medical education (CME) programs or recertification processes are now predominantly hour-based (see SECTION I Chapter 5.2. and SECTION II Chapter 3.1.).

The most common MM educational route in the USA is the predoctoral one. This is achieved by those who matriculate and successfully graduate from colleges of osteopathic medicine (COMs). In 2024, there were 41 COMs accredited to deliver instruction at 66 teaching locations in 35 of the United States of America. The U.S. Department of Education recognizes the American Osteopathic Association's Commission on Osteopathic College Accreditation (COCA) to accredit U.S. osteopathic medical schools. Today, these colleges are educating more than 35,000 future physicians—25 % of all U.S. medical students. All COM curricula contain both didactic and supervised hands-on education in osteopathic principles and practices (OPP) including palpatory diagnosis of somatic dysfunction and a wide range of manual methods and techniques referred to as "osteopathic manipulative treatment (OMT)". The baseline common curriculum guidelines are agreed upon by the Educational Council on Osteopathic Principles (ECOP) which is made up of the chairpersons of all of the COM teaching departments of Osteopathic Manipulative Medicine. COM students all undergo both institutional and independent national OPP/OMT testing and graduates of these medical colleges earn the degree, Doctor of Osteopathic Medicine (DO) (see Chapter 3.2. below).

A second route for MM education, open to both MDs and DOs, takes place at the post-doctoral residency-training level. Specialty residency-training programs in multiple medical and surgical disciplines in the United States may submit their competency-based curricula for "osteopathic recognition" with various combinations of OPP and OMT emphases. In particular, the specialty of "Family Medicine with OMT" (which takes place in a full-time, hospital-based supervised residency over 3 years) provides for significant supervised education in palpatory diagnosis of somatic dysfunction and OMT techniques integrated into clinical practice. Osteopathic recognition specialty programs are accredited by the national Accreditation Council for Graduation Medical Education (ACGME) for both MDs and DOs in training. For each specialty board in the USA, there are both MD and DO representatives to review and approve each specialty program's competency-based guidelines to determine if it meets the "osteopathic recognition" status.

Education in the specialty of Osteopathic Neuromusculoskeletal Medicine (ONMM) represents the most extensive MM training in the USA. This competency-based program, which is open to both MD and DO graduates, requires a 36-month supervised postdoctoral residency and produces the majority of this specialty's consultants, educators and researchers. It also leads to certification in the nationally-recognized specialty in ONMM. These programs are also accredited by the national Accreditation Council for Graduation Medical Education (ACGME) for both MDs and DOs in training. The ONMM specialty college for ONMM is the American Academy of Ostopathy (AAO) which is a member society of FIMM.

Finally, continuing medical education (CME) related to OMT is offered for MDs and DOs by many COMs, state osteopathic associations, osteopathic specialty organizations and the American Academy of Osteopathy (AAO). These CME programs are available (and required) to maintain specialty credentials related to osteopathic recognition and ONMM specialty status. They also provide physicians with basic

[r] There are various manual therapies offered in the USA but only Doctors of Osteopathic Medicine (DO) educated in the United States and Doctors of Medicine (MD) are to permitted to use therapeutic coding for osteopathic manipulative treatment (OMT) by physicians and surgeons. Physical therapists and chiropractors have separate therapeutic coding. Non-physician osteopaths are not allowed to use the protected term "osteopathic" in the USA. In the USA, there is a differentiation between "osteopathic manipulative treatment (OMT) by USA-trained DO physicians" and "osteopathic manipulative therapy (OMTh)" by internationally-trained non-physician osteopaths.

MM skills designed to help these practitioners to promote patient health and locomotor function as well as aid in pain reduction.

3.2. Curricula and Testing related to Manual Medicine in Colleges of Osteopathic Medicine in the United States of America (USA)

Both allopathic (MD) and osteopathic (DO) colleges of medicine in the United States share six competency-based curricular components; osteopathic education outlines a seventh.

The six similar core competency educational pathway for MD and DO physicians and surgeons encompasses these competency headings:

- Patient care
- Medical Knowledge
- Professionalism
- Systems-based Practice
- Practice-based Learning
- Interpersonal and Communication Skills

A 7th core competency is unique to colleges of osteopathic medicine (COMs). It is specifically related to MM education, manual skills and integrating osteopathic philosophy in healthcare. Designated as *"Competency One: Osteopathic Principles & Practice (OPP)"*, acquiring these competencies requires several years of supervised training and testing to ensure the acquisition of the palpatory skills needed to identify somatic dysfunction and effective skills to treat it with multiple manual methods and treatment techniques to positively affect healthcare.

The designated predoctoral core competencies in OPP and OMT in the predoctoral curriculum include:

	Osteopathic Principles and Practices
1.	**Approach the patient with recognition of the entire clinical context, including mind-body and psychosocial interrelationships.**
a.	Recognize and treat each patient as a whole person, integrating body, mind, and spirit.
b.	Listen and communicate effectively during the assessment and treatment of a patient presenting with somatic and/or visceral dysfunction.
c.	Obtain consent for procedures, and effectively answer the patient's questions about potential risks, benefits and complications.
d.	Demonstrate caring, compassionate, and empathetic behavior during the application of OMT in the clinical setting.
e.	Identify potential contraindications to treatment or assessment.
f.	Demonstrate in a patient encounter the impact of culture and world view on the presentation of somatic and/or visceral dysfunctions.
2.	Use the relationship between structure and function to promote health.
a.	Promote and integrate OMT as a method of improving the anatomic and physiologic functioning of the patient both as a stand-alone treatment and as a component of a treatment plan.

b.	Apply knowledge of the biomedical sciences, such as functional anatomy, physiology, biochemistry, histology, pathology, and pharmacology, to support the appropriate application of osteopathic principles and OMT.
c.	Utilize knowledge of the clinical sciences to formulate a treatment plan, emphasizing the correction of clinical manifestations resulting from somatic dysfunction.
d.	Identify the association between organ systems, function, and structural findings.
e.	Understand how structure can adversely affect fluid in low-pressure systems (venous and lymphatic).
f.	Identify somatic dysfunctions that may affect sympathetic or parasympathetic nervous tone.
g.	Demonstrate appropriate OMT to normalize autonomic tone.
h.	Prescribe rehabilitative/therapeutic exercises to address specific musculoskeletal imbalances to more effectively manage conditions that otherwise would become chronic.
i.	Identify common and referred pain patterns.
3.	Use OPP to perform competent physical, neurologic, and structural examinations incorporating analysis of laboratory and radiology results, diagnostic testing, and physical examination.
a.	Obtain historical information to advance the care and treatment of the patient that integrates physical, psychosocial, and cultural factors.
b.	Perform a physical exam incorporating visual inspection, auscultation, palpation, percussion, and range of motion testing.
c.	Perform a structural examination:
c.1	Perform palpation of the spine and Chapman's Reflex points.
c.2	Perform an osteopathic structural screening assessment, noting spinal curvatures, posture, and positioning, including the ten areas of the body (cranium, cervical, thoracic, lumbar, ribs, pelvis, sacrum, upper and lower extremities, and abdomen).
d.	Determine asymmetry or restriction of motion through static and dynamic evaluation of a patient.
e.	Assess paravertebral tissue for tissue texture abnormalities, asymmetry, restriction of motion, and tenderness.
f.	Use anatomical landmarks in the seated, prone, and supine positions to identify correct vertebral levels.
g.	Identify appropriate patterns of somatic dysfunction to evaluate in the differentiation of primary musculoskeletal disorders from primary visceral dysfunction.
g.1	Describe the symptoms and physical findings that are consistent with viscerovisceral, viscerosomatic, somatovisceral, and somatosomatic reflexes.
h.	Demonstrate the ability to diagnose and evaluate somatic dysfunction in the cervical, thoracic, lumbar, and sacral spinal regions; head, rib cage, abdominal and pelvis regions; and upper and lower extremities regions.
i.	Perform spinal segmental evaluation for evidence of facilitation related to viscerally mediated sympathetic and parasympathetic influences.
j.	Appropriately document somatic dysfunction related to primary medical diagnoses assessing for tenderness, asymmetry, restricted motion, and tissue texture abnormalities.

4.	Diagnose clinical conditions and plan patient care.
a.	Identify the patient's chief complaints and appropriately perform a logical physical examination in order to properly diagnose the condition.
b.	Identify key history and physical examination findings pertinent to the differential diagnosis.
c.	Use appropriate information resources to determine diagnostic options for patients with common and uncommon medical problems.
d.	Diagnose somatic dysfunction within the ten body regions relevant to the diagnosis (i.e., head, cervical, thoracic, rib, lumbar, abdomen, pelvic, sacral, upper extremity, and lower extremity body regions), prioritize a differential diagnosis, and develop an appropriate care plan.
e.	Describe how critical pathways or practice guidelines can be useful in sequencing diagnostic evaluations for the patient.
f.	Determine appropriate treatment for autonomic nervous system mediated symptoms.
g.	Formulate a differential diagnosis based on findings from the history and physical examination of the patient.
h.	Consider the patient's perspective and values in diagnostic decision making.
i.	Prioritize diagnostic tests based on sensitivity, specificity, and cost-effectiveness.
5.	Perform or recommend OMT as part of a treatment plan.
a.	Appropriately evaluate, position, and treat a patient with OMT while demonstrating cognizance of a. patient safety and dignity.
b.	Differentiate and perform specific manipulative techniques and assess their outcomes, e.g., high velocity-low amplitude (HVLA), articulatory, muscle energy, soft tissue, strain-counterstrain, myofascial release, lymphatic balanced ligamentous, ligamentous articular strain, facilitated positional release, Still, visceral, and cranial techniques.
c.	Differentiate specific visceral techniques and their expected outcomes, e.g., liver and splenic pump, mesenteric lift, colon release, collateral ganglia inhibition, and abdominal lymphatic drainage techniques.
6.	Communicate and document treatment details.
a.	Explain the anticipated benefits, potential complications and untoward effects) of osteopathic manipulative medicine to the patient and family members and/or caregivers.
b.	Respect and abide by an individual patient's decision to incorporate, or not incorporate, specific manipulative techniques (OMT) to specific body regions.
c.	Critically evaluate the relative value, advantages, and disadvantages of each treatment, indications, contraindications, and alternative treatments.
d.	Prescribe rehabilitative/therapeutic exercises to address specific musculoskeletal imbalances and improve management of these conditions.
e.	Use appropriate clinical documentation of structural findings and procedures, including the use of appropriate ICD and CPT terminology when documenting patient assessments.

7.	Collaborate with OMM specialists and other health care providers to maximize patient treatment and outcomes, as well as to advance osteopathic manipulation research and knowledge.
a.	Recognize the role of and demonstrate a commitment to the utilization of other health care professionals in the diagnosis and treatment of the patient.
b.	Critically self-evaluate your knowledge and clinical skills regarding the diagnosis of somatic dysfunction and pathological structure and function in patients, your ability to apply treatments for somatic dysfunction, obtain clinical improvement for your patient, and incorporate other physicians with additional expertise and skills when indicated for the benefit of the patient.
c.	Communicate appropriately with specialists as part of the health care team to engage in collaborative medical decision making.
d.	Advocate for the use of OMT in the appropriate clinical setting by advancing the utilization of OMM/OPP in the diagnosis and treatment of patients and its recognition as a contributing medical therapy among physicians, regulators, payors and patients.
8.	Evaluate the medical evidence concerning the utilization of osteopathic manipulative medicine.
a.	Understand and apply current OMT practice guidelines and evidence-based medicine to improve patient outcomes and conditions in the prevention and treatment of disease and pathology among patients.
b.	Use medical informatics to access the evidence base for OMT and demonstrate the ability to b. incorporate best-available medical evidence into clinical practice.
c.	Interpret and report epidemiologic data in the patient population with musculoskeletal dysfunction.
d.	Demonstrate the ability to explain to non-osteopathic health professionals and patients the indications and benefits of osteopathic medicine and manipulative therapies, including the clinical indications for its application and risks.
e.	Teach medical student peers and facilitate their development of osteopathic manipulative skills as appropriate.

A US national consensus was reached on assessing minimal safe and effective didactic and psychomotor core competency testing parameters of OPP and OMT training. This was established by a blue ribbon educational committee. In addition to providing structure to the national testing boards for osteopathic physicians-in-training, this consensus document also help inform a uniform base for on-site institutional (college and university) didactic and psychomotor assessments. (See https://www.nbome.org/wp-content/uploads/pdf/COMLEX-USA_Master_Blueprint_2024.pdf for the entire blueprint, including Core Competency Domain One).

3.3. "Osteopathic Recognition" residencies open to both MDs and DOs in various specialties

Across the USA, there are 234 residency programs in 27 specialties that have applied for and have been approved for "Osteopathic Recognition." All residency programs accredited by the American Council on Graduate Medical Education (ACGME), including osteopathic neuromusculoskeletal medicine programs ONMM), can accept both allopathic and osteopathic medical school graduates.

Osteopathic recognition programs must ensure that all residents have sufficient background or instruction in osteopathic philosophy and techniques in manipulative medicine (MM) to prepare them to engage in the curriculum of that program, as outlined in the Program Requirements. An allopathic medical school graduate would need additional education related to Osteopathic Principles and Practice prior to matriculation into the program. The program would determine how much education is required and can define how and/or where the education be obtained. For ONMM2 and ONMM3 levels of entry, programs can require that graduates complete another specialty's ACGME-accredited program with Osteopathic Recognition in a designated osteopathic position.

3.4. Residency training and competency-based milestones in the specialty of Osteopathic Neuromusculoskeletal Medicine (ONMM)

1. Specialty Description and Educational Pathway

The osteopathic neuromusculoskeletal medicine residency program is a primary residency disciplined in the neuromusculoskeletal system, its comprehensive relationship to other organ systems, and its dynamic function of locomotion. The principle focus of the discipline is osteopathic and patient-centered; specifically, it embodies structural and functional interrelation, body unity, self-healing, and self-maintenance. Specialists in this discipline must interpret and demonstrate specialized knowledge of the basic and clinical sciences, clinical evaluation, and management of disorders of the neuromusculoskeletal system and its related visceral and somatic structures. Specialists in this discipline demonstrate knowledge of the indications, risks, and benefits of manipulative medicine in treatment of patients with neuromusculoskeletal disorders.

The educational program is accredited by the American Council of Graduate Medical Education (ACGME). The requirements for this residency can be found at https://www.acgme.org/globalassets/pfassets/programrequirements/275_osteopathicneuromusculoskeletalmedicine_2023.pdf

2. Milestone Assessment of ONMM Competencies

ONMM Residency faculty are charged with assessing ONMM core competency formative milestones. Along with periodic national specialty inservice examinations and a final summative specialty board examination, these milestones constitute assessments contributing to the eventual certification needed to practice this specialty.

Programs use published "Milestones" in a semi-annual review of resident performance, and then report to the ACGME. Milestones describe knowledge, skills, attitudes, and other attributes for each of the ACGME Competencies and are organized in a developmental framework. They provide narrative descriptions that are targets for resident performance throughout their educational program. Competency Milestones are arranged into levels. Tracking from Level 1 to Level 5 is synonymous with moving from novice to expert resident in the specialty or subspecialty. For each reporting period, the Clinical Competency Committee will review the completed evaluations to select the milestone levels that best describe each learner's current performance, abilities, and attributes for each subcompetency. These levels do not correspond with post-graduate year of education. Depending on previous experience, a junior resident may achieve higher levels early in his/her educational program just as a senior resident may be at a lower level later in his/her educational program. There is no predetermined timing for a resident to attain any particular level. Residents may also regress in achievement of their milestones. This may happen for many reasons, such as over scoring in a previous review, a disjointed experience in a particular procedure, or a significant act by the resident.

A selection of MM-related milestones from the document include the following descriptors. (Not listed below are the various Milestones related to Systems-Based Practice (including Patient safety and quality

improvement), Practice-Based Learning and Improvement, Professionalism, and Interpersonal and Communication Skills.)

Patient Care 1: Patient Management: Osteopathic Approach to Patient Care				
Level 1	Level 2	Level 3	Level 4	Level 5
Integrates history, examination, diagnostic testing, and medication management into osteopathic patient car plan, with direct supervision and guidance.	Integrates history, examination, diagnostic testing, and medication management into osteopathic patient plan, with indirect supervision.	Independently integrates history, examination, diagnostic testing, and management into osteopathic patient plan.	Independently integrates history, examination, diagnostic testing, and medication management into osteopathic patient care plan in complex patients.	Role models the effective use of osteopathic-focused history, examination, diagnostic testing, and medication management to minimize the need for further diagnostic testing or intervention.
Performs osteopathic structural examination and diagnoses somatic dysfunction appropriate to patient condition, with direct supervision and guidance.	Performs osteopathic structural examination and diagnoses somatic dysfunction appropriate to patient condition, with indirect supervision.	Independently performs accurate and complete osteopathic structural examination and diagnoses somatic dysfunction appropriate to patient condition.	Independently performs accurate and complete osteopathic structural examination and diagnoses somatic dysfunction appropriate to complex patients.	Role models the complete osteopathic structural examination and diagnoses somatic dysfunction in patient care.
Incorporates osteopathic principles to promote health and wellness in patients with acute and chronic conditions, with direct supervision.	Incorporates osteopathic principles to promote health and wellness in patients with acute and chronic conditions, with indirect supervision.	Incorporates osteopathic principles to promote health and wellness in patients with complex conditions, with indirect supervision.	Independently incorporates osteopathic principles to promote health and wellness in patients with complex conditions.	Role models the integration of osteopathic principles to optimize patient health.
Comments:			**Not Yet Completed Level 1:** **Not Yet Assessable:**	

Patient Care 2: Osteopathic Manipulative Treatment (OMT) (Direct)				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs direct OMT for identified somatic dysfunction, with direct supervision and guidance.	Performs direct OMT for identified somatic dysfunction, with indirect supervision.	Independently and effectively performs direct OMT for identified somatic dysfunction in routine patient presentation.	Independently and effectively performs direct OMT for identified somatic dysfunction in complex patient presentations.	Mentors others to become competent in performing direct OMT for identified somatic dysfunction in complex patient presentations.
Comments:			**Not Yet Completed Level 1:** **Not Yet Assessable:**	

Patient Care 3: Osteopathic Manipulative Treatments (OMT) (Indirect)				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs indirect OMT for identified somatic dysfunction, with direct supervision and guidance.	Performs indirect OMT for identified somatic dysfunction, with indirect supervision.	Independently and effectively performs indirect OMT for identified somatic dysfunction in routine patient presentations.	Independently and effectively performs indirect OMT for identified somatic dysfunction in complex patient presentations.	Mentors others to become competent in performing indirect OMT for identified somatic dysfunction in complex patient presentations.
Comments:			**Not Yet Completed Level 1:** **Not Yet Assessable:**	

Patient Care 4: Diagnostic Screening, Testing, and Interpretation				
Level 1	Level 2	Level 3	Level 4	Level 5
Explains the rational, risk, and benefits for common diagnostic testing.	Explains the rational, risk, and benefits for common diagnostic testing.	Integrates value and test characteristics of various diagnostic strategies in patients with common diseases.	Integrates value and test characteristics of various diagnostic strategies in patients with comorbid conditions of multisystem disease.	Demonstrates a nuanced understanding of emerging diagnostic tests and procedures.
Interprets results of common diagnostic tests.	Interprets complex diagnostic data.	Integrates complex diagnostic data accurately to reach high-probability diagnosis.	Anticipates and accounts for limitations when interpreting diagnostic data.	
Comments:			**Not Yet Completed Level 1:** **Not Yet Assessable:**	

Patient Care 5: Management of Procedural Care (e.g., Trigger Point Injections, Joint Aspirations, Joint Injections)				
Level 1	Level 2	Level 3	Level 4	Level 5
Identifies the procedures that osteopathic neuromusculoskeletal medicine physicians perform.	Identifies patients for whom a procedure is indicated and who is equipped to perform it.	Demonstrates confidence and motor skills while performing procedures, including addressing complications.	Identifies and acquires the skill to independently perform procedures in the current practice environment.	Identifies procedures needed in future practice and peruses supplemental training to independently perform.
Recognizes osteopathic neuromusculoskeletal medicine physicians' role in referring patients for appropriate procedural care.	Counsels patients about expectations for common procedures performed by osteopathic neuromusculoskeletal medicine physicians and consultants.	Performs independent risk and appropriateness assessment based on patient-centered priorities for procedures performed by consultants.	Collaborates with procedural colleagues to match patients with appropriate procedures, including declining support for procedures that are not in the patient's best interest.	
Comments:			**Not Yet Completed Level 1:** **Not Yet Assessable:**	

Medical Knowledge 1: Applied Foundational Sciences				
Level 1	Level 2	Level 3	Level 4	Level 5
Explains the scientific knowledge (e.g. physiologic, pathologic, socioeconomic, and behavioral) for normal function and common conditions.	Explains the scientific knowledge for complex conditions.	Integrates scientific knowledge into an osteopathic treatment plan while respecting patient's comorbid conditions.	Integrates scientific knowledge into an osteopathic treatment plan while respecting the patient's complex comorbid conditions	Demonstrates a nuanced understanding of the scientific knowledge related to uncommon, atypical, or complex conditions.
Comments:			**Not Yet Completed Level 1:** **Not Yet Assessable:**	

Medical Knowledge 2: Manifestation of Systemic Disease through Neuromusculoskeletal System				
Level 1	Level 2	Level 3	Level 4	Level 5
Describes the basic interrelationship of structure and function through osteopathic structural findings.	Consistently describes the interrelationship of structure and function through osteopathic structural findings.	Consistently describes the interrelationship of structure and function through osteopathic structural findings as relates to the patient's systemic disease.	Demonstrates knowledge of the effects of health and illness on the whole patient – body mind, and spirit..	Teaches the osteopathic tenets to the multidisciplinary team.
Forms a osteopathic treatment plan based on the patient's history and physical exam findings, with guidance.	Forms a osteopathic treatment plan based on the patient's history and physical exam findings.	Consistently forms an appropriate osteopathic treatment plan based on the patient's complex history and physical exam findings..	Develops a long-range treatment plan to support the health and well-being of the patient.	Is a leader in the development and dissemination of osteopathic knowledge.
Comments:			**Not Yet Completed Level 1:** **Not Yet Assessable:**	

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