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Scientific evaluation of the MBST Magnetic Resonance Technology regarding the therapeutic potential and proof of clinical efficacy

The aim of the Clinical Evaluation Report (CER) is to demonstrate the therapeutic efficacy and safety of the MBST® Magnetic Resonance technology.

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Table of contents

1. Definition of scope and strategy of the clinical evaluation

The aim of the present Clinical Evaluation Report (CER) is to provide evidence of the clear therapeutic efficacy, performance and safety of MBST magnetic resonance therapy systems based on MBST® magnetic resonance technology. These devices are class IIa medical devices that meet all demands, including safety and performance, in accordance with the essential requirements of the MDD (Annex I). They differ in important points from other medical devices that require special risk assessments. These include

- no invasive surgery, no transplantations, no implantations
- no remedies
- no direct contact of patient with electric connections
- no ionising radiation
- no in-vitro diagnostics
- no necessary additives – therefore no control of amounts, especially
- no animal substances
- no contamination
- no measuring function
- no data connection
- no sterilisation required

Proof of the technical safety of the equipment has been provided within the technical documentation, whereas this report focuses on the evaluation of the therapeutic efficacy and performance of the devices.

The devices considered for this clinical evaluation currently include the following device variations including all available software versions (for different country codes) as well as the device and indication-specific therapy cards required for treatment, which are described in detail in the respective instructions for use:

- MBST® ClosedSystem 300/600
- MBST® OpenSystem 350/700
- MBST® OsteoSystem 1 (ODM)
- MBST® ProMobil
- MBST®·ARTHRO·SPIN·FLEX
- MBST®·ARTHRO·SPIN·LIFT

The MBST magnetic resonance therapy systems are a group of devices which are characterized by the fact that they are all based on the same technology and that the performance parameters which are achieved in the treatment zone and can affect a patient are comparable for all device variants (radio frequency power: max. 1W at resonance, radio frequency range: 14–18 kHz; magnetic field strength: max. 1 mT (directly at the cover of the applicators or max. 3–4mT directly at the coil).
The static values of the magnetic fields are only about 1 order of magnitude above the natural earth magnetic field and about 2 to 3 orders of magnitude below the field strength of NMR devices. Therefore, the recommended static limit values according to ICNIRP and IEC EN 60601-2-33 are observed. The dynamic characteristics of the magnetic fields are also smaller by orders of magnitude than those of NMR devices.

For all the devices listed above, the underlying physical principle of action is absolutely identical and the field-generating character of the individual product variants does not differ at all. Only the volume of the generated resonance and thus of the treatment field differs between the individual device variants. This is due on the one hand to the size and arrangement of the individual applicators, and on the other hand to the electrical power parameters required for this, which are permanently preset in the respective control unit. Under certain circumstances, the space required by the user can also be decisive for the selection of a certain device variant.
Thus, the individual devices differ mainly in the shape and design of the treatment unit, and thus conditionally in the size of the maximum achievable treatment field and thus in the body part areas that can be treated with the respective device variant.

In addition to the same physical principle of action, the intended purpose (see following page) is also identical.

Due to the previously described identical physical principle of action of this special form of therapy, the comparable performance parameters of the magnetic resonance field within the respective treatment zones of the individual device variants as well as the uniform determination of purpose, the study results obtained with one device variant on a certain tissue can also be transferred to the other device variants and comparable tissue structures. For this reason, in the following explanations, reference is mainly made only to the consideration of the form of therapy and the focus is no longer only placed on the special device variants used in the individual studies.

Clinical evaluation is based on data that provides objective and reliable information on the safety and performance of MBST magnetic resonance technology. The manufacturer plans and regularly updates the report over the entire life cycle of the MBST magnetic resonance therapy systems. The information and experience gained since the market launch within the framework of extensive studies or market observation also gives rise to new approaches – beyond the previous purpose – with regard to a possible future expansion of the field of application of this form of therapy, which are to be tested beforehand by appropriate studies and evaluated accordingly within the framework of the CER.

This document incorporates the results of risk management and active market surveillance, acknowledges the results of clinical trials conducted, reflects the current state of science and technology and evaluates clinical data for comparable products.

This report is a revision and update of the previous clinical evaluation from 2017, supplemented by new findings from current studies, publications, results of market observation by the manufacturer and further development.

State of the art evaluation

Not only clinical data on the MBST magnetic resonance therapy system itself, but also data on sufficiently similar reference products may be used to evaluate performance and safety. These equivalent products must be clinically and technically comparable and CE marked. The degree of equivalence must be demonstrated by clinical, technical and biological aspects.

Due to the patented uniqueness of the MBST magnetic resonance technology and in accordance with the regulations of MEDDEV 2.7.1 Revision 4, no comparative assessment is possible and necessary in this case.

Therefore, the MBST nuclear magnetic resonance therapy, the MBST nuclear magnetic resonance technology and the entire MBST nuclear magnetic resonance therapy system do not require the consideration of equivalent products.

Intended purpose

All variants of the MBST® magnetic resonance therapy systems considered within the scope of this CER are used for the treatment of painful, degenerative and/or pathological changes of the musculoskeletal system.
In general, all patients can be treated who have been diagnosed by a qualified specialist (physician) after an appropriate preliminary examination with a typical indication for MBST treatment (see treatment zones and typical indications) and for whom no contraindications are known which speak against such treatment.

Possible areas of application (treatment zones)

- With the exception of the MBST® OsteoSystem1 (ODM), all other device variants can only be used for treatment of one area of the body at a time.
- -The possible treatment zones of MBST magnetic resonance therapy result from the device-specific structure. People of almost any age and height can be treated efficiently. To determine the treatment zone, the individual treatment plan must be drawn up before the start of therapy. The plan must include the medical prescription stating the indication (consisting of diagnosis and leading symptoms) and the aim of the therapy as well as the result of the diagnostic findings. The procedure is adapted to the patient's reaction position. This applies in particular with regard to the positioning of the patient as well as the duration and scope of treatment. The regular treatment time is 60 minutes per therapy unit.
- The treatment zones are structured as follows, depending on the therapy device:
  - ARTHRO·SPIN·FLEX and OPEN·SYSTEM·700 are treatment couches for the treatment areas shoulder, back, spine, intervertebral discs, hip, leg, double knee. The extraordinary design and the open construction offer a lot of free space not only for anxious or claustrophobic patients.Thanks to the variable entry or the positioning system, physically handicapped patients as well as obese and claustrophobic patients can also be treated.
  - ARTHRO·SPIN·LIFT and OPEN·SYSTEM·350 are treatment units for the treatment zones arms, elbow, hands, fingers, legs, knees, ankles, feet and toes. The mobile magnetic resonance unit can be used variably. The patient takes a seat in the treatment chair and arm or leg to be treated are optimally positioned.
  - OSTEO·SYSTEM is an MBST nuclear magnetic resonance therapy treatment couch whose treatment field covers the entire body. The magnetic resonance applicators are located in the lying surface and define the effective range.
  - PRO·MOBIL is a flexible MBST magnetic resonance therapy system for the treatment zones cervical spine, lumbar spine, arm, shoulder, elbow, hand, finger, leg, hip, knee, foot and toes. The mobile magnetic resonance control unit and up to 2 magnetic resonance applicators enable the respective treatment zones.
  - CLOSED·SYSTEM·600 is a therapy device with semi-open design. The MBST magnetic resonance therapy treatment couch can be used for the treatment zones shoulder, back, spine, intervertebral discs, hip, leg, double knee.

- CLOSED·SYSTEM·300 is a therapy device with semi-open design. The MBST magnetic resonance therapy treatment unit can be used for the treatment zones arm, elbow, hand, finger, leg, knee, foot and toes.

Indications

The range of treatable indications includes, among others, the following diseases and associated pains:

- degenerative bone and joint diseases such as osteoarthritis, cartilage damage, degenerative osteoarthritis, chondropathy, osteoporosis in a partial body area (whole-body treatment is only possible with ODM)
- injuries of the joints
- fractures of bones
- tendopathy
- injuries of muscles, tendons and ligaments

Contraindications and restrictions on use

Under normal therapeutic conditions, MBST® magnetic resonance therapy devices do not pose any acute or chronic health risks. However, more and more patients have active implants. Even if we have not yet become aware of any specific cases, it cannot be generally ruled out that functional disorders of the implants may occur during therapy or that various undesirable effects may occur in connection with MBST treatment in or on the body (e.g. heat sensation), which in the worst case could damage or significantly injure individual persons. Therefore, before starting treatment, the patient must always be questioned about possible contraindications.

An MBST therapy must not be applicated if the following conditions are present:

- Implanted infusion, pain or insuline pumps or
- Cochlear implants or other implanted neurostimulators, etc., which are located in the active treatment field of the therapy device or in the immediate vicinity of the treatment zone: *It cannot be ruled out that in individual cases (depending on the material, its geometry, biological properties of the patient, frequency and position of the implant in relation to the treatment field) the high-frequency pulses used might induce a short-term weak current flow in these electrical conductors.*
- However, modern pacemaker units and also the electrodes (probes) are designed in such a way that they are not affected by the magnetic fields in the MRI system, are not damaged and do not overheat. Various types of pacemakers are available at the moment which are classified as suitable for MRI or suitable for MRI to a certain extent. In these cases, they are no contraindication. In cases of heart valve prosthesis, an MBST therapy is usually possible depending on the type and function of the prosthesis.
- In order to assess whether an MBST therapy can be carried out despite a medical implant pacemaker and defibrillator systems (e.g. ICD systems), the manufacturer is dependent on information about the material used (in particular model name and number, information about MRI suitability). In this case, the manufacturer of the medical implants must confirm that the

function is not impaired by contact with a magnetic field. *Otherwise, it cannot be ruled out that the implants may be damaged during treatment or that the interactions with the electromagnetic fields of the therapy system may lead to damage to the patient.*

In case of doubt, patients with ferromagnetic foreign objects (e.g. shards of metal or vascular clips made of ferromagnetic material) within the active treatment field should also be advised against therapy.

Negative effects of nuclear magnetic resonance therapy during pregnancy are not yet known. However, as the possible effects of such a therapy during pregnancy have not yet been sufficiently investigated, pregnant women should not be treated with MBST magnetic resonance therapy.

In the case of patients with one of the following pre-existing conditions, the treating specialist should be consulted prior to the start of treatment in order to determine any possible relative contraindications for an MBST therapy in an interdisciplinary decision for this individual case taking into account the appropriate safety measures.

- tumours in the treatment zone, leukaemia
- HIV infection
- bacterial infection
- active rheumatic episode

However, after strict consideration of the benefit-risk balance by the treating physician, therapy may still be possible, e.g. if the pre-existing condition is not within the intended treatment zone (the recommended distance is 40 cm around the active treatment field) or if the expected benefit of the therapy outweighs the possible risks.

The application of the MBST therapy does not impair the ability to drive and use machines. Interactions with other therapeutic measures are currently unknown. There is no age limit.

Treatment standard and application

Based on data from studies and the practical experience of physicians and specialists, the treatment duration of the MBST® magnetic resonance procedure is:

- Duration of therapy is determined by the treating physician depending on severity of damage and indication.
- Recommended treatment units (TU) depending on severity and indication:
  - early stages of osteoarthritis = 5 TU, advanced stages of osteoarthritis = 7/9 TU
  - refreshing therapy in case of osteoarthritis = 3 TU
  - acute injuries of muscles, ligaments and tendons = 5 TU
  - chronic injuries of muscles and tendons = 7 TU, ligaments = 9 TU
  - osseous structures, bones, intervertebral discs = 9 TU
  - whole-body treatment of osteoporosis 10 TU.

All treatments should take place on consecutive days. A break during the weekend is possible.
An additional radiologist's report may be required for the initial examination and for diagnosis by the treating and diagnosing specialist.
Other necessary diagnostic tools: anamnesis, MRI, CT, ultrasound or X-ray images or DXA measurements.

Presence of the medical professional

- Evaluation and monitoring in every hour of treatment
- Monitoring of correct positioning of the patient
- Monitoring and observance of therapy-related contraindications (possibly bacterial infections in the treatment area, electronic implants, tumors etc.)
- Start of the treatment device via the treatment software chip card
- Controll of proper functioning and running of the magnetic resonance spin field (field structure) of the treatment system
- Control of the magnetic resonance spin indicator
- Evaluation of the degree of disease using MRI, CT or X-ray images, the radiological medical diagnosis report or the measured values of the DXA procedure
- Detailed medical consultation and information about the disease and the possibilities of the mode of operation of the magnetic resonance method including indications and contraindications
- Determination and definition of the tissue-specific treatment software chip card (number of treatment hours and type of treatment software chip card)
- Planning and coordination of the treatment to be carried out
- Monitoring the proper course of treatment
- Explanation, control and evaluation of assessment scores (pain, function, efficacy) to be carried out for each patient in 4, if possible 5 time periods to monitor the success of the treatment (before and directly after the therapy as well as 3, 6 and, if possible, 12 months after)

Introduction

Living organisms are a highly complex biological system that follows cybernetic laws. The healthy or normal state in this biological system is determined by the balance of the ongoing processes of regeneration and degeneration. Disease is generally referred to changes or disturbances within this system that do not correspond to the norm. Disturbances of this equilibrium can not only be detected at different levels using scientific methods, such as biophysical and biochemical methods, but can also be corrected in many cases. This applies equally to the whole-body and organ levels as well as to the cellular and molecular levels. The basis for this, however, is an exact and comprehensive understanding of the molecular, chemical-cellular and physical processes including their interdependencies. Generally speaking, when correcting the disorder, a distinction is made between causal and symptomatic therapy. The number of available causal therapies is still very limited, as most disease processes could not yet be explained sufficiently. Therefore, in most cases symptomatic therapies must be used. Usually, these are based on medical experience and still represent the overwhelming part of medical practice. Unfortunately, in the foreground are still medical doctrines, which have to be modified by new study results.

- One of these outdated opinions is that cartilage tissue and cartilage cells could not or hardly be regenerated, even though evidence of the contrary has been given over 20 years ago.

- Another unsustainable and incorrect assertion, which is still often discussed, is that magnetic resonance can only be generated with extremely large magnetic fields (over 0.5 Tesla). Scientific tests and expert evaluations have shown that magnetic resonance can be generated even with a magnetic field of the size of the static magnetic field of the earth.

This is important in that the desired “evidence-based medicine” approach is not even possible for all established treatment strategies. The experience of the individual physician is therefore still a decisive factor in his therapeutic approach. This still derives mainly from interventions in chemical processes and much less from modulations through physical processes. This has historical reasons, as plant extracts, whose medical function comes from their chemical ingredients, have been used successfully for thousands of years. The application of physical principles could naturally only be attempted after recognition of the natural scientific connections at the molecular and cellular level. It was only after the discovery of the electrical processes in the living body that research was able to investigate their significance and propose corrective measures for the treatment of disorders. Exactly this therapeutic alternative of biophysical findings regarding electrical processes is the subject of the here discussed therapeutic treatment procedure with its now extensively confirmed causal and side-effect-free efficacy.

Another reason is the lobby of the pharmaceutical industry, which is trying to dominate the health care market with always new expensive drugs and promises. Under these conditions, it is very difficult to take hold in the healthcare market with new, innovative therapies that are effective, causal and inexpensive for the social system in the long term.

Physical therapy

The aim of the therapeutic application of physical methods is, as already described, to restore the impaired balance on a cellular and molecular level. An enormous advantage is the fact that the therapeutic application of physical methods is not invasive. An application can basically be achieved in two different ways.

- First possibility, the body is directly supplied with electrical energy, for example by means of tens devices. It is surprising for laypeople that enormous changes in brain activity can be achieved with the help of electrodes resp. the application of very small amounts of energy to the peripheral nerve. So it is not always possible to follow the motto: more helps more (example: electroshocks in the treatment of depression).
- Second possibility, the body is indirectly supplied with energy by using the principle of magnetism. Here too, there are application examples where a large amount is transmitted by induction, such as in the case of transcranial magnetic stimulation (TMS) for the treatment of depression (also known as “soft electroshock”).

The fact that even small amounts of energy have an influence on electrochemical processes in the body is now undisputed and has been proven by numerous scientific tests and studies about the efficacy of magnetic resonance applications. In the past, the problem with regard to the therapeutic application of smaller amounts of energy was partly due to the fact that the existing knowledge of biophysical processes at the molecular level, which are to be influenced, was still insufficient.

It could not be avoided that in therapeutic application a great deal of experiments were initially carried out using simple pulsating magnetic fields (PEMF technology) (especially field strengths, signal patterns and different frequencies) without there being a scientifically justifiable basis for the use of these application parameters. Therefore, it is not surprising that in the past, therapy

successes and a general acceptance of “magnetic field therapy”, as documented in Prof. Krone’s report, could not be achieved. Although minimal effects of special frequencies and the transport of energy via ions, which are known to exist in living organisms as charge carriers only in very small numbers, could not be ruled out.
A further disadvantage is that the dissipation factor of this PEMF technology is extremely high and only very small amounts of the available energy can be transferred into the ions of the body.

This changed fundamentally with the introduction of the imaging method based on magnetic resonance (MRI).
Application observations in diagnostic magnetic resonance imaging (magnetic resonance tomography (MRI) now led directly to therapeutic application in the form of highly effective magnetic resonance therapy systems (MBST® magnetic resonance therapy or MBST® therapeutic magnetic resonance).

Both, magnetic resonance imaging and magnetic resonance therapy, use the same technology, the physical phenomenon of nuclear magnetic resonance of hydrogen protons and the different relaxation times of different tissue types.
The transfer of energy and the resulting therapy effect or treatment effect is achieved by the protons of the hydrogen atoms of the human or animal tissue, which are present in large numbers due to the very high content of water of the human and animal body.

This was confirmed in an evaluation of the University of Würzburg, Germany.

Scientific confirmation of the operating lever of magnetic resonance therapy
[Wissenschaftliche Bestätigung der Wirkhebels der Kernspinresonanztherapie]
Prof. Dr. P. Jakob, Insitute of physics at the University of Wuerzburg, chair of experimental physics 5, Germany, May 2005.

Therefore, it cannot be compared to or equated with conventional magnetic field therapies. The use of a special frequency, the larmor frequency, which is used for resonant excitation of the protons of the hydrogen atoms for therapeutic purposes, is absolutely new and unique and patented worldwide with numerous patents.
Here, the radio frequency and modulated special low frequencies are radiated via a technically complex control unit and a connected highly complex air coil system with a static basic magnetic field, thus causing the loss-free resonant energy transfer via the stimulated protons.

Technical Background

In the use of magnetic fields for therapeutic purposes, a basic distinction must be made between:

a) static magnetic fields
b) dynamic, pulsating magnetic fields
c) nuclear magnetic resonance spin effects based on the larmor frequency of protons

Since the effects of these three types of application on living biological cell systems are very different, it is important to warn against confusion – as is often the case in the popular and lay media – and to point out the fundamental differences.

Ad a) The importance of static magnetic fields in nature is well described in the literature and is not subject of this assessment of clinical efficacy. To what extent these findings can be used for therapeutic purposes is still open.

Ad b) The importance of pulsating magnetic fields is discussed in literature in two ways. On the one hand, there is a well-founded suspicion that, in the context of radio broadcasting, people are

exposed to unsolicited magnetic fields, the effects of which cannot yet be finally estimated. For example, a double-blind, placebo-controlled, randomized clinical trial shows a significant effect on electrical brain activity in humans (Reiser et al., 1995).
On the other hand, pulsating magnetic fields were investigated in a large number of studies with regard to their effects on living matter in order to use them therapeutically. Here, too, the literature reports individual successful experiments that mainly produced effects on a cellular basis, but which cannot be generalized due to heterogeneous test designs using a wide variety of frequencies in the most diverse indications.
A comparison with the MBST method evaluated in this report is not possible.

Ad c) However, the application of the principle of nuclear magnetic resonance based on the well-known magnetic resonance imaging using both static and dynamic magnetic fields for therapeutic purposes is – scientifically speaking – still quite new.

This may be partly due to the fact that this technology was developed just a few years ago. These are the therapy devices offered under the name MBST-Technology, the availability of which is unfortunately but understandably due to its young age still limited.

With regard to the principle underlying this technology of triggering a special nuclear magnetic resonance of protons and its implementation in the therapy device offered, I refer again to the expert opinion of Prof. Dr. Jakob, University of Würzburg.
His evaluation clearly shows that these therapy devices contain the specified properties with regard to the triggering of the special magnetic resonance (Jakob, 2005) and thus differ from a purely technical point of view in the most significant way from conventional therapy devices which are based on only one of the other two forms of application of magnetic fields (static or pulsating).
The technological invention concerns a device for magnetic resonance therapy by means of which magnetic resonance can be achieved in the tissue to be treated by sweeping a magnetic field, which extends as homogeneously as possible through a treatment volume, and simultaneously irradiating an alternating magnetic field perpendicular to it, at least while the swept field falls.

The field strength of the swept field is between 0.3 and 3 mT. This is accompanied by a frequency of the alternating field of 10 to 100 kHz. The maximum field strength of the alternating field is preferably between 0.1 and 3 mT. The coils are preferably mainly in Helmholtz configuration and thus generate an essentially homogeneous field that runs across the couch.

In addition, the MBST system uses Adiabatic Fast Passage (AFP), which compensates for the inhomogeneity of the required static basic magnetic field B0.

The technology has all the characteristics of uniqueness. Scientific studies on the therapeutic efficacy of magnetic resonance therapy, both in vivo and in vitro, are available in large numbers and are presented below.

Therapeutic magnetic resonance (MBST)

The physical effect of nuclear magnetic resonance is also used in the MRI diagnostic procedure. This is based on a highly developed technique, also known as magnetic resonance imaging (MRI). In contrast to the ion function transfer principle of magnetic field therapy, nuclear magnetic resonance technology is used to transfer energy into the organism at the very effective proton level of the hydrogen atoms. The basic conditions for nuclear magnetic resonance are a homogeneous static basic magnetic field, the sweep field and an additional coupled radio frequency field. This signal (reflection or echo) is then used to create the image. In this way, the entire body can be

penetrated without contact and without side effects. However, in a conventional MRI device to process the signal in order to display an image very large amounts of energy are required in order to obtain the necessary magnetic field of 0.3 to 4 Tesla.

Since the human body consists of 70% to 80% water, in this way energy can be optimally transferred into the body in resonance, i. e. almost without losses, and can be directed to the target location of the damaged tissue in a further resonance. The physical effect of nuclear magnetic resonance makes it possible to stimulate proton spins in living tissue in order to to use them for energy transport (intermediate energy storage via the protons of the hydrogen atomic nuclei) so that they in turn emit a measurable signal.

The energy transmitted by the resonance system (B0 and RF field) by means of the protons of the hydrogen atoms into the tissue is precisely controlled by the cell resonance effect into the still living, damaged cells of the tissue and here stimulates regeneration. The cell group (skin, cartilage, bone, organs etc.) is defined by the program of the treatment chip card.

Devices for therapeutic magnetic resonance

For the application of therapeutic magnetic resonance therapy, special medical technological devices have been developed that are capable of producing low-energy therapeutic nuclear magnetic resonance effects. Depending on the area of application, ring-shaped or open applicators or flat applicators are used for energy transfer.

Developmental stages:

1st generation of therapeutic nuclear magnetic resonance, ClosedSystem series

- Ring systems with permanent magnets
- Magnetic resonance field volume of approx. 1 litre for type CS300 and 10 litres for CS600

2nd generation of therapeutic nuclear magnetic resonance, OpenSystem series

- Electrical generation of the static basic field B0
- **Fast Adiabatic Passage, FAP**
- The transition from the ClosedSystem generation of devices (ring systems with permanent magnets) to the OpenSystem (open applicators) was only possible through the invention of the Fast Adiabatic Passage. This greatly homogenizes the static basic magnetic field.
- The volume of the magnetic resonance spin field has been increased by a factor of 10, i. e. approx. 30 litres of field volume for type OS350 and 150 litres for type OS700.
- The success rate of the treatment is hereby considerably increased (due to minimization resp. prevention of errors in patient positioning).

3rd Generation of therapeutic magnetic resonance

- Completely new therapy systems with extended range of treatment zones
- Basis of 4 new patents
- **Fast Adiabatic Passage, FAP**
- Electronic testing and monitoring functions of quality, size and effectiveness of the nuclear magnetic resonance spin field
- Pausing the therapy session is possible
- Improved compensation of metal parts in the treatment room
- Optimized and enlarged magnetic resonance treatment field with extended treatment zones and a significantly higher therapeutic success rate
- All treatment options can be carried out easily and comfortably

The size of the magnetic resonance field is in the range of 0.4 mT, which is a fraction of the field of a magnetic resonance tomograph used in MRI. Due to technological restrictions, it cannot exceed a maximal value of 4 mT.
In order to prevent errors in the operation of the device, the treatment process has been automatized, starting is carried out easily and error-free by means of a special start button.
Prior to the start of treatment, tissue-specific treatment data depending on the indication is automatically loaded into the control unit via a smart card reader unit. For each indication the correct, study-based, tissue-specifically programmed treatment chip card is required. The treatment takes one hour and is applicated daily. During this time, different tissue-specific program sequences are processed.
Depending on the indication, a series of treatments lasts between 7 to 10 hours. The devices can be used for a wide variety of clinical indications.

2. Identification and selection of relevant documents and information

Research data

The evaluation of MBST magnetic resonance therapy is based on a comprehensive research of literature at monthly intervals. For this purpose, the current literature databases for scientific literature are used and the relevant results are taken into account. Naturally, such a keyword search also leads to a large number of irrelevant search results, which can be excluded from the present evaluation. The most common reason for this is that these publications do not use the therapy procedure examined herein or a comparable technology.

In order to collect data, international and national literature databases are searched in a first step in order to identify published, scientifically recognised studies and publications. Due to its importance as the most important and comprehensive database, Pubmed and the Cochrane Library are used at first.
Because MBST technology was developed in Germany, literary sources in this language are to be expected. Therefore, the databases of the German Institute for Medical Documentation and Information (DIMDI) and the German Network for Evidence-Based Medicine (DNebM) are also used in the search. In addition, WHO and FDA are consulted. There is no need to include MedLine in the search, since its database is also included in Pubmed. Due to the high equivalence of hits with the databases already listed, the continuous use of EMBASE was waived.

The following search terms are defined and searched individually or in combination: mbst, nmrt, KSRT, Nuclear magnetic resonance therapy, Kernspinresonanz-Therapie.

The search is carried out continuously on a monthly basis and is supplemented with new results. Depending on the findings and other relevant new information, a summarising assessment of this new data in the context of the CER is carried out at least once a year. The stated literature data was compiled on the basis of research in March 2018 and thus shows the content of the databases at that point of time.

Only studies evaluating a therapeutic or other effect of MBST magnetic resonance technology – positive or negative – on cells and/or tissues are relevant for this evaluation. It is to be expected that the results for the search terms used will contain a large number of hits on a) the therapeutic use of simple magnetic field therapies such as pulsating signal therapy and b) the use of magnetic resonance for diagnostics as in MRI. Ad. a) are not relevant to the present study and can be excluded immediately, as the technology used in the two procedures is fundamentally different (see section Physical Therapy) and therapeutic results from the application of one cannot be transferred to the other. Ad. 2. are also not relevant. Although in both the technological basis is nuclear magnetic resonance, it is not exactly the technology that is used.

Furthermore, in the context of diagnostics (imaging methods) the magnetic field strengths differ by several orders of magnitude from those in the field of therapeutic use. Also, these publications do not evaluate any therapeutic effects of the technology which is the point of interest for the study at hand.

Pubmed
The keyword “mbst” yields 24 results. Some matches can be excluded directly beacuse they result from the use of the same letters for abbreviation (m-b-s-t) but concern completely different therapies and/or methods. This relates to all matches that deal with psychological or psychosocial topics (e.g. on Mindfuldness Based Supportive Therapy) (2, 5) and also Chinese medicine (mao-bushi-saishin-to) (17, 18, 20–23), furthermore, articles on laboratory diagnostical/virological/bacterial topics (4, 5, 16, 19) or tumour treatment (8, 12, 24). This leaves 3 relevant matches: Krpan/Kullich, 2017; Jansen et al., 2011; Temiz-Artmann et al., 2005. For the Keyword “nmrt” only 2 of the 10 results are relevant: Krpan/Kullich, 2017; Steinecker-Frohnwieser et al., 2017. All others can be excluded for the reasons described above. “Kernspinresonanz Therapie” brings no or no relevant results.

Problem des Suchbegriffs Nuclear magnetic resonance therapy
“Nuclear magnetic resonance therapy” turns out to be an unsuitable or at least difficult search term, as it results in a very high number of matches, which, however, almost exclusively deal with the diagnostic use in magnetic resonance imaging for therapy planning. Very often the matches found can also be assigned to the area of drug development or effects of drugs, which is also not relevant due to the non-use of drugs in the context of MBST therapy.
The Pubmed search gives 191,969 search results for “Nuclear magnetic resonance therapy”. The reduction to only title search leaves 20 hits. The first two are relevant: Krpan/Kullich, 2017; Salfinger et al., 2015.

In a second step, an attempt is made to reasonably limit the number of Matches by adding the main indications as defined by the manufacturer MedTec Medizintechnik GmbH to the search term, assuming that studies that are conducted using MBST magnetic resonance therapy devices will cover these and not completely different indications. However, the attempt to limit the number of non-relevant matches by adding “osteoarthritis” as one of the main indications of MBST magnetic resonance therapy as definded by the manufacturer is only partially successful. The number of matches is still extremely high and most refer to the diagnosis of, for example, gonarthrosis using MRI technology. The addition “osteoarthritis” only yields one relevant result: Steinecker-Frohnwieser, 2017. The combination with “pain” as symptom of most indications also yields one relevant hit already known: Salfinger et al., 2015. “osteoporosis” as an addition also yields a hit that has been previously found by the title search: Krpan/Kullich, 2017.
In another attempt, the search term is shortened, as it is likely that it is not necessarily the full term that is used. At the same time, however, the term must be specified in order to increase the number of relevant results if the assumption proves correct that the Overall number of hits is higher due to the shortening. Therefore, “magnetic resonance therapy osteoarthritis” is used as search term. This still results in 1608 matches. On the first page, the article Steinecker-Frohnwieser, 2017 is listed.
The function “best matches” of the PubMed search results in two further relevant titles: Gökşen et al., 2016; Kullich et al., 2013.

Cochrane Library
The Cochrane Central Register of Controlled Trials (CENTRAL) is particularly interesting due to its exclusive listing of randomized and quasirandomized studies, as all of these studies are of high quality due to their methodology.
The search term “MBST” results in 7 matches. As in Pubmed, all Matches involving Chinese medicine, psychological or virological/bacterial examinations can be excluded.
Thus, 3 relevant matches remain which can be used for the present evaluation: Kullich/Schwann/Walcher/Machreich, 2006; Kullich/Schwann/Machreich/Außerwinkler, 2006; Temiz-Artmann, 2005.

The search terms “nmrt” and “nuclear magnetic resonance therapy” do not bring any relevant results.

The 4445 matches of the search term “Nuclear magnetic resonance therapy” necessitate a further reduction (see above). Here, the main indications as defined by the manufacturer are also added.

The addition “pain” (as an abbreviation of low back pain, back pain) still results in 728 matches. However, the first 3 of These are directly relevant, some of them already known from Pubmed: Kullich/Schwann/Machreich/Außerwinkler, 2006; Salfinger et al., 2015; Salomonowitz et al., 2011 Another relevant match on the first search page is listed twice in different spellings and publications: Gökşen et al., 2016 (Goksen).

The addition “osteoarthritis” results in 142 hits, the only 2 relevant ones are those already found with the keyword "pain”.

The additions “osteoporosis” and alternatively “fractures” and “bone” do not yield any relevant hits. The same applies to “muscle”, “tendon”, “ligament” and “sport injury”.

Overall, the majority of the matches found in the Cochrane Library are studies in which magnetic resonance imaging is used diagnostically to initiate a therapy other than that examined here or to assess the success of the therapy (e.g. in cartilage transplants).

Clinical Trials
For reasons of completeness, the database clinicaltrials.gov of the US National Library of Medicine, which lists planned and conducted studies worldwide, is used.

The keyword “mbst” provides 1 relevant listed study: Nuclear magnetic resonance therapy in Knee Osteoarthrosis: A Double Blind Randomised Controlled Trial, Simon L. Barker, MD, Woodend Hospital Aberdeen, UK.
Another study is found under the keyword “Nuclear magnetic resonance therapy”: Cytotron® Delivered Rotational Field Quantum Nuclear magnetic resonance therapy for Multiple Sclerosis (RFQMR), The Centre for Advanced Research & Development, India. This is, however, not relevant, as a technology other than the one examined here is used. According to the information on its website, the Cytotron technology does not work with magnetic resonance fields, but uses several hundred “guns” from which radio frequency pulses are “shot” at the patient.

WHO
From the databases listed by the WHO, WHO IRIS, Ebsco Greenfile and Directory of Open Access Journals are chosen for research, as no relevant results are to be expected from any of the others due to the respective focus, especially on developing countries or accident prevention.

WHO IRIS
The keyword “mbst” results in 9 matches, but all of them can be excluded due to the publishing time dating back to before the development of MBST magnetic resonance therapy. Also all other used keywords bring only few and no relevant results. Only the search for “Nuclear magnetic resonance therapy” yields 249 results, which are exclusively concerned with the diagnostic use of magnetic resonance imaging, which is not relevant for the present study.

Ebsco Greenfile
“mbst”, “nuclear magnetic resonance therapy”, “nmrt” does not lead to any relevant results.

“Nuclear magnetic resonance therapy” finds 79 results. It is noteworthy that 16 of these deal with the effects of static electromagnetic fields in medicine. However, none of these articles use the MBST technology based on nuclear magnetic resonance technology. Data from the application of simple electromagnetic fields such as pulsating signal therapies, however, cannot be transferred to MBST therapy due to the fundamental differences in the technology used. Therefore, none of the results are relevant (regarding the differences between simple electromagnetic fields and therapeutic nuclear magnetic resonance, see the section on physical therapy).

DOAJ Directory of Open Access Journals
The key words “mbst”, “nuclear magnetic resonance therapy”, “nmrt” do not bring any relevant results. Only “Nuclear magnetic resonance therapy” again leads to 289 hits, which, however, as already described above, are not relevant for the present evaluation.

FDA
No relevant matches for any keyword are found in the FDA database, which is not surprising, as the its focus is on the registration of pharmaceutical products. Furthermore, MBST magnetic resonance technology is not yet available in the USA and is therefore not listed with the FDA. This database can therefore be neglected for the present evaluation.

Deutschsprachige Datenbanken
As a final step in the literature research, the databases of 2 German organisations are used with the aim of finding any German-language publications that are not listed in the international databases.

DIMDI
The database DAHTA of the DIMDI German Institute for Medical Documentation and Information does not provide a result for any of the keywords.
The second easily accessible database of DIMDI, AMIS, is of no interest for the present study, as ist focus is on drugs.

DNebM
The second organization, the German Network for Evidence-Based Medicine (DNebM), does not have its own database, but lists various databases for medical literature on its homepage and thus opens up further research possibilities. Some of them, such as PubMed and Cochrane, have already been used in this evaluation. The last database to be used here is LIVIVO, The Search Portal for Life Sciences of the German National Library of Medicine in Cologne.

LIVIVO
The Keyword “nmrt” brings only the already known article Steinecker-Frohnwieser, 2017.

“Magnetic resonance therapy” yields 123.332 matches. Adding indications, as previously tried, only increases the number of irrelevant matches. With the intention of excluding results that use diagnostic magnetic resonance for therapy planning, the list of results is sorted according to “Rank” so that only those matches are shown in which all 3 words occur together.
The match Göksen et al., 2016 is already known.
The second match, Taghva et al., 2015, does not use MBST magnetic resonance therapy but a different technology, as can be seen by the description in the abstract: “Magnetic resonance therapy (MRT) is a variation of transcranial magnetic stimulation where treatment frequencies are

derived from patient's dominant alpha-band frequency and resting heart rate". Neither applies to the MBST technology examined here. Therefore, this match is also irrelevant despite the identical term.
Jolesz et al. 2008 can also be excluded, since this is a reprint of an article from 1995, which means that it was written before the development of MBST nuclear magnetic resonance therapy.
Other already known matches are Salfinger et al., 2015; Salomonowitz et al., 2011.
One article might be interesting for this study, Cséplö, 2009, but on closer inspection it is noticeable that here too the MBST nuclear spin technology is not used, but a simple electromagnetic field, i.e. no nuclear spin, see section Physical therapy.
All further matches can be classified as irrelevant, since here MRI is used only for diagnostic purposes.

The search term "mbst" leads to 50 matches. We exclude all matches from ORTHOpress, since only scientific contributions shall be considered here. Also all matches on Chinese medicine, psychology, infections and in this case also computer applications are excluded.
Relevant remaining results are: Levers et al., 2011; Brockamp, 2009; Froböse et al., 2000; Auerbach/Melzer, 2003; Jansen et al., 2011; Temiz-Artmann et al., 2005.

The keyword "Kernspinresonanz Therapie" increases the list of results to 188 matches. After excluding irrelevant results according to the principle just described, further matches not yet found under the keyword "mbst" come up: Fagerer/Kullich, 2007; Kullich/Außerwinkler, 2008; Salomonowitz et al., 2011; Kullich et al., 2005.

Data collection from other, partly unpublished sources
Further data was provided by the manufacturer on request. Some of this is unpublished for different reasons. The studies from 2002 and 2003 were conducted as a prospective study shortly after the development of MBST therapy and were only presented at congresses. Others, Oliva, 2014 and Budny, 2015, are master resp. doctoral theses that have only been published within the university. An article, Egg, 2017, has not yet been published, but has been accepted for publication by a peer-reviewed journal. As it is highly relevant for the current state of knowledge about MBST nuclear magnetic resonance technology, a lecture manuscript with similar content has been included.

Other studies are also included here, which were published but could not be found in the databases used. They should nevertheless be used here, as they are indispensable for a comprehensive picture of MBST magnetic resonance therapy. Furthermore, it is necessary to consider various expert opinions in order to be able to present the technical background of MBST technology, also in contrast to other therapy procedures. A comprehensive list of all used and further sources can be found at the end of this report.

In addition to the data from literature, this report also includes information from market observation (PMS/vigilance) and reports of possible/actual incidents. However, there is no data regarding both of these so that neither can be included in the current assessment. For this reason, no further separate statements are made on these points below.

Criteria for the assessment of found data
In accordance with this table, all search results are also classified regarding their usefulness for the evaluation of the performance and safety of the medical device. The weighting of the individual references is based on the equivalence criteria in column 3.

Level 1 data means references, that are mostly classified 1 (A1, I1, P1, R1) and not classified 3 in any category.
Level 2 data means references, that are mostly classified 2 (A2, I2, P2, R2) and have a maximum of one topic classified 3, if another topic is classified 1.
Level 3 data means references which are classified 3 (A3, I3, P3, R3) at least twice or three times, if the classification in another heading is 1.
Level 4 data means references that are only classified 3.
Level 1 > Level 2 > Level 3 > Level 4
Assessment criteria for the suitability of found data

Assessment criteria	**Description**		**Classification**
Corresponding application	The device is used for the same purpose (e. g. same type of application)	A1 A2 A3	Same purpose Small deviation Large deviation
Corresponding indication	The same tissue or same body part is examined	I1 I2 I3	Same indication Small deviation (e. g. same symptoms in other part of the body) Large deviation (e. g. different tissue, different indication)
Corresponding target group	Data is collected from a representative group of patients (e. g. age, severity of condition)	P1 P2 P3	Homogenous group Group with small deviations Different population
Acceptable collection of data	Search results/studies/ publications contain enough information for a rational, objective evaluation	D1 D2 D3	High quality of data Small deficiencies (e. g. small number of cases < 50, but homogenous population Insufficient data (e. g. small number of cases, inhomogenous group or different condition)

Evaluation of the relevance of the data found in relation to the total number of search results found

Literature	Criterion application	Criterion indication	Criterion target group	Criterion quality of data	Level of weighting
Osteoarthritis					
Auerbach/Melzer, 2003	A1	I1	P1	D2	L1
Brockamp, 2009	A1	I3	P3	D2	L3
Fagerer/Kullich, 2007	A1	I1	P1	D2	L1
Froböse et al., 2000	A1	I1	P1	D2	L1
Jansen et al., 2011	A1	I3	P3	D3	L3
Kullich/Ausserwinkler, 2008	A1	I1	P1	D2	L1
Kullich et al., 2013	A1	I1	P1	D1	L1
Levers et al., 2011	A1	I1	P1	D2	L1
Steinecker-Frohnwieser et al., 2017	A1	I2		D1	L1
Temiz-Artmann et al., 2005	A1	I2		D1	L1
Klapsch, 2002	A1	I2	P1	D2	L2
Gökşen et al., 2016	A3	I2	P2	D3	L3
Barker, 2010?	A3	I1	NN	NN	NN
Mucha et al., 2017	A1	I3	P3	D3	L3
Mueller et al., 2015	A1	I3	P3	D3	L3
Intervertebral discs					
Kullich et al., 2013	A1	I1	P1	D1	L1
Kullich/Schwann/Machreich/ Ausserwinkler, 2006	A1	I1	P1	D1	L1
Kullich/Schwann/Walcher/ Machreich, 2006	A1	I1	P1	D1	L1
Salfinger et al., 2015	A1	I1	P1	D2	L1
Salomonowitz, 2011	A1	I,	P2	D2	L2
Osteo/bone					
Krpan/Kullich, 2017	A1	I1	P1	D1	L1
Temiz-Artmann et al., 2005	A1	I2		D1	L1
Handschuh/Melzer, 2008	A1	I1	P2	D2	L2
Klapsch, 2003	A1	I1	P2	D2	L2
Overbeck et al., 2003	A1	I1	P2	D2	L2
Krpan et al., 2015	A1	I1	P1	D1	L1
Kullich et al., 2016	A1	I1	P1	D1	L1

Only studies are evaluated in the table above, as articles, expert opinions etc. usually do not bring statistically meaningful results. Some titles are excluded from the relevance assessment because they deal with basic research on the application and technology of MBST magnetic resonance therapy. As this naturally applies equally to all indications, it makes no sense to include them here, but of course they are highly relevant for the overall evaluation.

3. Analysis of clinical data

The therapeutic nuclear magnetic resonance changes the balance in intracellular calcium and reduces the interleukin-1 induced increase of NF-κB activity in chondrocytes

The new, scientifically high-quality research project of an interdisciplinary team of the Ludwig Boltzmann Department for Rehabilitation, Ludwig Boltzmann Cluster for Arthritis and Rehabilitation in Saalfelden, Austria, and the Department of Special Anaesthesia and Pain Therapy of the Medical University of Vienna, investigated the influence of MBST magnetic resonance technology on cellular processes in chondrocytes.

For this purpose, Cal-78 human chondrosarcoma cells were kept under inflammatory conditions by application of IL-1β. NMRT-treated cells were tested for changes in histamine-induced Ca^{2+} release by fura-2-calcium imaging. The effects of IL-1β and NMRT treatment were further investigated by determining intracellular ATP concentrations and the activity of MAP kinases and NF-κB.

NMRT influenced intracellular calcium signalling by increasing basal [Ca^{2+}]. The calcium peak concentration caused by 10 µM histamine was increased by IL-1β and this increase was reversed by NMRT treatment. Screening of various kinase activities showed an apparent increase in the activity of MAPK/ERK and MAPK/JNK in NMRT stimulated cells, p38 was down-regulated, the IL-1β-induced decrease in intracellular ATP and the increased NF-κB activity was reversed under NMRT stimulation.

This leads to the following conclusions:
Under inflammatory conditions, NMRT has influenced cellular function by modulating cellular calcium inflow and/or calcium release. In addition, NMRT-induced changes in MAPK activities such as the down-regulation of NF-κB and increasing intracellular ATP could help to stabilize chondrocytes and delay cartilage damage caused by osteoarthritis.

The therapeutic nuclear magnetic resonance changes the balance in intracellular calcium and reduces the interleukin-1 induced increase of NF-κB activity in chondrocytes
B. Steinecker-Frohnwieser, W. Kullich, A. Mann, H.-G. Kress, L. Weigl, Clinical and Experimental Rheumatology, PMID 29185963

MBST and the circadian clock: effect of magnetic resonance therapy on the circadian clock and the hypoxia signaling pathway

A very interesting three-year research project with zebrafish entitled “Effects of Therapeutic NMR (MBST magnetic resonance therapy) on the Circadian Clock and the Hypoxic Signaling Pathway in Zebrafish Cells” at the Leopold Franzens University of Innsbruck, Faculty of Biology, Institute of Ecophysiology, provided a completely new way of looking at the effects.
The zebrafish (Danio rerio) belongs taxonomically to the family of Cyprinidae and is endemic to South and Southeast Asia as well as northeastern India, Bangladesh and Myanmar (Nelson, 1994; Barman, 1991).
Danio rerio was used as a model organism in genetics, developmental biology, neurophysiology and biomedicine due to special characteristics such as the short generation time of 3–4 months, cheap breeding costs and several hundred eggs after 2–3 days. The large and transparent eggs (0.7 mm diameter during fertilization), the possibility of external feeding, that is relevant for monitoring, and rapid development stages are also very interesting in research. The development of important organs within 36 hours is exemplary for further advantages of the model organism (Kimmel et al., 1995; Spence et al., 2008).

The most interesting feature is the genotypic comparability of the syntenic relationship between zebrafish and humans (Dawson et al., 2000), which is described often in specialist literature.

The very innovative, scientifically advanced research programme of a team of scientists from the University of Innsbruck, led by Dr. Margit Egg, confirms a new proven functional model for zebrafish. In the series of experiments, which were carried out repeatedly, the zebrafish cells were exposed to therapeutic magnetic resonance (MBST) for one hour per day for 4 days. The measurements were carried out on day 5.

Results

- The MBST treatment leads to a synchronization of the internal clock with a strong increase in amplitude.
- The application of magnetic resonance changes the circadian clock in zebrafish cells, thereby influencing the hypoxia signaling pathway highly significantly, which in turn has a massive influence on cell ATP.
- The effect is apparent at the mRNA level and at the promoter regulation level (reporter assay). Both of the pathways influenced play an important role in many diseases, which indicates that MBST technology might be used in a wider range of applications beyond the indication fields of degenerative diseases such as osteoarthritis and osteoporosis.

The gene transcription experiments confirm the effect of NMR treatment (MBST®-CS300) compared to control sham experiments.

- The first test series showed that the timing of the NMR treatment and/or measurement is decisive for the result.
- The second series of experiments was carried out in order to compare the experimental setup for the integration of the optimal cell culture time on the one hand and the number of NMR treatment days on the other.

This experiment was necessarily performed three times because usually patients are treated on 7–10 consecutive days, a period of time that is not possible when working with zebrafish cells. Even the reduced experimental set-up of seven days led to a loss of rhythmicity in the circadian oscillation of the cells due to the absence of synchronizing timer light

- Therefore, the third experiment was carried out with only 4 instead of 7 days of treatment time.

The results of this last experiment again confirmed the question of treatment time, as had already been the case with the first pilot experiment. The potential phase shift of two hours occurring in the oscillations of the Per1 and cry1 genes caused by NMR treatment show the involvement of the circadian clock in the cellular effects caused by NMR.
The timing of the therapeutic NMR (MBST®-CS300) treatment could be very important to achieve a continuous synchronisation of the circadian clock in the tissue.
The treatment time of one hour per day triggers a new synchronisation of the circadian.

An involvement of the circadian clock in cartilage matrix homeostasis and the progression of osteoarthritis was recently reported (Gossan et al., 2013; Gossan et al., 2014).
The positive effects of NMR treatment on clock oscillation in our study explained that the method of application plays an important role for the cellular signaling pathways.

In addition, the last experimental set-up also shows an effect of NMR treatment on the hypoxic signaling pathway.

- It could be shown that the HIF1 gene transcription degree changed significantly over the entire cycle.
- HIF3 also showed significant upregulation in gene transcription between 24h and 8h.

Although the role of HIF3 is still insufficiently researched, its role in the articular cartilage of the knee joint by hypoxia dominates. It is likely to act as a negative regulator of HIF-1 (Li et al., 2006; Ke/Costa, 2006; Makino et al., 2001). Naturally, the results of experiments on human chondrocytes and osteocytes need to confirm the observed effect of NMR treatment on zebrafish cells.

Effects of Therapeutic-NMR (MBST-Nuclear Magnetic Resonance) on the Circadian Clock and the Hypoxic Signaling Pathway in Zebrafish Cells
R. Oliva, Master thesis for the academic title Master of Science (MSc), Faculty of Biology, Institute of Ecophysiology, Leopold Franzens University of Innsbruck, Innsbruck, Austria.

MBST and the circadian clock: Effect of magneitc resonance therapy on the circadian clock and the hypoxic signalling pathway
[MBST und die Circadiane Uhr: Auswirkungen der Kernspinresonanztherapie auf die Circadiane Uhr und den Hypoxie-Signalweg
R. Oliva, F. Benscheidt, A. Michael Sandbichler, M. Egg, Institute of Zoology, University Innsbruck, Austria, Lecture at the Scientific training series Anwenderkongress Wetzlar, RIttal Arena, March 3–4, 2017.

Hypothetical active principle

The molecular basis of electrical activity in individual cells is bound to the presence of ion channels in the cell membrane (that separates the interior from the exterior of a cell). These ion channels are formed by large protein structures (protein molecules) which, due to their configuration, allow very selective ions to pass through the membrane or exclude them from the passage.
In contrast to the generally known current coming from the socket, the charge carriers in living tissue are ions and not electrons. Ions are negative or positive charged atoms like K^+, Na^+, Ca^{++}, Cl^-, but also H^+ (protons). In the latter case, they are also called proton channels. Recent research in this field has made it possible to assign biological functions to the different channels, which are among others distinguished by their conductivity. For example, it was possible to establish a link between the proton channels and the receptor for vanilla acid. This receptor is important in pain transmission (Hellwig et al., 2004).
A change in the passage of protons through these channels due to changes in the energy level of protons (caused by resonance) would clearly affect the experience of pain. The importance of proton channels, rapid transport of protons, energy-transmitting membrane proteins and enzymes is clarified by recent research (e. g. Pomes/Roux, 2002; Miloshevsky/Jordan, 2004). An explanation of pain reduction caused by a successful therapy with MBST technology is therefore based on quantum mechanics.

In recent years, numerous scientific investigations of the natural scientists Kullich, Steinecker-Frohnwieser and Weigl of the Ludwig Boltzmann Department for Rehabilitation in Saalfelden and the Medical University of Vienna have been carried out in the field of cell research. The most important ones will be described in more detail in the following part (in vitro studies) of this clinical evaluation report.

Clinical-pharmacological expertise commissioned by the Investitionsbank Hessen on the efficacy of magnetic resonance therapy in various orthopaedic indications
As early as 2004, a clinical-pharmacological report was prepared on behalf of Investitionsbank Hessen on the efficacy of magnetic resonance therapy for various orthopaedic indications. The report refers to extensive material of various clinical observations submitted by MedTec Medizintechnik GmbH, Gotenweg 51, D-35578 Wetzlar, as well as discussions with clinical investigators and with the “notified body” that has issued the CE mark. Author of the report: Prof. Dr. med. Peter Luecker, FACP physician for clinical pharmacology/toxicology, physician for clinical pharmacology.

Excerpt of this report dating from 2004
On the Effectiveness of magnetic resonance therapy:
In order to assess the expert opinion, the company MedTec Medizintechnik GmbH, Gotenweg 51, D-35578 Wetzlar, Germany, presented application observational surveys of various clinical institutions and medical practices. In total, the material consists of 13,686 cases treated with nuclear magnetic resonance therapy from 3 studies that were evaluated statistically correct but partly without prospective design.
Until today [2004!], nuclear magnetic resonance therapy is not a recognised medical treatment method, as despite the high number of surveys, its effectiveness has not been scientifically proven with the examinations submitted. Nearly all of the studies submitted do not meet the latest medical and scientific requirements of a clinical trial. However, since 13,686 cases were submitted as proof of efficacy, Prof. Lücker concludes that nuclear magnetic resonance therapy is highly effective in the treatment of the in the evaluation reported and described indications of degenerative cartilage damage of various joints and osteoporosis. Lücker continues: “If the efficacy can be proven by appropriate cell biological examinations and a large clinical study, the associated worldwide patents are financially very worthwhile with almost certainty. In addition to the studies already under way at renowned German universities and Austrian institutes, these and the proposed clinical study will also with a probability bordering on certainty lead to a positive result [this assumption has indeed come true!]. I recommend that the further studies described in this report be carried out in order to provide a more detailed scientific representation of nuclear magnetic resonance therapy and to establish it as a generally recognised standard medical technology therapy in hospitals, rehabilitation centres, doctors’ surgeries and health insurance companies”.

The problem with this report lies in the fact that, on the one hand, there are well over 13,000 case studies which largely show that magnetic resonance therapy, depending on the indication, leads to a significant improvement of between 70 and 90 percent of the clinical finding, combined with a significant improvement of the patient’s state of health. On the other hand, there are only 3 studies that have been evaluated using a valid statistical method.
However, the studies suggest that nuclear magnetic resonance therapy is highly effective in the treatment of the indications tested. Regarding the unfortunate description of the study and the name of the therapy in the study of the German Sports University Cologne – title: Evaluation of the effectiveness of three-dimensional pulsating electromagnetic fields of MultiBioSignalTherapy (MBST) on the regeneration of cartilage structures – it has to be stated that the technology used is not the widely applicated PEMF (Pulsating Electro magnetic Fields) technology but the nuclear magnetic resonance spin technology that is protected by worldwide patents, as it is described in the paragraph “Material and Method” of this study. Due to this conglomeration of inadequate methodology but 3 very acceptable studies and positive clinical findings on the other, the final statement of the evaluation can only lead to a very positive assessment of nuclear magnetic resonance therapy, because according to generally accepted clinical standards the treatment of the 2 indications has been very successful and can thus be considered highly effective.

Clinical-pharmacological expertise commissioned by Investitionsbank Hessen on the efficacy of nuclear magnetic resonance therapy in various orthopaedic indications
[Klinisch-Pharmakologisches Gutachten im Auftrag der Investitionsbank Hessen zur Frage der Wirksamkeit der KernspinResonanzTherapie bei verschiedenen orthopädischen Indikationen]
Prof. Dr. med. P. Luecker, FACP, Pharmacology/Toxicology Doctor, Clinical Pharmacology Doctor, October 2004, Germany

In vitro studies

As with any other new form of therapy, it is important to detect indications of possible damage to the organism in good time. Increasingly, in vitro models such as that of primary cell culture are being used for this purpose (also in order to spare animal experiments). Programmed cell death (e. g. apoptosis), changes or retarded growth can be clearly identified and recorded partly not only qualitatively but also quantitatively. Investigations into the possible risks of MBST therapy were therefore quite appropriate.

Innocuousness (cell cultures)

Temiz-Artmann et al., 2005, were able to report that in a prospective study of primary chondrocytes and osteoblasts the exposure of the primary cell cultures to the field on nine occasions with a duration of 30 or 60 minutes each, did not show any cell-damaging effect. The viability of the cultures was determined using the generally accepted trypan blue exclusion method. Apoptosis (cell death) was detected using a commercially available kit. Positive controls in the presence of H202 (caused cell death) were also carried out. The duration of field exposure was based on the usual duration of clinical therapy and can therefore be considered relevant.
In addition to this positive result, a tendency towards stronger cell growth was observed. However, this could not be verified statistically by the applied method of counting selected, randomized visual fields, since the cells were almost confluent (grown together without visible transitions) at the end of the experiment. The counting of the cells at day 15 could not be expected to yield a clearer result. The differences in the proliferation rate of 271 and 290% are rather modest in view of the overall proliferation rate of almost 1,400% and could not be verified statistically significant in contrast to placebo due to the scattering of the measured values. It has to be noted that it is unfortunate that the authors did not determine the total protein content of the cultures. This would have provided clearer information on the growth rate of the cells and would have been easier to handle for statistics. Nevertheless, the work is of particular importance because it has not shown any evidence of tissue-damaging effects, but on the contrary has given first indications of a proliferation of chondrocytes and osteoblasts.

NMR In Vitro Effects on Proliferation, Apoptosis, and Viability of Human Chondrocytes and Osteoblasts
A. Temiz-Artmann, P. Linder, P. Kayser, I. Digel, G.M. Artmann, P. Luecker, Methods and Findings Exp. Clin. Pharmacol., 27(5), 391–394.

Since the effects of magnetic fields on biological cells have already been reported in a large number of publications, it has become necessary to differentiate the completely new mode of functioning and active principle of nuclear magnetic resonance therapy using different models of examination.

Changes in protein synthesis in fibroblast cultures

In a further study, Prof. Dr. Artmann, University of Aachen (Artmann, 2007) conducted a three-part study on fibroblast cultures using this new technology. In this series of tests, the technology was tested not only against placebo, but also very sensibly against the application of a static magnetic field. In this way, not only the possible effect of MBST therapy should be recorded, but also a demarcation from the application of static magnetic fields should be achieved. The result impressively confirms this hope. Definite differences between the application of placebo and the application of a static magnetic field on one side and the application of the MBST® therapy device on the other side were found during 12 hours of application (6 times for 2 hours per day). In the latter case, there were major changes in protein synthesis. An upregulation of some protein classes as well as downregulation of other protein classes was found, both of which could not be observed in the application of placebo or static magnetic fields. Based on comparative analyses

using the proteome map of a human fibroblast cell line, the majority of these proteins could – with reservation – be assigned to the structural and regulating protein classes.

Two main effects of NMR on fibroblast cells:

a) Influence on cellular protein expression
   NMR treatment leads to a change in the protein profile of skin fibroblasts that is visible on 1D and 2D PAGE gels. The proteins affected are probably related to the cytoskeleton and the inflammatory signaling pathways.

b) Changes in collagen crosslinking
   NMR treatment led to a significant increase in soluble EZM collagene, while at the same time decreasing sparingly soluble and insoluble EZM collagene. This leads to an improved hydration of the ECM.

The author concluded that these changes in the sense of a positive influence due to a better hydration occurred as a result of the MBST application. Interestingly, one class also included proteins of the inflammatory signaling pathways (indication of an influence on inflammatory processes). This finding establishes a direct reference to the positive effects of MBST on inflammatory processes during joint treatment that were observed in the treatment of patients. These extensive and very complex investigations not only prove a biological effect of the MBST application, but also clearly show the assumed difference to the application of static or pulsating magnetic fields.

Decrease in extracellular collagen crosslinking after NMR magnetic field application in skinfibroblasts
G. M. Artmann, A. Temiz Artmann, I. Digel, E. Kurulgan, Pt. Linder, P. Kayser, D. Porst, G. J. Braem, K. Zerlin, Journal of the International Federation for Medical and Biological Engineering, 45, 91–97.

Proteome level effects of the MBST application in the skin cell model

In a further study, Prof. Dr. Artmann, University of Aachen (Artmann, 2006) conducted another three-part study on fibroblast cultures with the title “Proteome-level effects of MBST application in the skin cell model in cultures”, using the new technology of gene-chips (proteome level model). This series of tests was again very sensibly performed not only against sham or placebo, but also against the application of a static magnetic field. In this way, not only the possible effect of MBST therapy should be recorded, but also a demarcation from the application of static magnetic fields should be achieved.

Extensive analytical methods were used in execution of the tests:

- Sample groups and the planning of experiments
- Experimental controls: SDS-PAGE data, 2D-PAGE data
- Protein groups impaired by NMR
- Effect of NMR on collagen cross-linking

Example groups: 1 – culture medium before NMR; 2 – culture medium 1 day NMR; 3 – culture medium 3 days NMR; 4 – culture medium 6 days NMR; 5 – culture medium 9 days NMR; 6 – cell biomass; 7 – NaCl extract pH 5; 8 – acetic acid extract at room temperature; 9 – acetic acid extract 70ºC, probe analysis: protein content (Bradford method), protein content (Lowry method), SDS SITE, 2D SDS SIDE, ELISA, Western Blotting
Results: Two major effects of NMR on fibroblast cells were found:
Influence on the expression of cellular protein

- NMR treatment led to protein profile changes visible in 1D and 2D PAGE gels. The proteins involved are probably cytoskeletal and inflammatory pathways. Changes in collagen cross-linking.
- The NMR application caused a significant increase in soluble ECM collagens with a corresponding decrease in semi- and insoluble ECM collagens. This leads to improved hydration of ECM in the skin.

Proteome level effects of MBST application in the skin cell model in culture
[Proteom-Level-Effekte der MBST Anwendung im Hautzellmodell in Kultur]
A. Temiz-Artmann, P. Linder, P. Kayser, I. Digel, G.M. Artmann Artmann GM (2006). Study report (assigned study MedTec Medizintechnik GmbH, Wetzlar)

Influence of magnetic resonance on the NFAT pathway in osteo- and chondrosarcom cells

A further study by the Austrian team of researchers Steinecker-Frohnwieser, Weigl, Kullich and Kress of the Ludwig Boltzmann Department in Saalfelden and the University of Vienna on a possible influence of magnetic resonance on the gene expression of CAL-72 cells showed that the expression of components that are involved in the NFAT pathway in CAL-72 cells increased. NFATc1, c3 and NFAT5 seem to be most conspicuously regulated, the two transcription factors NFATc2, 4 and NFATC2IP seem to be hardly regulated and are also expressed very weakly. As a result of the two experiments, it was possible to observe clearly and divergently altered expression levels with respect to calcineurin (PPP3), glycogen synthase kinase (GSK3), calmodulin (CALM) and calcium/calmodulin-dependent protein kinase (CAMK). In addition to a clear increase in the expression of NFKB2 and NFKBIE, the expression pattern of the stimulated cells has also changed with regard to other different regulatory proteins. With the exception of GSK3, RT-PCR enabled the detection of a prominent expression of the individual genes for both CAL-72 and CAL-78 cells; the specificity of the selected primers was confirmed by controls. The first real-time PCR experiments were able to show the effects observed in the gene array with CAL-72 partially or using the Chondrosarcom-CAL-78 test series more clearly.

Results and conclusion: The magnetic resonance caused a change in the expression of the components of the NFAT pathway in both investigated cell lines. The observed differences between the effects of gene arrays and PCRs could be attributed to different specificities (samples of gene array versus “genespecific” primers) of the used methodology. Further PCR experiments are expected to provide more detailed information on the expression rate. Statistical data analysis makes it possible to validate those genes that also show changes in the expression level in the gene array analysis under the influence of magnetic resonance. The observation, that magnetic resonance effects a modulation of the NFAT pathway within osteosarcom and chondrosarcom cells, coincides with studies that discuss the induction of cell growth in connection with the active principle of magnetic resonance. Inhibition of the NFAT pathway in both osteoblasts and osteoclasts leads to a reduction in the proliferation and differentiation of these cells. Due to the fact that the activation of NFAT leads to a dephosphorylation event triggered by an increase in the intracellular Ca^{2+} concentration, additional investigations at the protein and cellular levels are indispensable. Planned measurements of the intracellular Ca^{2+} concentration and activity of the NFAT using a reporter gene assay should provide information about the more precise mechanism.

Influence of nuclear magnetic resonance therapy on the regulation of the NFAT pathway in osteo- and chondrosarcoma cells
[Einfluss der Kernspinresonanz-Therapie auf die Regulation des NFAT-Pathways in Osteo- und Chondrosarkomzellen]
B. Steinecker-Frohnwieser, L. Weigl, W. Kullich, H. G. Kress, J Miner Stoffwechs, 15(4), 11/2008, 201.

Influence on the metabolism of cell lines

Another study entitled “Influence of NMR Therapy on Metabolism of Osteosarcoma and Chondrosarcoma Cell lines” was conducted in order to register the regulation of different genes under the influence of magnetic resonance therapy.

Important osteological/rheumatological facts are:

- Stress activated protein kinases (SAPK / JUN amino-terminal kinases / JNK) are members of the MAPK family and are activated by a variety of environmental stress factors, inflammatory cytokines and growth factors.
- c-Jun signalling together with NFAT is decisive for the RANKL-regulated osteoclast differentiation (IKEDA et al., 2004).
- NFAT plays an important role in the transcription program of osteoblasts.
- NF-κB is activated by RANKL and plays a crucial role in osteoclastogenesis.
- The Fas ligand (FasL) serves as an important death factor in the immune system by inducing apoptosis.
- The ras/raf/MAPK/ERK-pathway negatively regulates IGF stimulated PG synthesis in chondrocytes.
- Apoptosis inhibitor (IAP) are a family of proteins that prevent cell death. The expression of BIRC-3 is increased after the action of NF-κB by TNF receptor.
- Glycogen synthase kinase 3 (GSK-3) activity may dictate how cells react to glucocorticoids
- (Galliher-Beckley et al., 2008).

Several growth factors (e. g. IGF, TGF, VEGF) regulate the performance of cells in bone and cartilage and play a role in the inflammatory immune response.

Methodology: For the investigations CAL-72 osteosarcoma cells and CAL-78 chondrosarcoma cells were purchased by DMSZ (German collection of microorganisms and cell cultures). The cells used for RNA isolation were treated with an NMR therapy device (MBST®, MedTec, Wetzlar, Germany) for 20 hours within 4 days (6 hours on the first 3 days and 2 hours on the last day).

The extracted RNA was labelled with biotin and hybridized on membranes carrying different gene markers. The expression of specific genes was quantified by bioluminescence. In addition, quantitative PCR was performed to support the results of gene arrays. RNA of cells incubated at room temperature at the same time is used for controls. The concentration of free Ca^{2+} in living cells was determined fluorometrically with cells loaded with Fura 2 AM for 60 min. Using histamine, the cells were transfected with DNA constructs corresponding to the luciferase reporter genes to test the up and/or down regulation of the activation of regulatory proteins involved in signal transduction pathways.

Results and conclusions:

- As shown in the microarray technique, different genes are regulated differently compared to control group.
- Obviously, the genes of the NFAT pathway are regulated uniformly.
- The qPCR of the most conspicuous genes showed no significant changes compared to control group.
- Luciferase reporter gene assays definitely showed no significant increase, but a slight decrease in NF-κB or MAPK activity compared to untreated cells. This could be important because high NF-κB and MAPK support the properties of inflammatory processes in rheumatic diseases.

- Intracellular Ca^{2+} signaling was not significantly altered due to the influence of the NMR.
- From the qPCR, it can be concluded that NMR in the therapeutic dosage triggers no apoptotic mechanisms in Cal-72 and Cal-78 cells.
- Arrays relating to apoptosis, cell cycle and osteogenesis are effective tools for evaluating the feedback of potential dangers and showed no oxidative, metabolic, repair or heat shock voltage during NMR exposure.
- The results show that NMR with a magnetic field strength of up to 2.3 mT and a therapeutic treatment time of 20 hours in 4 consecutive days has no harmful effects on osteo- and chondrosarcoma cells.

Influence of NMR Therapy on Metabolism of Osteosarcoma- and Chondrosarcoma Cell lines
B. Steinecker-Frohnwieser, L. G. Weigl, C. Höller, E. Sipos, W. Kullich H. G. Kress, Arab Health, Dubai, The official magazine of the Arab Health Exhibition, Januar 2010, 40.

Influence of NMR therapy on Ca^{2+} signalling and gene expression in osteosarcoma and chondrosarcoma cell lines

Introduction

Nuclear magnetic resonance therapy (NMRT) with weak magnetic fields (up to 2.3 mT, 100 kHz) has shown that repair processes in cartilage are stimulated and pain signaling is influenced. On the contrary, strong magnetic fields (3 T) used for imaging purposes are believed to have harmful effects on chondrocytes and cartilage repair. In order to assess the effect of NMRT with an optimized field strength on cellular processes, we used microarrays and quantitative PCR (qPCR) for the expression profiling of NMRT-treated chondrosarcoma and osteosarcoma cells.

RNA was isolated from cells treated with an NMR therapy device (MBST®, MedTec, Wetzlar, Germany) for 20 h in 4 days. The RNA was labelled with biotin and hybridized on membranes carrying different gene markers. Bioluminescence was used to quantify the expression of specific genes. A qPCR was used to confirm the results of gene arrays.
The concentration of free Ca^{2+} in living cells was determined fluorometrically with cells loaded with Fura 2 AM for 60 min. Ca^{2+} release was triggered in osteosarcoma and chondrosarcoma cells by the application of different concentrations of histamine. To investigate the voltage-activated Ca^{2+} current, we used PC12 cells, a cell line of neuronal origin. The depolarization of the cells was achieved by a solution with a high concentration of potassium.

Conclusion

- The degree of expression of the transcription factors of the NFAT family was detected by microarrays or qPCR in cells after NMR treatment and in control cells.
- A quantitative effect of the NMR treatment of osteosarcoma and chondrosarcoma cells could not be demonstrated.
- The modulation of the transcription via NFATs is not necessarily dependent on its expression rate. The functional modulation of NFATs is due to their phosphorylation state.
- A functional modulation of NFATs by NMR was not detectable.

Influence of NMR therapy on metabolism of osteosarcoma- and chondrosarcoma cell lines
B. Steinecker-Frohnwieser, L. G. Weigl, C. Höller, E. Sipos, H. G. Kress, W. Kullich, Bone 2009, 44(2), 295.

Studies with animals

In the field of drug development, the examination of a human indication using an animal is very often carried out worldwide in order to be able to take measurements that are prohibited in living humans. It was therefore standing to reason to examine the effects of MBST therapy in the animal experimental model in order to gain additional insights into the effect of MBST.

Posttraumatic gonarthrosis in rabbits

Jansen and his colleagues at the University of Muenster (Jansen et al., 2006) surgically severed the anterior cruciate ligament of both hind legs of 12 male adult rabbits, race New Zealand White (resection), in order to produce moderate arthrosis over a period of 6 weeks (= experimental gonarthrosis in the animal model). After these 6 weeks the animals were randomized into 2 groups. The therapy group was treated for 7 consecutive days, 1 hour per day, using an MBST® device from MedTec. The control group was kept under the same conditions, but the therapy device was not activated. After the killing of the animals, the knee joints were examined macroscopically and microscopically with the help of various scores.

The examination of osteophyte formation showed a statistically significant ($p < 0.05$) doubling under active therapy. The overall macroscopic score for the therapy active group was significantly lower. Therefore, it was possible to give positive proof of a therapeutic intervention by MBST therapy in animal experiments under controlled laboratory conditions.

In contrast, the microscopic evaluation of the study period of 6 weeks showed no significant difference between the therapy and the control group because the examination period was too short.

Inaugural dissertation on obtaining the doctor medicinae of the medical faculty of the Westfaelische Wilhelms-University Muenster: Does MBST nuclear spin resonance therapy have an influence on post-traumatic gonarthrosis in the rabbit model?
[Inaugural-Dissertation zur Erlangung des doctor medicinae der medizinischen Fakultät der Westfälischen Wilhelms-Universität Münster: Hat die MBST®-Kernspin-Resonanz-Therapie einen Einfluss auf die post-traumatische Gonarthrose im Kaninchenmodell?]
T. Brockamp, University Hospital Münster, Clinic and Polyclinic for Trauma, Hand and Reconstructive Surgery; April 2009.

Effects of low-energy NMR on posttraumatic osteoarthritis: observations in a rabbit model
H. Jansen, S. P. Frey, J. Paletta, R. H. Meffert, Archives of orthopaedic and trauma surgery, 2011, 131(6), 863–868.

Cub-, gon- or coxarthrosis in dogs

Introduction

As osteoarthritis is also a common disease in animals, Dr. Bockstahler conducted a double-blind, randomized study with dogs at the University of Veterinary Sciences in Vienna.
Canine osteoarthritis (OA) is treated for the associated pain, stiffness and lameness.

Aim of the study

The aim of the study was to evaluate whether magnetic resonance therapy (MBST®) improved clinical signs of dogs suffering from osteoarthritis. Control dates were immediately after MBST® treatment and 3 and 6 months after treatment.
Over a period of nine days, 15 dogs were actively treated with NMR (TG) and 15 received placebo (PG).
Used for the evaluation: lameness and pain score, symmetry indices, peak vertical force and vertical impulse, drop-out, additional painkillers or physical therapy during the course of the study. From these parameters, an individual score was calculated for each dog to evaluate the overall effectiveness of the treatment (OTE) at the evaluation points.

Results

- 3 months after MBST®, the animals in the active group showed a significantly better OTE compared to the animals in the plaebo group. Lameness, score and symmetry as well as indices for peak vertical force and vertical impulse were significantly improved 3 months after treatment.
- As a result, the authors concluded that treatments with NMR had positive effects on the clinical signs of OA in dogs 3 months after therapy.
- The assessment point 6 months after the end of the therapy showed a slight deterioration in the improved impression of the dogs.

The reasons for this are probably the control behaviour of the dog owners (too early exertion or overload) and in the higher metabolism of dogs (which is 10 times higher than that of humans).

Treatment of the clinical symptoms caused by osteoarthritis using nuclear magnetic resonance (MBST®) in dogs a randomized trial
M. Mucha DVM, I. Virac[1], C. Lang[1], K. Wittek[1] DVM, A. Tichy[2] MA, DSc, B. Bockstahler[1] DVM; PD*,[1] Department for Small Animals and Horses, Small Animal Surgery, Section for Physical Therapy and Rehabilitation, University of Veterinary Medicine, Vienna, Austria, [2]Department for Biomedical Sciences, Platform Bioinformatics and Biostatistics, University of Veterinary Medicine, Vienna, Austria.

Nuclear magnetic resonance treatment (MBST®) of clinical symptoms caused by osteoarthritis: a double-blinded placebo-controlled study in dogs
M. C. Mueller, K. Wittek, B. A. Bockstahler, Poster presentation at the Veterinary Congress in London, 2015.

Indication organ regeneration

Effect of magnetic resonance therapy on liver regeneration

Introduction

Main interest of this investigation was to determine a possible effect of nuclear magnetic resonance on liver regeneration.
The liver is the only organ capable of regeneration. Almost all modern liver resection techniques, including innovative split liver transplantation techniques, are based on this ability.
In addition to the positive effects of the application of MBST therapy at the cellular level, it seemed useful to investigate the effects at the organ level. A promising animal model to test the hypothesis of a positive influence on the regeneration of rat livers was used to provide more information.

Methodology

As evidenced by the interim and final reports of Prof. Dr. Spiegel, University of Muenster (Hölzen et al., 2006), 108 male Lewis rats were randomized into 6 groups. The aim of the study was to investigate the effect of nuclear magnetic resonance therapy on liver regeneration after 70% hepatic resection as well as on untreated liver tissue.
For this purpose, the animals were put under anaesthesia for 60 minutes (the usual duration of a treatment session) and irradiated. A total of 6 groups were formed, each with 2 controls, 2 with an irradiation as used in osteoarthritis therapy and 2 with an irradiation as used in osteoporosis therapy in the clinical area. Both blood parameters and histological parameters were used as measuring parameters.
The study included 3 control groups in which only the abdomen was opened and 3 resection groups. Group size was always n = 18 animals. In each group, either a placebo treatment or an application of nuclear magnetic resonance with one of two different programs (dose I or II) was performed on the first 3 days postsurgical. Liver biopsies were taken on days 4, 7 and 14 after intravenous administration of 100 mg/ml bromodesoxyuridine (BrdU) per kg body weight. Weight and various serum parameters (AST, ALT, alkaline phosphatase) were examined as markers for possible liver damage. The progress of liver regeneration was assessed with mitoses, mitoses in the S-phase, signs of inflammation, cell necrosis, connective tissue, glycogen and angiogenesis. Overall, no damaging effect of the non-invasive procedure on healthy tissue was found.

- 70% resection of rat livers
- MBST to examine liver regeneration
- 3 groups of 18 rats each:
- 1 control group (placebo group)
- 1 therapy group treated with osteoarthritis therapy cards
- 1 therapy group treated with osteoporosis therapy cards

On day 1, 2 and 3 postsurgical 60 min MBST

- Termination of rats after 4, 7 and 14 days.
- Study parameters:

- weight, liver volume, general condition
- Blood laboratory (Na, K, Krea, Bili, Ammonia, PCHE, GOT, GPT, Y-GT, LDH, AP), Histology (Mitoserate BrdU/Ki 67, VEGF (angiogenesis) and liver injury (silver and HE staining as well as immunohistochemical determination of antivimentin)

Only about 25% of patients can have an initial curative operation. A non-invasive procedure such as nuclear magnetic resonance therapy might be able to increase this number.
In split liver transplantation, the concomitant treatment with nuclear magnetic resonance therapy to stimulate liver cell regeneration might reduce the risk of a postsurgical dysfunctioning for both the donor and the recipient and might contribute to a faster recovery of the patients.
This model has shown that the frequency modulations I and II of nuclear magnetic resonance therapy have different effects on healthy as well as on regenerating liver tissue.

In healthy tissue, however, this led to a significant difference between the 3 groups only for the glycogen content of liver cells, but in the longitudinal course a tendential difference between the 2 actively treated groups especially with regard to the detected mitoses in the cells could be detected. This was also evident in the regenerated liver tissue after resection.

- The frequency modulation of the clinical application for osteoporosis of the treatment device showed the greatest influence on liver cell proliferation (OD map). In this treatment pattern, significantly higher mitosis rates were observed partially, especially in the specific rate of S-phases compared to the two groups that were treated differently. Additionally, this group had significantly smaller nuclei in the histological evaluation on day 14, which marks the completion of regeneration.
- Under frequency modulation II, which is usually used for osteoarthritis (OA card), a delay seemed to occur with regard to some of the regeneration processes mentioned here. Mitotic rates in this group tended to be lower than those in the untreated group. The same applies in particular to the S-phases.

In this study, data was collected for a period of 14 days, as it was assumed that liver regeneration is largely completed after this time. Further investigations should be carried out to examine the long-term effect of nuclear magnetic resonance therapy on the schematic representation of the regeneration of the resected rat livers under the various treatment patterns in longitudinal proliferation as well as the cell activity in the control groups of proliferating tissue.

In particular, the different effects that depend on frequency modulation and thus on the depth of penetration require further analysis. The author concludes: “Nuclear magnetic resonance therapy – in this case MBST – obviously influences various molecules in the cells as well as receptors and enzymes by stimulating hydrogen atoms and the resulting changes in intra- and extramolecular bonds such as hydrogen bridge bonds. This opens up many more further questions.”
The application of MBST therapy led to statistically significant differences in 2 important parameters, namely the regeneration volume of the resected liver and the histologically recorded mitosis rate ($p < 0.05$)

Results
This experiment has shown that the frequency modulations I and II of magnetic resonance therapy have different effects on both healthy and regenerated liver tissue.

- Proliferation cycle non-parenchymal cells/hepatocytes different
- One of 20,000 hepatocytes in replication phase (co-rate 0.005%)

- Control groups (no resection) on days 4, 7, 14: equal values of mitoses per mm^2 ($20/mm^2$)
- Osteo card frequency: significant increase in mitosis ($p < 0.01$) after day 7
- Expression of VEGF (angiogenetic factor, reg. factor/wound healing/growth) in hepatocytes on day 4 higher than on day 14 (OD and OA therapy card)
- VEGF score for non parenchyma cells on day 4 strongly significantly ($p < 0.01$) increased compared to day 7, significantly lower on day 14 = regeneration completed earlier! (OD card only)
- At no time liver cell damage such as inflammation or cell necrosis (HE staining)
- The glycogen score (glycogen of hepatocytes synthesized from blood glucose under the influence of insulin, but also degraded under the influence of adrenaline and glucagen if necessary) is significantly higher at both MBST frequencies on day 4 than in the control group. Significantly lower in the OD chart on day 7

It can therefore be assumed that the activity of hepatocytes was clearly increased following MBST treatment.

- Liver regeneration was already well advanced in contrast to the other 2 groups.
- Vimentin expression (marker for identification of degenerate cells) not increased!

Cell necrosis can be found in all 3 resection groups, but at different times:

- OD- and OA therapy card: isolated necrosis on days 4 and 7
- Control group: only from day 7 onwards

Liver regeneration was also characterized by controlled cell necrosis. Earlier onset of this phenomenon = faster regeneration!

Nucleus size:

- OD and OA therapy card: On day 14, the cell nuclei were significantly smaller. This speaks in favour of a largely completed regeneration at this time

Thesis for obtaining the doctorate rerum medicinalium from the Medical Faculty of the Westfaelische Wilhelms-University Muenster: Effects of nuclear magnetic resonance therapy on the dynamics of liver regeneration.
[Inaugural-Dissertation zur Erlangung des doctor rerum medicinalium der Medizinischen Fakultät der Westfälischen Wilhelms-Universität Münster: Auswirkungen der Kernspinresonanztherapie auf die Dynamik der Leberregeneration.]
N. Budny, University Hospital Muenster, Clinic for General and Visceral Surgery, Department of Surgical Research; October 2015.

The effects of magnetic resonance therapy on the regeneration of liver cirrhosis and the question of what frequencies might be used to intervene at certain points in the cell metabolism need to be clarified and should be examined in further studies.

This study showed that treatment with different frequency modulations in the form of nuclear magnetic resonance therapy did not have a damaging effect on healthy tissue during the study period. The available results also show that different frequencies have different effects on both healthy and regenerating liver tissue.

An improvement in cell proliferation, also in a parenchymatous organ such as the liver, might enable a larger extent of liver resection in liver tumor surgery if it is necessary and thus to maximize the possibility of surgical radicality. As already mentioned, only about 25% of the patients can have an initial curative operation.

The test results clearly show that the application of nuclear magnetic resonance could have a therapeutically useful effect, which may play a role in the treatment of liver diseases in the future

Clinical results

Influence on osteoarthritic symptomatology

Since a biological effect of using nuclear magnetic resonance therapy at the cellular and organic level could be demonstrated, the question of therapeutic usability arises. In contrast to a general effect on biological systems, the focus here is on the efficacy for certain indications. Following numerous reports in the literature on the efficacy of pulsating magnetic fields in orthopaedic indications, Kroesche and Breitgraf (1998) carried out a prospective study of the application of MBST therapy for multiple joint complaints in 30 patients.
Since in some patients more than one joint was affected, a total of 44 treatments were performed. Gonarthrosis was documented in 27 patients. The assessment was based on a 6-stage analogue scale for sensitivity, pain frequency, intensity of pain, restriction of movement, change of bending angle in the knee joint, swelling, overheating, redness and discomfort.

Results

6 weeks after therapy 20 patients (66.6%) showed an improvement, 8 patients (26.7%) showed no improvement and 2 patients (6.7%) showed a deterioration. 5 patients had a follow-up treatment carried out in the same setting, 3 of which showed an improvement.
Regarding that this study was carried out under everyday conditions, the result is remarkable, especially since there were no negative effects, side-effects or other impairments apart from an occasional feeling of warmth or tingling.

Looking at the overall results, including follow-up treatments, 76.7% of the treated patients experienced an improvement in at least one treated joint, 70% of the patients had an improvement in all treated joints. According to the authors, this proves that MBST therapy is an effective and innovative treatment for osteoarthritic disorders.

Long-term monitoring of MBST® MultiBioSignalTherapy
[Langzeitkontrolle der MultiBioSignalTherapie MBST®]
G. Breitgraf, M. Kroesche, MBST therapy center Cologne, final report, December 1998

Effects on tissue

Dr. Klapsch, Spittal an der Drau, Austria, came to a similarly positive conclusion in his observational study. The results were presented at the 27th annual conference of the Austrian Orthopaedic Society in Graz (Klapsch, 2003).
In his study, the author treated predominantly knees and ankle joints with 5 hour therapy cycles (34/11) and 9 hour therapy cycles (52/7). Subjective satisfaction of the patients, pain levels at rest and stress as well as joint function were assessed.
Very good to good results were achieved in 70% of the patients who received short treatment and 73.5% of the patients who received long (9 hours) treatment.
Although these results can only be regarded as a trend for the time being, as stated by the author himself, these results represent a certain amount of experience which can serve as a basis for planning and designing future double-blind, randomized and placebo-controlled studies.

MBST magnetic resonance therapy – effect on tissue
[MBST-Kernspinresonanztherapie – Wirkung im Gewebe]
W. Klapsch, Spittal, Austria; lecture at the annual conference of the Austrian Society for Orthopaedics, Graz, Abstracts, 2003.

MBST nuclear magnetic resonance therapy – therapy for degenerative and traumatic joint changes
[MBST-Kernspinresonanztherapie – Therapie bei degenerativen und traumatischen Gelenksveränderungen]
W. Klapsch, Spittal, Austria; lecture at the annual conference of the Austrian Society for Orthopaedics, Graz, Abstracts, 2003.

Regeneration of cartilage structures in cases of gonarthrosis

The literature includes a work by Prof. Dr. Froboese, University of Cologne (Froboese et al., 2000), which reports about the application of the above-mentioned magnetic resonance therapy on 14 patients with gonarthrosis.
The success of the treatment was demonstrated by means of an in the meantime technically highly optimized tomographic imaging method, which is also based on nuclear magnetic resonance. The field size of the MRI scanner was 1 Tesla.
Before the start of treatment, the patients of the MBST® showed cartilage defects, some of which very serious (Wirth 2 to 3).
The MRI images of the knee joint were taken before and 3 months after MBS therapy. The subsequent cartilage quantification and visual presentation of the positive adjustments of the cartilage structures of the knee joint showed a highly significant increase (increase in volume was more than 30%) in the thickness, volume and area of the cartilage structures. The mean density of the cartilage structures of patella and tibia was compared before and after treatment with magnetic resonance therapy. Statistically, highly significant differences between the pre-value and the post-treatment value were recorded for both structures.

Of course, when presenting such results, the question of a controlled test design always arises. It should be noted that the visual representation of an MRI image is real, i. e. a momentary, real, controlled state and thus placebo-free. Taking into account the fact that the results of the measurements provided a clear approximation to the values measured in healthy people, a relatively high value must be attributed to the study, especially as the authors believe that equivalent successes were a complete novelty and had not yet been observed.

Pulsating electromagnetic waves
[Pulsierende elektromagnetische Wellen]
G. Breitgraf, I. Froboese, Cologne; lecture at the German Orthopaedic Congress Wiesbaden, Abstracts, October 2000.

Evaluation of the effectiveness of three-dimensional pulsating electromagnetic fields of MultiBioSignalTherapy (MBST ®) on the regeneration of cartilage structures
[Evaluation der Effektivität dreidimensionaler pulsierender elektromagnetischer Felder der MultiBioSignalTherapie (MBST®) auf die Regeneration von Knorpelstrukturen]
I. Froböse, U. Eckey, M. Reiser, C. Glaser, F. Englmeier, J. Assheuer, G. Breitgraf; German University of Sports Cologne, Insitute for Rehabilitation, University of Munich, Klinikum Großhadern, Department of Diagnostic Radiology, University of Munich, Anatomic Institue, Insitute for Radiology Cologne, ReAgil Therapy Centre; Orthopaedische Praxis 8/2000, 510–515.

Prospective study of the effect of the MBST magnetic resonance therapy on gonarthrosis

Further evidence of the efficacy of MBST therapy in the treatment of gonarthrosis was reported by Auerbach and colleagues of the Waldkrankenhaus Bad Düben – an orthopaedic clinic – and presented at the German Orthopaedic Congress in Berlin (Auerbach et al., 2005). Title of the study: “Prospective study on the efficacy of MBST®-magnetic resonance therapy in conservative treatment of gonarthrosis”.
In this study, 60 patients with arthroscopically verified cartilage damage were treated with a therapy device of MedTec Medizintechnik GmbH, Wetzlar, for 1 hour treatments on 5 consecutive days. The success of the treatment was objectified by means of various internationally recognised analogue scales and questionnaires.

Results

- Evaluation of efficacy in 59 patients immediately after treatment and after 2 and 6 months. For all criteria (7 in total) a statistically significant improvement compared to the previous value could be documented. Pain, joint stiffness as well as joint functions had improved. Directly after the treatment 6–15% of the patients reported improvements, 19–27% after 2 months and up to 32–40% after 6 months, depending on the parameters.
- The success of the treatment was also clearly visible in a further assessment 12 months after completion of the therapy. After this period of time, placebo effects are no longer to be

expected. This time frame is remarkable because it must be concluded that magnetic resonance therapy has initiated long-term structural regeneration processes that may result from changes in protein synthesis (see section on preclinical effects).

Prospective study on the efficacy of MBST® nuclear magnetic resonance therapy in conservative treatment of gonarthrosis
[Prospektive Untersuchung zur Wirksamkeit der MBST®-Kernspinresonanztherapie bei der konservativen Therapie der Gonarthrose]
B. Auerbach, A. Yacoub, C. Melzer, Waldkrankenhaus Bad Düben, Specialist Hospital for Orthopaedics, lecture at the German Orthopaedic Congress, Berlin, Abstracts, Nov. 2003.

Prospective examination of the efficacy of MBST® magnetic resonance therapy in the treatment of gonarthrosis
[Prospektive Untersuchung der Wirksamkeit der MBST®-Kernspinresonanztherapie bei der Behandlung der Gonarthrose]
B. Auerbach, C. Melzer, Waldkrankenhaus Bad Düben, 2003.

Prospective examination over 1 year on the efficacy of MBST® nuclear magnetic resonance therapy in conservative treatment of gonarthrosis
[Prospektive Untersuchung über 1 Jahr zur Wirksamkeit der MBST®-Kernspinresonanztherapie bei der konservativen Therapie der Gonarthrose]
B. Auerbach, A. Yacoub, C. Melzer, Waldkrankenhaus Bad Düben, Fachkrankenhaus für Orthopädie, Orthopaedic practice, Taucha, lecture, poster presentation at the 1st Joint Congress Orthopaedics – Trauma Surgery, October 19–22, 2005, Berlin, in: Congress Catalogue, Abstracts, Poster R2–446.

Treatment options for diseases of the musculoskeletal system

Today's generally known medical conservative treatment options for degenerative diseases are very limited. So far, there are no known ways of treating musculoskeletal disorders effectively and long-lasting. Almost all known forms of treatment in the medical field are pure impact treatments, but no causal treatment of the symptoms as the magnetic resonance therapy. Not to mention the extensive lists of side-effects for numerous widely administered drugs.
Since usually treatments for osteoarthritis only aim at the symptoms but not at the causes – these are 1) Painkillers (mostly NSAIDs) and 2) intra-articular administration of corticoids or hyaluronic acid – all of them ultimately lead to expensive artificial joint replacement. In addition, even these are usually worn out after 10–15 years and have to be replaced, which becomes increasingly difficult with each revision. For total endoprostheses, it is now common knowledge that 50% of patients are not satisfied with the result of a joint replacement surgery.
However, an important question remains unanswered: Where is the wear and tear of the joint replacement deposited? What are the long-term negative consequences for the patient?
In contrast to all known forms of treatment, with the exception of the often unsatisfactory SYSADOA (systemically effective agents such as glucosamine), magnetic resonance therapy (MBST) causally targets degenerative joint changes at the cellular level.
Through the regeneration of cartilage or bone tissue, long-term pain is significantly alleviated or even eliminated, function and mobility are restored.

Advantages of MBST treatment:

- Non-invasive procedure
- Causal therapy form
- No known side effects so far
- No risk of infection
- Uncomplicated form of treatment for diseases of the musculoskeletal system for which no essential form of therapy exists (e. g. finger joint arthrosis, spondylarthrosis, polyarthrosis, metabolic or circulatory disorders in the area of bone, osteoporosis, etc.)
- Short treatment time (5, 7, 9 or 10 treatment hours depending on the stage or type of the disease)
- Delaying surgery or for accelerated regeneration after necessary surgery
- In the case of surgical interventions such as cartilage smoothing the causal active principle at the cell level can be used to build up cartilage
- In the case of intervertebral disc problems and herniated discs, surgery and the resulting scar tissue can be prevented
- Sustainable and long-lasting therapeutic effect of 4.5 years and more
- Causal and sustainable treatment for pain patients or sports and accidental injuries

Effect of MBST magnetic resonance therapy on low back pain

Introduction

The high costs of treatment and the frequent sick leave of patients with chronic low back pain as a result of the relative therapeutic refractory have an important social medical significance. In multidisciplinary rehabilitative approaches, we are nowadays looking for concepts that include new ways of improving pain-related disabilities. Back pain often becomes chronic due to various psychosocial factors and because of psychological stress due to the feeling of not being able to cope with daily activities (e. g. in the job): It is an urgent goal to interrupt the structures involved in back pain as quickly as possible by means of appropriate therapy measures, in order to enable a reduction of the impairment. Thus, the treatment of back pain should be multimodal and this can be realized best in the context of in-patient rehabilitation.

Recently, a special form of magnetic resonance technology, a therapy method with special and highly complex magnetic fields based on the nuclear magnetic resonance, known as MBST® magnetic resonance therapy (MBST®), can be used. The active principle is based on the one well-known in the magnetic resonance tomographic diagnostic system.

Methodology

The study included 62 patients (36 men, 26 women) aged 18 to 71 (mean age: 48.1 years) with low back pain who had been admitted to the special hospital for illnesses of the musculoskeletal system of the Saalfelden pension insurance institution for a 3-week in-patient rehabilitation. The diagnoses of the patients with chronic low back pain were secured by a physician and supported by means of computer tomographic, radiological or magnetic resonance imaging (MRI) techniques. They included: chronic lumbar syndrome (chronic low back pain, disc protrusion, spondylarthrosis, condition after spinal column fractures) n = 52, discus prolapse n = 7, postlaminectomy syndrome after discus extraction n = 6, cervical syndrome n = 10 (partly combinations of several diagnoses).

The study was designed as placebo-controlled, double-blind, randomized, monocentric, multipointsurvey over a period of 3 months. All patients were treated with a standard in-patient multidisciplinary rehabilitation concept for spinal disorders including a physiotherapy concept consisting of spinal gymnastics in water and outside, mechanotherapy, massages, parafango and medical baths. Electrotherapeutic applications and stanger baths on the affected spinal segments were avoided.

All patients were treated in a highly complex air coil system with static permanent magnetic field (MBS therapy) with 1-hour therapy sessions for 5 consecutive days (total treatment time with MBST® magnetic resonance therapy = 5 hours).

The treatment device (magnetic resonance therapy system version KSRT-Key K1B, type MBST 600 KSRT; serial number 12100015) of MedTec Medizintechnik GmbH, D-35578 Wetzlar, Germany, works according to a new MBS therapy principle, which brings the protons of the hydrogen atoms into resonance using magnetic resonance. The protons of the hydrogen atoms (hydrogen nuclei) use the special permanent magnetic field to align their polarity (spin axis) in the magnetic field following the field lines. The energy level of the hydrogen nuclei is influenced by defined frequency changes of the electromagnetic field through coupled radio frequencies with modulated treatment sequences. This magnetic resonance of the hydrogen protons generates energy which is emitted highly effectively and in resonance into the surrounding tissue when the field direction changes.

In contrast to the conventional technique of pulsating electromagnetic fields (PEMF), the MBST® uses a command control unit with 12 separately controllable and independent coil systems, which are arranged partly ortogonally, i. e. offset by 90° to generate 3 threedimensional treatment fields that together with the permanent magnetic field generate a magnetic resonance field in the center of the coil system. The coded computer chip cards were also used for double-blind randomization. In this way, for half of the patients the generation of the complex nuclear magnetic resonance treatment field was initiated by the control unit (= patient group with MBS therapy). In the other group of patients no magnetic resonance field was generated (= patient group without additional MBS therapy = magnetic resonance placebo treatment).
After a comprehensive clinical examination at the start of the study (= day 0), 1 week after therapy and after 3 months the pain symptoms were assessed by means of a 10-part visual analogue scale (VAS) for a) peak pain, b) average pain during movement and c) pain at rest. In order to assess the extent of the disability caused by chronic low back pain, the Roland & Morris questionnaire for low back pain was used at the above-mentioned measurement times.

Results

In the context of in-patient rehabilitation, the Roland & Morris' overall score for low back pain improved significantly after the 3-week rehabilitation period in all patients with low back pain with the standardized multidisciplinary rehabilitation program, both in the group with additional MBS therapy ($p < 0.00001$) as well as in rehabilitation patients without MBST® ($p < 0.005$).
It is noticeable that those patients with active MBST® magnetic resonance therapy, starting from a higher average Roland & Morris score, improved more markedly than the comparative group despite double-blind randomization, with values of 10.93 ± 4.42 compared to 6.37 ± 4.48. On average, both study groups were practically identical after the 3-week rehabilitation with regard to the Roland & Morris score. After 3 months, however, the Roland & Morris overall score for the patient group without MBS therapy rose again in scores close to those of baseline and was then no longer significantly lower than baseline with a score of 10.07. In the patient group, which had additionally received the 5-hour MBST® magnetic resonance therapy during in-patient rehabilitation, a significantly reduced (7.30; $p < 0.00001$) Roland & Morris overall score could still be documented after 3 months.
Particularly noticeable improvements in the MBST® group were observed in question 18 regarding sleep disorders, where a significant ($p < 0.02$) improvement was observed after only 3 weeks which persisted even after 3 months. Also in question 6 – "Because of my back I lay down to rest more often" – the percentage of patients who replied with "Yes" was reduced by half. Further advantages for MBST® treated patients were found in the time needed for dressing, which is discussed in Roland & Morris Question 9.
The pain measurements with the 10-part visual analogue scale showed that pain during the 3-week in-patient rehabilitation could be significantly improved in both placebo and active MBST® patient groups after only 1 week. This reduction in low back pain was partially still noticeable 3 months later. For example, the low back pain patients assessed the peak pain after 3 months with VAS at 5.3 respectively 5.1 which is significantly lower than before the 5-day treatment series (VAS 7.9 respectively 8.1). The VAS-values of stress pain were significantly reduced under MBST® even after 3 months, but not under placebo. In general, all patients in the active MBST® group rated the MBST® as pleasant, free of side effects and pain.

Discussion

The lifetime prevalence of low back pain, i. e. the frequency of spinal pain related to the whole life, is reported to be 50–80%. This high incidence gives rise to a great social-medical significance of low back pain due to its adverse effects, as it causes considerable costs in the health economy. The evaluation of the success of therapy is nowadays regarded as standard: spine-specific

functioning, pain, general health, ability to work and contentment of the patient. The Roland & Morris questionnaire is an instrument for recording the functional status of low back pain patients that also has a validated German language version. With the combined application of a 10-part Visual Pain Scale (VAS) and the Roland & Morris questionnaire it is possible to measure the success of Low Back Pain Therapy regarding pain, disability and physical improvement.

The results show that the successes achieved with standardised physiotherapy during 3-week rehabilitation with significant improvements in function, measured using the Roland & Morris questionnaire for low back pain, are likely to lead to longer-term success in those patients with additional MBST®, as was evident after 3 months. At that time, the overall Roland & Morris score was still significantly improved. In contrast to this, the rehabilitation effect of the standardised physical therapy measures is likely to be exhausted after 3 months without MBS therapy, since the Roland & Morris score values of the placebo group were again within the range of the baseline values at that time.
In many of the Roland & Morris scores, patients treated with active MBS therapy had a significant advantage over the group with standard therapy program and additional MBST® placebo treatment. For example, the patients treated with MBST® were significantly less handicapped in for example crouching down and dressing after 3 months than in the placebo group.
It is interesting to note the significant improvement of sleep disturbances caused by low back pain, which could be observed only a few days after the therapy. The patients treated with MBST® were able to benefit from an improved sleep quality even 3 months after the therapy. It should be noted that these patients also reported less pain-related periods of rest (Roland & Morris, question 6).
The pain measurement (VAS) shows that a longer-term positive improvement of the pain tolerance could be achieved in both groups. This significantly documents the success of the 3-week in-patient rehabilitation program. However, a clear advantage was observed in the group with active MBST® therapy who reported a reduction of stress pain, which could be recorded over the entire observation phase. This naturally suggests a structurally modifying effect, which would be possible after 3 months. However, the clear improvement in pain after just 1 week of therapy indicates an additional fast triggering of other effects that are directly analgesic.

In general, MBST® magnetic resonance therapy is seen as an additional, easy-to-use therapy procedure with very short therapy times, which can significantly increase the therapeutic success in the rehabilitation of patients with low back pain without side effects.

Osteoarthritis as main indication for MBST

Background

Arthrotic changes of the musculoskeletal system are a very big problem for health systems due to their enormous frequency and them being one of the highest cost factors. The age structure rises and the conditions of the private and working environment are constantly becoming more negative, so that the frequency of degenerative changes in joint and bone structures, osteoarthritis, spinal disorders and osteoporosis is rising enormously.

The medical doctrine that prevailed up to the year 2000 that cartilage tissue once damaged could not be regenerated, has in the meantime been proven to be inaccurate based on the findings in cell research.
The counterevidence was also supported by the results of studies using magnetic resonance therapy equipment.
A large number of scientific investigations conducted in accordance with internationally recognized regulations showed that nuclear magnetic resonance fields can trigger verifiable regenerative processes in living tissue.

Low back pain
Chronic back pain is very common and causes considerable psychosocial and health economic costs. The cervical and lumbosacral regions are usually affected. Low back pain is often associated with functional deficits/disabilities (Urwin et al., 1998).
The prevalence of chronic, non-specific low back pain is constantly on the rise in all industrialized countries. In addition to the impairment of patients at work and in everyday activities due to treatment costs and loss of work, it is also associated with high socio-economic expenditures for the general public (Waddell, 1996; Murtezani et al., 2011; Deyo et al., 1991). The vertebral joints with the articular surfaces on the processus articulares can cause considerable pain when affected by degenerative arthrotic changes. With the wear and failure of its function as mechanical stabilization and load distribution due to the degeneration and reduction of the height of the intervertebral discs, pathological shifts, shear movements and tilting are possible, which affect the entire motion segment.
In the region of the posterior pillar of the spinal column, overstressing and degeneration or osteoarthritis of the vertebral arch joints occur.
These arthrotic processes of the spine are called spondylarthrosis or facet joint syndrome. Here, too, the characteristics of osteoarthrosis are a narrowing of the joint line, sclerosis and edge serration that is visible in x-rays.
These changes in the vertebral joints cause pain, muscle tension and vertebral blockages with myofascial pains at the tendon/band attachments.

Functional improvement in fingerpolyarthrosis

Introduction
Due to the limited therapeutic possibilities for hand and finger joint arthrosis, there is a need to evaluate new therapeutic principles. Nuclear magnetic resonance can stimulate repair processes in the cartilage and influence pain signal transduction cascades. Thereby therapeutic effects in the treatment of osteoarthritis are possible.
Latest research literature on wrist arthrosis urgently demands the evaluation and examination of new therapeutic strategies in clinically controlled studies. This demand is met with the nuclear magnetic resonance therapy.

Osteoarthritis of wrists and finger joints is the main cause of the disability to cope with daily activities. Main symptoms of finger osteoarthritis are: in early stages a feeling of tension and stiffness, stress-dependant pain, increased pain in cold and damp weather, swelling and redness of the joints, restrictions on movement, tense muscles due to compensatory relieve postures, loss of function.
To date, not all pathogenetic processes are known, so therapy consists of combating symptoms or a surgical intervention. This is why concepts that also include new ways to improve pain-related handicaps in the treatment of wrist and finger joint osteoarthritis are of great interest. One of these new concepts is therapeutic nuclear magnetic resonance (KSRT). Cells can react to the nuclear magnetic resonance of hydrogen protons with a functional or structural change.

Everyday activities such as finger functioning, dressing as well as hand functioning for personal care and household activities, “hold a cup” or “open a lock” are well captured with the applied QUABA score.
The effect of nuclear magnetic resonance treatment on 70 patients with osteoarthritis of wrist or finger joints was examined in a double-blind, randomized, placebo-controlled study over a period of 6 months (length of treatment series: 9 x 1 hour).

Methodology
The study design included patients with clinically and radiologically diagnosed finger joint osteoarthritis according to the criteria of the American College of Rheumatology (ACR). Medial age of patients was 69 ± 8 years. Assignment to one of 2 groups was performed randomly and double-blind: group I (n = 35) with active magnetic resonance therapy and group II (n = 35) placebo group without activated magnetic resonance field.
Blind computer chip cards for the control unit of the magnetic resonance therapy system guaranteed double-blind randomization. The therapy system used was a device from MedTec Medizintechnik GmbH, Wetzlar, Germany (magnetic resonance therapy, Key 1B, type MBST 300). Therapy duration was 1 hour daily on 9 consecutive days (total therapy duration = 9 hours).
In order to measure the effect of the magnetic resonance therapy and to be able to make statements about the progression of the finger joint osteoarthritis, the following outcome measurement instruments were used:
Visual analogue scale (VAS) for peak, stress and pain at rest; the clinically functional handscore according to QUABA for assessing hand function and disability for the criteria:

1 Dressing (pull on stockings; button blouse/shirt),
2 Personal care (wash and comb hair; dry with a towel),
3 Household activities (cut with scissors; open cans with a mechanic opener),
4 Manual everyday activities (grasp single coins from a wallet; hold a soft plastic cup filled with water, open or close the front door lock; write with a pen).

Measurement dates were days 0, 10 and 180.

Results
Pain intensity could be significantly reduced by magnetic resonance therapy, but not in the placebo group. Peak, stress and pain at rest improved with the application of KSRT, but not under placebo. During the active magnetic resonance therapy and in the follow-up after 6 months, pain frequency could be significantly reduced continuously.
In the control group with placebo treatment, however, there was a steady and after 6 months even significant increase in pain frequency ($p < 0.005$).
Hand functioning improved significantly after treatment with active magnetic resonance, as can be seen in the highly significant increase of the QUABA overall score. This significant improvement was still there even after 6 months ($p < 0.00001$). In the placebo group, on the other hand, QUABA values concerning hand functioning did not improve after placebo treatment; in contrast to the group with active magnetic resonance treatment, the values of this group deteriorated significantly after 6 months. Both treatment groups did not differ statistically on day 0, but after 6 months the group with active magnetic resonance therapy had a significantly higher QUABA score than the placebo group. Additionally, for the subcriteria of the QUABA score, dressing, personal care, household activities, manual dexterity, similarly good results in the group with active nuclear magnetic resonance and a deterioration of the functioning in the placebo group could be observed. In both groups, not a single adverse effect was recorded during treatment with the magnetic resonance therapy system.

Summary
Due to the limited number of available therapy options for hand and finger joint osteoarthritis, there is a need for the evaluation of new therapeutic principles.
Magnetic resonance therapy is a new effective treatment for hand and finger joint osteoarthritis. Everyday functionality such as finger functioning when “dressing” as well as hand functioning in personal care and household activities, “holding a cup” or “opening a lock” are well captured with the QUABA score. Our studies show that these finger functions as well as stress pain were

improved after 6 months in patients treated with KSRT, but not after placebo treatment. The placebo group showed a significantly reduced hand functioning with an increase in pain within 6 months.
A proliferation of volume and density of cartilage in knee joint cartilage following the therapeutic application of magnetic resonance treatment was already computer tomographically demonstrated a few years ago. Stamm et al. recommends clinical outcome variables such as daily activities and pain as well as mobility and stiffness. Studies by Kjeken et al. show that about half of the patients with finger joint osteoarthritis have problems opening bottles and wringing out clothes, because the strength of their grip is reduced by more than 40% and the limited mobility of the hands is painful. Our examinations show that with the application of therapeutic magnetic resonance in the treatment of finger joint osteoarthritis finger functioning in manual everyday activities is improved sustainably for several months and pain is reduced. This make it clear that magnetic resonance therapy is a new treatment option for osteoarthritis of the finger and wrist joints.

Functional improvement in the case of finger joint arthrosis after therapeutic use of nuclear magnetic resonance
[Funktionsverbesserung bei Fingergelenksarthrosen durch therapeutischen Einsatz der Kernspinresonanz]
W. Kullich, M. Ausserwinkler, Orthopädische Praxis, 44 (6), 2008, 287–290.

Improvement of function in finger joint arthrosis by magnetic resonance
[Funktionsverbesserung bei Fingergelenksarthrose durch Kernspinresonanz]
W. Kullich, M. Ausserwinkler, Jatros Orthopaedics, official organ of the ÖGO, No. 4/2008, 29

Improvement of function in finger joint arthrosis through the therapeutic use of nuclear magnetic resonance
[Funktionsverbesserung bei Fingergelenksarthrosen durch therapeutischen Einsatz der Kernspinresonanz]
W. Kullich, Ludwig Boltzmann Institute for Rheumatology, Balneology and Rehabilitation; Ludwig Boltzmann Institute for Rehabilitation of Internal Diseases; scientific poster presentation at the 56th Annual Conference of the Association of South German Orthopaedic Surgeons, May 1–4, 2008, awarded with a poster prize of the Association of South German Orthopaedic Surgeons, Baden-Baden.

Long-term effect of magnetic resonance therapy on osteoarthritis shown by multicentric data of more than 4,500 patients

Introduction

In this study, over a period of 10 years treatment data from a technical medical device was evaluated in an unusually large group of 4,518 treated patients. Data was recorded and evaluated multicentrically for various types of arthrosis at follow-up evaluation times of 10 days, 3 months, 6 months and 12 months after magnetic resonance therapy treatment using internationally recognized pain questionnaires and score sheets. In patients with chronic non-specific low back pain, there is no clear indication for surgical intervention. Therefore, depending on the pain condition, therapy is usually medication or physiotherapy. The non-surgical MBST therapy tries to delay or even reverse the course of the disease. Non-drug treatments for osteoarthritis are often based on relieving the joint to reduce symptoms (Rannou/Poiraudeau, 2010).

Methodology

The evaluation criteria for the therapeutic effect of this large-scale study was to assess pain at rest, stress pain and peak pain using the Visual Analogue Scale VAS. Validated functional indices, which are well suited for long-term documentation of osteoarthritis and are able to measure disability, functional deficits and limitations of everyday activities in addition to pain condition, were used for further evaluation of the clinical success.

- For the indications *gon- and coxarthrosis* the score sheet of Lequesne was used (Lequesne, 1991; Lequesne/Mery et al., 1987).
- Score sheets developed for gon- and coxarthrosis by Lequesne (1987, 1990, 1991) for the detection of symptoms and physical functional handicaps are often recommended for use at the end of a study in evaluations of symptom-oriented therapies (Stucki et al., 1996). The Lequesne Index is a self-assessment tool that is well established internationally. The time requirement is short and the sensitivity to change is excellent.

- The score sheet of Mazur et al. (1979) was used to assess *osteoarthritis of the ankle joint*.
- *Back function* was assessed using the Oswestry back disability questionnaire from Fairbank et al. (1980).

The evalutation included the reports of 4,518 patients (gonarthrosis n = 2770; coxarthrosis n = 673; osteoarthritis of the ankle joint n = 420; low back pain n = 655). Medial age of the patients was 62.4 ± 12.9 years (gonarthrosis), 64.6 ± 10.7 years (coxarthrosis), 58.6 years ± 15.3 years (osteoarthritis of the ankle joint), 62.8 ± 14.1 years (low back pain).

Gonarthrosis
The largest number of evaluable protocols come from cases of knee joint arthrosis. 41.9% of gonarthrosis patients were male, 58.1% female. It is noticeable that the highest percentages of overweight (45.8%) and obese (22.2%) persons were observed in cases of gonarthrosis. Only 32% of the patients surveyed were of normal weight with a BMI below 25.
During the course of the 1-year follow-up, peak pain, stress pain and pain at rest were on average continuously reduced. Already directly after the MBST treatment series, patients reported reduced pain scores on the VAS scale. The improvement was further intensified after 3, 6 and 12 months and did not return to baseline levels. For all 3 types of pain, the pain reduction was significantly reduced at all 4 evaluation times with a significance level of $p < 0{,}00001$. The frequency of pain in the knee joint also decreased significantly for all 3 types of pain with a remarkable low incidence of pain after 6 and 12 months after MBST® therapy. The stress pain decreased from a score of about 6 (= often) on a 10-part scale to about 4 (= little), the frequency of peak pain was reduced to “very little” (= 3) and the pain at rest to “rare” or “very rare”.
In addition to the reduction of pain, the functional handicaps evaluated with the Lequesne index were significantly improved.
The Lequesne Osteoarthritis index consists of 3 sections with a total of 10 questions. In addition to the overall score, the survey also evaluated these 10 questions on complaints, walking and functioning and calculated the 3 sections statistically. All 3 sub-sections of the Lequesne index improved just like the significant improvement of the overall score. Most noticeable being the highly significant reductions in functional handicap and in pain and discomfort ($p < 0.000001$). The number of patients with gonarthrosis who had no complaints at night was increased from a baseline of 39% to 72% 12 months after magnetic resonance therapy.

The group without pain while walking was also increased from 23.5% to 48.2%. Remarkably good improvements with high percentages were recorded especially in climbing stairs, walking on uneven ground, kneeling and walking distance 6 to 12 months after magnetic resonance therapy. 31.9% of patients with knee joint osteoarthritis were able to kneel or squat without any difficulty 1 year after the therapy. Before, this had only been possible for 14.9% of the 2,770 patients.
The correlation analysis showed significant correlations between pain and functional limitations in patients with gonarthrosis with respect to the changes within 1 year after an MBST treatment series. Thus, for example, the reduction of the stress pain described above correlated clearly with the complaints while walking as described in the Lequesne index ($r = 0.42$; $p < 0.000001$).

Another example is the correlation between the decrease in the intensity of peak pain within 12 months and an improved ability to “squat down” ($r = 0.38$; $p < 0.000001$) or go down the stairs ($r = 0.40$; $p < 0.000001$).
It should be noted that significant improvements in the degree of movement could be observed after only 3 months. These increases in flexion and extension were even higher after 6 and 12 months.

The analysis of the collected data with regard to the Body Mass Index (BMI) is also interesting. In the case of obesity with a BMI > 30, a significantly higher Lequesne global index could be demonstrated at all times of measurement. This also applies to the subsections pain/complaints, walking distance and functional handicaps. The initially significantly higher pain in obese patients, regarding both intensity and frequency of pain, did not differ from the values of normal weight gonarthrosis patients with a BMI < 25 1 year after the application of magnetic resonance therapy.

Coxarthrosis

The application of a series of magnetic resonance treatments showed an overall definite improvement in pain and functioning in the group of patients with hip joint arthrosis. It is interesting to note that these improvements could still be observed 1 year after the therapy. Stress pain improved from a median VAS score of 4.6 ± 2.4, which stands for strong pain, to a value of 3.3 ± 2.1. Intensity of peak pain also decreased significantly from 5.2 ± 2.7 to 3.1 ± 2.9 after 1 year. Calculation of the percental change in each individual patient, based on the baseline value of peak pain, shows on average a clear increase in the amount of a reduced peak pain in coxarthrosis patients from 18.9% at 3 months to 27.7% at 6 months to 34.5% at 12 months.

The improvement in pain were also noticeable for pain at rest ($p < 0.000001$), where the value after 1 year, VAS 1.4 ± 1.7, differed significantly from the baseline value of 2.8 ± 2.5.

Based on the improvement of each individual patient, the level of pain at rest improvement after 1 year was 42.8% in terms of intensity and 36.3% in terms of frequency. With the decrease in the intensity of the pain, a significant reduction in the 10-part ranking of the frequency of pain with regard to peak pain, stress pain and pain at rest was observed in the course of 1 year after magnetic resonance therapy. Peak pain and stress pain correlated significantly with the overall score of the Lequesne index ($r = 0.33$ resp. $r = 0.34$; $p < 0.01$), but also with functional handicaps ($r = 0.34$, $p < 0.01$).

These changes also explain the improvement in sleep quality recorded in the Lequesne index. Overall, the Lequesne index for the assertion of symptoms and physical functional restrictions in the case of coxarthrosis decreased significantly in the overall score from 7.14 on average ($p < 0.000001$) to 4.58 within the 1-year follow-up period. This is also confirmed by the distribution-independent median value, which dropped from 7.0 to 4.0.

In addition to the Lequesne overall score, which comprises the values assessed in 10 questions assigned to 3 sections, the sections on pain/complaints, walking and functioning were also statistically evaluated individually for hip joint arthrosis. Especially the values for complaints improved highly significantly ($p < 0.000001$) from baseline. The functional handicaps were also significantly lower than before treatment at the time of 3–12 months after magnetic resonance therapy.

It was noticeable in the percental distribution of the individual questions that after 1 year almost half of the patients, 47.5%, reported that they did not have any problems with walking. At baseline this was only possible for about 20% of the patients. Before treatment, 21.9% reported that they were only able to put on stockings with considerable effort or great difficulty. 12 months after the therapy this handicap existed for only 12.1%. 13 patients had not even been able at all to put on their stockings themselves before the therapeutic application because they could not bend the leg in the hip so far forward.

1 year later, there were no more patients with this kind of handicap. More than half of the patients with hip joint arthrosis (53.5%) were able to put on their stockings themselves without difficulty. All patients were also able to get in and out of a car after 1 year, nobody had great difficulties and only 4% of them had to make a lot of effort. Parallel to the lower rate of functional handicaps and reduced pain, the percentage of patients who were able to walk up/down stairs without difficulty was doubled after 12 months (59.6%).

In the rank correlation analysis following Spearman, which allows an exact examination of non-normally distributed measured values, clear, significant correlations between the intensity of coxarthrosis pain and the Lequesne index, that mirrors functioning, could be shown in the analysis of changes between baseline and 12 months after KSRT ($p < 0,01 – p < 0,001$).

Osteoarthritis of the hip joint is often one-sided and predominantly of secondary etiology. As the disease progresses, the possible walking distance shortens increasingly with characteristic limping. The examinations indicate that patients with coxarthrosis showed a clear improvement of their restricted walking distance after magnetic resonance therapy, while at the same time the discomfort of walking was reduced.

Chronic low back pain
The data included 655 patients (247 men = 37.7%; 408 women = 62.3%) with chronic nonspecific back pain. Therapeutic magnetic resonance had a definite influence on the symptom back pain in degenerative spinal diseases. Chronic pain in the spinal column was clearly reduced during the 1-year observation phase, both during daytime peaks as well as under stress and at rest.

For example, the intensity of stress pain was remarkably reduced 1 year after magnetic resonance treatment, it decreased on average from 5.01 to 2.86. At the same time, the distribution independent mean value of peak pain decreased from 6.0 baseline to 2.5 after 12 months. Mean pain intensity at rest was also clearly and highly significantly ($p < 0.000001$) reduced with a value of 1.96 on average (1.0 in the median) at 6 months and 1.91 (median: 1.0) at 12 months compared with the mean pain intensity of 3.2 (median: 3.0) at baseline. The frequency of peak, stress and pain at rest in low back pain also decreased clearly and significantly during the 12-month follow-up period ($p < 0.000001$). Considering the percental improvement in pain intensity of each individual spine patient, it becomes clear that the greatest reductions are observed 6 months after magnetic resonance therapy (peak pain 37.7%; stress pain 32.4%; pain at rest 35.9%), but that they are only marginally lower after 12 months (35.5%; 32.0%; 33.1%). This clearly demonstrates the sustainable effect of magnetic resonance therapy for chronic back pain.

In addition to the reduced pain, patients with spinal affections were able to perform everyday activities such as lifting, walking, sitting, standing and travelling more easily, especially in the period of 6 months to 1 year. The quality of sleep improved continuously and the ability to personal care was less restricted. These functional improvements are included in the Oswestry Disability Index. The overall score of the Oswestry Disability Questionnaire showed a clear downward tendency both on average and in the median. The change from 23.9 (median: 22.5) points in baseline to 12.4 (median: 7.5) points in the Oswestry after 12 months represents a clear improvement, which is usually defined from a difference of 10 points or more, statistical data processing showed a significant decrease in the Oswestry disability score ($p < 0.000001$). This reduction of the restriction of activity or subjectively experienced handicaps has a very positive effect on the psychosocial influencing factors in the process of chronification of back pain.

When comparing obese and normal weight patients with back pain in relation to the sustainability of the effect of the therapeutic magnetic resonance, it is noticeable that in the case of obesity the effects are weaker. A significant worsening of all types of pain in terms of intensity and frequency after 12 months can be observed. These values are significantly different from the VAS measurement results of normal weight patients, who reported the lowest pain scores after 1 year. This fact is also confirmed by the Oswestry Disability Index with significantly ($p < 0.000001$) better values for back functioning with normal weight (BMI < 25) compared to those with obesity (BMI > 30) 12 months after magnetic resonance therapy.

Osteoarthritis of the ankle joints
For the patients with painful arthrotic degenerations in the ankle joint included in the survey, a clear significant reduction in the intensity of stress pain, but also with regard to peak and rest pain was achieved right after magnetic resonance therapy.
The improvement, derived from the changes of each individual patient with ankle joint arthrosis, averaged 46.7% for peak pain, 47.0% for stress pain and 40.4% for pain at rest 1 year after the therapy series. Pain reductions of about 37–40% were already observed 3–6 months after magnetic resonance therapy.
Also the frequency of pain showed a statistically significant ($p < 0.000001$) decreasing tendency from score values around 6 = often/daily over 4 = little to 2 = rarely/1x per month.

The score calculated according to Mazur averaged 51.8 (median: 53.0) points with pain being the leading complaint. In the 12-month follow-up, the survey showed a continuous increase in points over 63.5 (median: 70.0) points 3 months after magnetic resonance therapy up to 69.3 (median: 75.0).

Because of the complaints in the upper ankle joint, there were clear restrictions due to limping, especially with regard to walking distance and climbing stairs. All of these parameters were significantly improved after 12 months ($p < 0.01$ for climbing up stairs to $p < 0.000001$ with regard to the walking distance).
These observations show a clear improvement in the functioning of the upper ankle joint after therapeutic magnetic resonance. With regard to functioning, it should also be noted that after just 6–8 weeks the walking distance, which is a good indicator of an improvement regarding the ankle joint, had improved considerably with further increases over the entire observation period of 1 year. At the same time, other parameters such as climbing stairs, walking uphill, tiptoeing improved and the use of walking aids was reduced significantly.
The statistical analysis proves these observations with correlations, in particular the intensity of the peak pain with the overall score according to Mazur ($r = 0.46$; $p < 0.003$), walking up and down stairs ($p < 0.02$ - $p < 0.002$) as well as the walking distance ($r = 0.40$; $p < 0.01$). Clearly, there is a significant formal correlation between the increase in the distance covered and walking up and downhill ($r = 0.68$ or $r = 0.60$; $p < 0.00001$ or $p < 0.000001$).

A Finnish study (Karjalainen et al., 2003) describes a negative influence of a high BMI on the success of therapies for low back pain. This observation is confirmed by our examinations, since after the application of magnetic resonance therapy the effects on pain in patients with a high BMI are lower than with normal weight patients, especially after 12 months. Also back function was significantly better in patients with normal weight (BMI < 25) after 1 year than in those with obesity (BMI > 30). In contrast, the effects resulting from magnetic resonance therapy for normal weight and obese patients did not differ in the case of osteoarthritis of the ankle joint, gonarthrosis and coxarthrosis.

Summary
The presented improvements in pain and functioning in knee and hip joint arthrosis after KSRT treatment can also be valued positively for fatigue, which occurs in about half of the patients. This connection was recently described by a Dutch study group in an examination of 231 patients with gon- and coxarthrosis (Snijders et al., 2011).
As is the case in other joints, osteoarthritis of the upper ankle joint is associated with cartilage degeneration, increased abrasion and a narrowing of the joint line. As with other kinds of osteoarthritis, in the course of the disease the symptoms in the ankle joint become more frequent and the exercise capacity decreases. Further damage is caused by inflammatory reactions in the

joint. Due to the osteoarthrosis of the ankle joint with functional handicaps, the quality of life of the affected person decreases continuously.
The chronicity of low back pain also includes individual, psychosocial and acquired risk factors, such as changes in the boundaries of pain (pain memory), depression, obesity. Therefore, the data of normal weight and obese patients were compared in the evaluation. Any long-term pain-reducing treatment, such as in our case therapeutic magnetic resonance, is important to prevent a chronification of pain with negative effects on the pain memory. The data from this 10-year survey confirms the experiences of previous studies. The Oswestry disability questionnaire clearly shows the functional improvements regarding back pain following the magnetic resonance treatment series for everyday activities such as walking, sitting, lifting, travelling, personal care and quality of sleep.

Conclusion

The data on the use of magnetic resonance for therapeutic purposes with an observation period of almost 10 years clearly shows that the application of therapeutic magnetic resonance in degenerative rheumatic diseases can lead to lasting improvements in pain experiencing and handicaps due to functional deficits in everyday activities.
From a cost-benefit point of view, the statistical analyses carried out show that the application of magnetic resonance therapy in the treatment of degenerative rheumatic diseases, osteoarthritis in particular, represents an economic additive therapy or alternative treatment due to its long-term effects and thus makes a highly significant contribution to the health economy.

The therapeutic application of nuclear magnetic resonance in the treatment of gonarthrosis, low back pain and finger polyarthrosis
[Die therapeutische Anwendung der KernspinResonanz bei Gonarthrose, Low back pain und Fingerpolyarthrose]
W. Kullich, Ludwig Boltzmann Institute for Rehabilitation of Internal Diseases, Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Saalfelden, Austria; lecture at the conference “Evaluation and Research in Rehabilitation”, Groebming, Austria, September 13, 2007.

Long-term effects of nuclear magnetic resonance therapy in arthrosis show multicentre data from more than 4,500 patients
[Nachhaltige Wirkung der Kernspinresonanztherapie bei Arthrosen zeigen multizentrische Daten von über 4.500 Patienten]
W. Kullich, B. Stritzinger, B. Steinecker, Ludwig Boltzmann Institute for Rehabilitation of Internal Diseases, Saalfelden; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Saalfelden, Austria; poster presentation at the first LBG Meeting for Health Sciences, Vienna, Austria, December 2, 2013.

Long-term effects of nuclear magnetic resonance therapy in arthrosis show multicentre data from more than 4,500 patients
[Nachhaltige Wirkung der Kernspinresonanztherapie bei Arthrosen zeigen multizentrische Daten von über 4.500 Patienten]
B. Stritzinger, B. Steinecker, W. Kullich, Ludwig Boltzmann Institute for Rehabilitation of Internal Diseases, Saalfelden; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Saalfelden, Austria; Journal for Mineral Metabolism 20 (4), 2013, 159.

Nuclear magnetic resonance therapy - sustained improvement of arthrosis pain (multi-center observational study in 4,518 patients)
[Therapie mit Kernspinresonanz – Nachhaltige Verbesserung von Arthroseschmerzen (Multizentrische Beobachtungsstudie an 4.518 Patienten)]
W. Kullich, B. Steinecker, Ludwig Boltzmann Institute for Rehabilitation of Internal Diseases, Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Saalfelden, Austria, “Dream and Reality. Pain therapy between ethics and economy” [Traum und Wirklichkeit. Schmerztherapie im Spannungsfeld zwischen Ethik und Ökonomie“, ÖSG lectures, Leykam,2013, 43-44.

One-year-survey with multicenter data of more than 4,500 patients with degenerative rheumatic diseases treated with therapeutic nuclear magnetic resonance
W. Kullich, J. Overbeck, H. U. Spiegel. J Back Musculoskeletal Rehabil 26 (1), 2013, 93–104.

Application of Magnetic Resonance as a new therapeutic option

Methodology/Results

Additional studies by the authors of the Ludwig Boltzmann Department in Saalfelden and Groebming (Austria) on a small group of 32 patients showed a good pain-reducing effect of magnetic resonance therapy, even with only 5 therapy units, but here with the effect showing a slightly decreasing tendency after 6 months. Experience shows that 7 to 9 units are more advantageous for sustainability.
If the handicap of the activities of daily life is reduced in accordance with the intensity of the pain as indicated in the Visual Analogue Scale, which could be demonstrated for the therapy with KSRT in several thousand patients, an overall assessment of the long-term course of the disease becomes possible.

Application of nuclear magnetic resonance as a new therapy option for gonarthrosis
[Anwendung der Kernspinresonanz als neue Therapiemöglichkeit bei Gonarthrose]
N. Fagerer, W. Kullich, Arzt und Praxis, 927, 2007, 180–182.

Analysis of the long-term effects of MBST magnetic resonance therapy for gonarthrosis

Aim of the study and evaluation basis

The results of the study are based on questionnaires on pain condition and restrictions in everyday life of 39 patients suffering from gonarthrosis who were treated with MBST magnetic resonance therapy up to 4 years before the time of the current survey. Patient data includes information on their state of health directly before and after the therapy, as well as 6 months after the therapy and at the time of the current survey. MBST treatment was 9 treatment sessions of 60 minutes each on consecutive working days. The survey was carried out by means of an anonymous patient questionnaire for self-assessment of the course of the disease, which is described by the frequency and intensity of spontaneous peak pain, mean stress pain and pain at rest as well as by the Lequesne index for knee diseases. While the information on pain frequency and intensity is recorded directly via a numerical analogue scale from 0 (no pain) to 10 (permanent pain or strongest imaginable pain), the Lequesne index was determined indirectly by means of a multiple-choice survey on restrictions in everyday activities such as climbing the stairs.

Results

An overview of the study shows that in all areas examined – pain intensity, pain frequency and Lequesne index – all levels have been shifted to lower values. The result is thus an improvement of the general health status after MBST therapy. A comparison of the distribution of pain and Lequesne levels before and after the therapy shows a significant increase in the percentage of patients with no or little pain. Similar values can be observed regarding the intensity and frequency of pain. The proportion of patients in the range of lower points [0–1] increases from 50–60% to 85% for pain at rest, from 10% to 40–55% for moderate stress pain, and from 15% to 40% for spontaneous peak pain. At the same time, the number of patients with severe pain [>5], which was in some levels more than 60% before therapy, is reduced to a maximum of 15%. The Lequesne index also shows a shift to lower values after magnetic resonance therapy. In this context, the number of patients with low or no handicap increases from approx. 30% to 45%.

Discussion

The results of the study have shown that MBST can have a very positive and sustainable influence on the restrictions in everyday activities assessed by the Lequesne index as well as on intensity and frequency of pain. The temporal development of pain implies that the healing process takes at least 1 year, but that the symptoms of the patients often subside significantly after only 6 months, so that overstressing the regenerating cartilage tissue during this period has a negative effect on the healing process. The generally significant reduction in pain at rest indicates that the regeneration process of degenerated cartilage tissue that is activated by MBST therapy first affects pain at rest, which usually only occurs at an advanced stage as a result of a high degree of cartilage degeneration. The analysis of the reduction of pain intensity shows that the extent of the decrease is not correlated with the corresponding value before treatment but is also influenced by additional factors such as gender, age and physical activity. In contrast, a clear correlation can be observed between the frequency of pain before therapy and the level of pain reduction. A higher value in pain before treatment correlates with a greater reduction in the frequency of pain.

Patients with higher stages of osteoarthritis and/or more active forms can therefore benefit more. The gender-specific comparison shows that the therapy definitely has a more positive effect in female patients, despite similar initial values in the areas of pain intensity and the Lequesne index. It is possible that an increase in bone density, which is also stimulated by the therapy and which tends to be low and steadily decreasing in women at least after the menopause, is probably more noticeable and leads to a stronger subjective experience of pain reduction. In the analysis regarding age, the study shows that there is a much more pronounced reduction of the restrictions and a more significant decrease in intensity and frequency of pain in the elderly group of patients.

A possible cause might be the higher age and thus state of retirement of this group of patients who, as a result, are not exposed to the physical stress of working life and more everyday stress. It is also conceivable that a concomitant effect on the osteoporosis, which is mostly detectable at this age, occurs.
The data regarding sports activity shows a slightly higher decrease in mean stress pain and peak pain in the active group, although the level of pain remains above that of inactive patients after treatment. When it comes to pain at rest, however, a much more positive effect on inactive patients could be found, so that they tend to achieve a better overall therapy success. Therefore, a positive influence of sports activities is neither recognizable regarding restrictions of everyday life nor pain condition. A possible reason could be that even when practising sports that are regarded as easy on the joints, wrong performance or misinterpretation of the individual limit of stress can have a negative effect on the cartilage tissue. The study has shown that MBST magnetic resonance therapy can achieve significant success in the treatment of osteoarthritis and that the regeneration process is not yet complete even years later. Patients obviously feel better for years after a therapy. Further and mostly more expensive treatments are often rendered unnecessary. It is conspicuous that especially in elderly patients with an advanced stage of osteoarthritis there is a significant improvement of condition. In many cases, total endoprothetic joint replacement can be delayed for years or even avoided. Another conservative method of treatment that produces similar results is hardly known to date.

Analysis of the Long-Term Effect of MBST® magnetic resonance therapy in Gonarthrosis
[Analyse der Langzeitwirkung der MBST® KernspinResonanzTherapie bei Gonarthrose]
W. van Laack, G. Froning, Orthopädische Praxis 47, 11/2011, 536–543.

Indication sports and accidental injuries

Chronic and acute injuries of ligaments, muscles, tendons, bones and joints

In 2007, Dr. Gorschewsky from the Sports Orthopaedics Clinic in Bern carried out a prospectively randomized double-blind study with a group of 60 patients with intraoperatively arthroscopically confirmed gonarthrosis or chondromalacia in order to investigate the efficacy of magnetic resonance therapy. Because of patient compliance (distance between place of residence / place of therapy application), the study was carried out with only 5 hours of treatment (every second day with 1 hour over a period of 2 weeks each) in deviation from the guidelines that propose 7 hours. The follow-up check was carried out 4 weeks after the therapy, deviating from the usual 3-month period.
In contrast to the results of earlier studies, this study showed no significant difference in the evaluation of accelerated rehabilitation after knee arthroscopy in patients with chondromalacia. Both the Lysholm and Koos scores showed no significant difference between the placebo and the MBST group. The researchers put these results in relation to the findings of a study of 2,868 knee patients and found that changes in the MBST application interval have a very negative effect on the efficacy and the overall result. The daily application and the number of treatment hours must therefore be strictly adhered to in MBST treatments in order to achieve the optimum effect. An evaluation of the achieved and objective treatment success is not possible when the periods of follow-up resp. evaluation examinations deviate from the guidelines and are too short.

Investigation of the efficacy of nuclear magnetic resonance therapy for arthroscopically confirmed chondromalacia of the knee joint or gonarthrosis
[Untersuchung der Wirksamkeit der Kernspinresonanztherapie bei arthroskopisch gesicherter Chondromalazie des Kniegelenks bzw. Gonarthrose]
O. Gorschwsky, Specialist hospital Sportorthopaedics Bern, 2007.

Top-class medicine in handball – Better care by combined use of different therapies for acute muscle injuries

Aim of the observations

This study examined the therapeutic successes of the therapy in sports and accidental injuries. For some time now, a new method has been used to treat various injuries in handball players: magnetic resonance therapy (MBST). 85% of the patients benefited from the therapy with effects that sometimes lasted for several years. Based on the active principle, it is an alternative option that can be used for various sports injuries: to accelerate the healing process (MRI-controlled) in addition to rehabilitative measures and to restore performance more quickly.

Among others, the following diagnoses could be treated with good or very good success:

therapy-resistant fracture of the sesamoid metacarpal bone, bone marrow edema acromion after contusion, non-dislocated fracture MTF V, retropatellary, femoral cartilage damage in IM rupture, internal ligament fracture of the knee joint, partial rupture of the anterior cruciate ligament, bone marrow edema/bone bruise tibia, muscle bundle rupture M. rectus abdominis, ruptured muscle fiber M. iliopsoas, rupture Musculus teres major.

Generally, different target structures (bones, muscles, cartilage/joint, tendons/ligaments) can be treated by means of varied, standardized treatment schemes. The very good efficacy of magnetic resonance therapy MBST will be illustrated in the following two case studies of muscular injuries in handball.

1) Injury: rupture of muscle fiber Musculus iliopsoas, November 1, 2015 in match, conservative treatment
Treatment: 7 treatment units MBST muscle (November 10–18, 2015)
Therapy/rehabilitation: physiotherapy, general conditioning and build-up of stress (e. g. exercise bath, training therapy), from fourth week after injury onwards in combination with handball specific build-up training 1x/day, control MRI 8 December 2015
Result: ability to compete after 6 weeks, free of complaints under full stress, no follow-up or recidivism injury.

2) Injury: rupture of M. obliquus internal abdominis, partial rupture of M. obliquus externus, February 2, 2015 in training, conservative therapy
Treatment: 7 treatment units MBST muscle (February 11–19, 2015)
Therapy/rehabilitation: physiotherapy, general conditioning and functional therapy with continuous build-up of stress (e. g. exercise bath, training therapy), after 4 weeks of being completely free of symptoms in combination with handball specific build-up training, control MRI March 3, 2015
Result: ability to compete after 5.5 weeks, free of complaints under full stress, no follow-up or recidivism injury.

Conclusion

Both the individual application and in particular the combination of methods such as cryolight therapy, ESWT and magnetic resonance therapy (MBST) can further develop and optimise the treatment of muscle injuries. In addition to the time factor, the focus is also always on avoiding recidivisms and injuries that are more or less directly related to the treated muscle injury. This is one of the most important arguments from the point of view of sports medicine for a long-term successful return to competition.

MBST – Nuclear magnetic resonance therapy. The new opportunity in the treatment of chronic skeleton diseases and sport injuries
D. Krpan, lecture at the scientific meeting, Bucharest, Romania, September 2013.

Nuclear magnetic resonance therapy. The new opportunity in the treatment of chronic skeleton diseases and sport injuries.
D. Krpan, lecture at the Russian-Slovenian Science Meeting, Terme Olimia, Podčetrtek, Slovenia, June 2014.

Therapeutic efficacy in the treatment of osteoporosis as well as metabolic and circulatory disorders of the bone

Osteoporosis is a pathological, painful condition of the body that is characterized by a reduction of bone mass compared to the age and gender relevant norm. The diagnosis is made with the help of various procedures, on the one hand with quantitative tomography (QCT) and on the other hand with the low-radiation DXA procedure, whose technology and measured values are internationally recognized.

Prospective study on the effectiveness of MBST magnetic resonance therapy for whole-body treatment of osteoporosis

This indication was examined by an observation of application by the specialists Overbeck, Gerhardt and Urban (Overbeck et al., 2004). The examination that was carried out in three medical practices and one treatment centre provides concrete indices for the useful application of magnetic resonance therapy in the indication osteoporosis. A total of 27 patients with diagnosed osteoporosis and bone density measurement results were treated. The therapy series consisted of 10 1-hour treatments. Following therapy, 4 bone density measurements were carried out within a period of 6 months: before the therapy, approx. 6 weeks, 3 months and 6 months after the beginning of the therapy. The therapy was generally characterized as painless, free of side effects and gentle. The evaluation of 21 patients, whose data was complete, showed significant improvements in pain condition, frequency of pain and bone density compared to the first measurement.
Even though bone density was determined using two different measurement methods, an overall assessment was made possible by breaking down evaluation to individual patients. For this indication, the absence of a placebo or control group or evaluation against an alternative treatment has no negative effects on the results, since osteoporosis does not improve without therapy. The successes achieved with magnetic resonance therapy therefore speak for themselves, even if they were initially only gained within the scope of an observation of application. Since – as already mentioned – physicians still primarily use their experiences as guidelines, the enthusiasm of the authors at the end of the report is quite understandable: “The MBST® magnetic resonance therapy is impressive because of its high effectiveness and the existence of no known side effects. According to our results, bone density and thus stability under MBST® magnetic resonance therapy increases faster than with any other therapy known to date.”

Prospective Study on the Effect of MBST® Nuclear SpinResonanceTherapy in Whole Body Treatment as a Possible Nondrug Therapy for Osteoporosis Disease [Prospektive Untersuchung zur Wirkungsweise der MBST®-KernSpinResonanzTherapie bei Ganzkörperbehandlung als mögliche nicht medikamentöse Therapie bei Osteoporoseerkrankung]
J. Overbeck, A.Urban, G. Gerhardt, J. Gerhardt, 2003/2004.

MBST magnetic resonance therapy as possible non-drug therapy for osteoporosis

A small-scale study on osteoporosis was conducted at the Justus Liebig University Giessen to determine whether MBST® magnetic resonance therapy is an effective treatment for this disease.

Result

A considerable improvement in pain intensity and pain severity could be found. Similarly, a highly significant increase of up to 55% bone density and mineral salt content was observed within 22 to

120 days. The author concludes that the magnetic resonance method in osteoporosis treatment is an extraordinary and very fast-acting treatment method.

MBST® nuclear magnetic resonance therapy as a possible non-drug therapy for osteoporosis
[MBST®-KernspinResonanzTherapie als mögliche nicht medikamentöse Therapie bei Osteoporose]
S. Grumbrecht, Dept. of Diagnostic Radiology, Justus-Liebig-University of Giessen, Article May/2003.

Prospective study on the efficacy of MBST magnetic resonance therapy in whole-body treatment as a possible non-drug therapy for osteoporosis

Introduction

In the case of osteoporosis, bone mass per volume unit is reduced in comparison to the age and gender norm. It is a pathological condition that can be separated from the physiological decline of bone mass with older age in which the composition of the bone substance does not deviate significantly from the norm. Osteoporosis can appear generalized and localized. The generalized form is the most common metabolic osteopathy that is mostly prevalent in the female sex and predominantly postmenopausal. Osteoporosis can also occur premenopausally, in men and adolescents, even in children. The incidence of manifest osteoporosis is estimated to be around 5 million in Germany.

Aim of the scientific survey

After very positive experiences in osteoarthritis treatment, it was of interest to examine whether magnetic resonance therapy is similarly effective in osteoporosis.

Methodology

A total of 15 female volunteers took part in an initial scientific survey. Median age was 65 years (49–78 years). The patients were treated with 10 1-hour MBST sessions for whole-body treatment. Prior to treatment, the patients filled in a questionnaire including an individual assessment of pain on a 10-point scale. In addition, the volunteers agreed to regular blood sampling and urine tests, which were used to determine the course of various bone metabolism parameters, e. g. calcitonin IS or desoxypyridinoline, can be controlled.
Before, during and after treatment only vitamin D tablets were administered to the patients. An additional therapy with bisphosphonates was excluded.
Before and after the first treatment, a QCT to determine bone density was made by an independent radiological institute.

Results

- There was no significant change in the concentration of certain metabolic parameters, especially not in calcitonin and parathormone.
- Pain intensity was improved markedly by an average of 5 points. At the end of the treatment, all patients assessed their pain severity at least 8 points better than before treatment. Pain frequency had also decreased significantly (improvement by 4 resp. 7 points).
- The measured QCT values showed an increase in mean bone density from 88 +/-37 to 90+/- 28 mg/cm3 calcium hydroxylapatite, which is equivalent to a mean percentage increase of 12%. An average increase in mineralization of 28.2% was observed in 9 patients and a maximum decrease of 16% was recorded in 6 patients.
- Time passed between the first and second QCT was 44 days on average (minimum 22, max. 119 days). A longer time between the density measurement and the end of therapy had a positive influence on bone density. This might suggest a long-term effect.
- The determined Z- and T-values showed a dramatic increase of up to 54.75% in some cases, but this is due to the fact that the WHO corrected the reference values downwards

during the course of the current survey and the radiological institute used these new reference values for most of the second measurements. Therefore the determined T- and Z-values cannot be used methodically!

Summary
In summary, the author concludes that the therapeutic effects of magnetic resonance therapy can not be explained by metabolic stimulation, the regenerative effects are probably much more complex and multifactorial. However, subjective pain sensation in advanced osteoporosis was significantly improved, an effect which is already known from osteoarthritis therapy with MBST. The results obtained from the scientific survey should be the basis for further clinical and radiologically controlled studies, in particular studies with a longer time frame, maybe with repeated applications, and they should be planned in order to confirm the promising initial results obtained so far.

Prospective study on the efficacy of MBST magnetic resonance therapy in whole-body treatment as a possible non-drug therapy for osteoporosis [Prospektive Untersuchung zur Wirksamkeit der MBST-KernspinResonanzTherapie bei Ganzkörperbehandlung als mögliche nicht medikamentöse Therapie bei Osteoporoseerkrankung]
W. Klapsch, 2003.

Treatment of Osteoporosis with MBST magnetic resonance therapy

The aim of this study by the Orthopaedic Clinic in Bad Dueben, Germany, was to find proof of the influence of magnetic resonance therapy on bone mineralization content.

Material and methodology
In the period between January 2004 and March 2006, a total of 54 patients were treated with MBST® magnetic resonance whole-body treatment for osteoporosis. All patients included had a bone density in the range of osteopenia or manifest osteoporosis before the start of the therapy. For this purpose, a QCT (Quantitative Computed Tomography) measurement of the lumbar spine was performed in a radiological practice. Control measurements were carried out under standardised comparative conditions 6 months after treatment. In addition, the standardised examination of the patients was carried out on the basis of the “osteology checklist” (anamnesis, clinical examination, laboratory, risk profile, primary diseases, e. g. osteomalacia, history of an osteoporotic fracture, medication).

Patients who had already suffered vertebral body fractures related to osteoporosis or who were treated with teriparatide were not included in the study due to the risk of a falsification of bone density measurements. Patients taking bisphosphonates or selective estrogen receptor modulators were evaluated separately. In addition to magnetic resonance therapy, a basic therapy with calcium and vitamin D3 was administered as well as hydrogenation prior to treatment with about 2 litres of liquid. The treatment was carried out on 10 consecutive weekdays with a 2-day break (interruption by weekend) always at the same time of day on a standard whole-body magnetic resonance therapy couch (ODM) of the company Medtec Medizintechnik, Wetzlar. The treatment time was 10 x 1 hour. Measuring dates: before the start of therapy, after the end of therapy, three months and six months after the end of therapy. Scores: modified Fairbank Score, Roland-Morris-Score, Osteoporosis Quality of Life Questionnaire and the Numerical Analog Scale to determine peak pain, pain at rest and permanent pain. The bone mineralization content was determined by QCT before and 6 months after therapy.

Result
Mean bone density of the patients (bone mineralization content in mg/ml, measured with QCT at the lumbar spine) was 97.5 mg/ml (SD: 16.9) before the start of magnetic resonance therapy. After 6 months, mean bone mineralization content had increased to 100.2 mg/ml ($p < 0.05$, SD: 15.8).

There was no significant difference in bone mineralization content after 6 months in the 14 patients under continuous osteoporosis therapy with bisphosphonates and SERM. The Osteoporosis Quality of Life Questionnaire records pain, restrictions on activities of daily life, household activities, exercise, leisure and social activities, perception of general health and mood. Therefore, it is a good indicator of the general condition of the patients. No significant differences could be found in measurements during therapy and shortly afterwards. Correlating with the increase in the mineral content of bones, however, we were able to observe a significant reduction in symptoms over the course of 6 months. We were also able to find similar results for the modified Fairbank Score and Roland-Morris Score. The most significant indicator of pain is an evaluation with the Numerical Analogue Scale for the determination of peak pain, pain at rest and permanent pain. Pain at rest did not change during therapy or shortly afterwards. All 3 types of pain showed a significant reduction after 3 resp. 6 months.

Discussion
The 27 patients included in the study showed a significant increase in bone mineralization content 6 months after therapy. It was also noteworthy that for the 14 patients who received long-term medication with bisphosphonates and SERMs, no significant change in bone density after 6 months could be detected. It can be assumed that the reason for this is the stabilizing effect of bisphosphonates and SERMs on the bone structure. No side-effects of MBST® magnetic resonance therapy could be detected for the activity scores (OIQÖQ, Fairbank, Roland-Morris). The only exception to this is a short-term increase in pain during and after therapy. The cause of the increase in pain remains unclear. Presumably it is an expression of the physical response (activation of bone metabolism) to the therapy.

Conclusion
MBST magnetic resonance therapy is an innovative, free of side effects and easy-to-use therapy that, in combination with a basic therapy with calcium and vitamin D3, at least for a while stabilizes resp. increases bone density, reduces the patient's complaints and improves his general condition. It has no influence on the bone density of patients with a long-term drug therapy with bisphosphonates and SERMs. Comparing the costs of long-term medication for osteoporosis with the one time only costs of MBST magnetic resonance therapy, another interesting therapeutic approach evolves. As there are as yet no long-term results or comparable studies, the long-term effect resp. the benefit of conservative osteoporosis therapy remains to be seen.

Treatment of osteoporosis with MBST® KernSpin
[Behandlung der Osteoporose mit MBST® KernSpin]
T. Handschuh, C. Melzer, Orthodoc, 5/2008, 1–4.

Therapeutic application of magnetic resonance in osteoporosis

The aim of a study in Croatia was to investigate the long-term effects of the therapeutic application of magnetic resonance imaging (KSRT) on bone density parameters in patients with osteoporosis.

Methodology
103 patients aged 45–89 years with a secure diagnosis of osteoporosis and a reduced bone density (T-score below –2.5) were included in the study. All patients were treated with magnetic resonance osteoporosis therapy for 1 hour per day on 10 consecutive days (MBST-Osteo treatment couch, MedTec, Germany). Before and 12 months after KSRT treatment, bone density was determined by DEXA measurement. In addition, the bone turnover markers osteocalcin and bone cross-laps (ß-CTX; crosslinked telopeptides of collagene 1) were determined using commercial Elisa techniques.

Results
Bone density and serum levels of osteocalcin increased statistically significantly from baseline to 12 months. ß-CTX remained stable.

Conclusion
A therapeutic application of magnetic resonance increases the parameters of bone density within 1 year after a treatment series (10 x 1h). Therefore, KSRT can be recommended as an alternative or additional therapy to drug therapy for osteoporosis patients.

Non-pharmacological treatment of osteoporosis with Nuclear magnetic resonance therapy (NMR-Therapy)
D. Krpan, B. Stritzinger, I. Lukenda, J. Overbeck, W. Kullich, PERIODICUM BIOLOGORUM, 2015, 117, No. 1, 161–165.

Therapeutic application of nuclear magnetic resonance in osteoporosis
[Therapeutische Anwendung der Kernspinresonanz bei Osteoporose]
W. Kullich, I. Lukenda, B. Stritzinger, J. Overbeck, D. Krpan, Ber. nat.-med. Ver. Salzburg, Vol. 18, 2016, 7–17.

A new concept of integrated holistic approach in treatment of chronic musculoskeletal diseases – the "BAR" method

Another study was carried out and published in the polyclinic K-CENTAR, Zagreb, Croatia under the lead of Prof. Dr. sc. Dalibor Krpan under extended "BAR" conditions.

The "BAR" method, a new concept in the treatment of chronic bone and joint diseases. An essential part of the concept is cell regeneration using magnetic resonance therapy.

The "BAR" treatment concept stands for: B – for Biomechanics A – for analgesia and R – for regeneration.
It is an integrated, holistic therapy approach with a combination of methods to improve "biomechanics" which offers very good and regular biomechanical impulses and stimulates the regeneration of cartilage and bone formation very well. It relieves pain very quickly, even during the treatment, improves mobility and thus the quality of life. It also stimulates regeneration of cartilage and bone formation.

Conclusion
The statistical analysis of a number of clinical trials in patients with osteoarthritis treated with MBST magnetic resonance therapy shows after an MBST cycle of 5 or 7 days:

- general improvement of more than 60% up to 80% and
- pain reduction to about 50%
- constant decreas in pain intensity and frequency
- All of these improvements yielded a maximum result after 8 weeks to 6 months after the therapy as well as lastingly for a period of 1 year. The osteoporosis treatment showed a significant increase in BMD up to 35%, T-score of up to 33.9% and Z-score to 72.46%.

Based on clinical experience, the results of the scientific and clinical studies and a cost-benefit analysis MBST can be recommended for usage under the following conditions:

1. MBST program once a year for all persons with an increased risk of osteoarthritis or osteoporosis in combination with regular exercise
2. MBST program of 5 or 7 days for all people with osteoarthritis once a year together with exercise and pain therapy.
3. MBST program of 7 days twice a year in combination with physical and sometimes orthopaedic therapy of advanced osteoarthritis.

4. 10 days MBST osteoporosis program in case of osteopenia, increased risk of osteoporosis or failed pharmacotherapy.

A new concept of integrated holistic approach in treatment of chronic musculoskeletal diseases The "BAR" method
D. Krpan, PERIODICUM BIOLOGORUM, 2015, 117, No. 1, 119–124.

Nuclear magnetic resonance therapy in osteoporosis reduces the risk of fractures in accidents/downfalls – case report study

Despite various pharmacological treatments for osteoporosis, the problem of osteoporosis has not yet been solved or reduced. Fractures, side-effects of drugs after long-term pharmacotherapy show a need for new treatment methods. Magnetic resonance therapy could be an alternative or supplement to pharmacotherapy. The aim of a case report study is to present clinical experience in the application of NMRT in the treatment of osteoporosis based on follow-up screening of the incidence of fractures.

For the examination of fractures, 450 patients (male n = 55, female n = 395) with a median age of 68.4 years were assessed on the basis of anamnesis and medical documentation. All of them had been treated with MBST therapeutic magnetic resonance standard cycles of 10 days during a period of 5 years. The data shows a reduction in the rate of fracture after NMRT even for more than 1 year after an NMRT cycle of 10 days.

All patients were treated with therapeutic magnetic resonance (NMRT) during a period of 5 years at the K-Centre (Policlinic / Centre for Osteoporosis and Other Bone and Joint Disorders, Director: Prim. Prof. Dr. med. D. Dalibor Krpan, Zagreb, Croatia).

All patients suffered from osteoporosis, which had been diagnosed with DEXA measurement (T-score less than –2.5) and were treated with therapeutic NMRT in an MBST magnetic resonance therapy series with the MBST osteo treatment couch (ODM device), from MedTec GmbH, Wetzlar, Germany (1-hour per day for 10 consecutive day).

Due to the fact that NMRT works with a time delay, the maximum effect is reached after about 6 months.The time of assessment of the fractures is divided as follows:

a) less than 3 months after the treatment,
b) between 3 months and 1 year after the treatment
c) between 1 and 2 years
d) more than 2 years after the treatment

Particularly noteworthy is the fact that in 11 well-documented cases no incidences of fractures occurred, even after severe trauma. Despite the fact that there are further studies on the NMR treatment of osteoporosis, these case reports support the expectations that NMRT could be a useful alternative or addition to other therapeutic modalities in patients with osteoporosis. It is particularly important that NMRT has no risk for undesired side-effects and is very suitable for early prevention of fractures in combination with exercise and vitamin D3.

Because they are very important evidence of a therapeutic effect, these cases are described separately as case reports.

Results
a) less than 3 months after NMR treatment: 2 patients with fractures
b) between 3 months and 1 year after NMR treatment: no patient with fractures
c) between 1 and 2 years: 2 patients with fractures
d) more the 2 years after treatment: 14 with fractures

In the period less than 3 months after NMR treatment (a) there are 2 patients with fractures. Both suffered a fracture of the forearm after a severe fall, and both had had previous fractures and a very low BMD.
No fractures occurred within the period between 3 months and 1 year after NMR treatment (b).
Within the period between 1 year and 2 years after NMR treatment (c) there were 2 patients with fractures:

> One patient aged 80 years with a new compression fracture of L5. The fracture became apparent on x-rays.
> The other patient aged 83 years suffered an underarm fracture, but no hip fracture despite the fact that she fell down the stairs and had a large hematoma around the left hip, which clearly indicates a severe trauma.

Within the period of more than 2 years after NMR treatment (d) there were 14 patients with fractures. In 1 case a severe hip fracture trauma, in 4 cases a vertebral compression fracture and in 9 cases a fracture of the forearms occurred. It is important to add that the lady with the hip fracture could be completely restored after TEP.

Very important proofs are patients who suffered a severe trauma but no resulting fracture. All of them had a low BMD before NMRT, and 4 of them had previously suffered fractures.

An overview of the examined patients
Case study 1. Patient, 82, had several falls after NMR treatment and suffered no fractures. Twice she had a large hematoma at the hip but no fracture.
The last time was 5 years after MBST treatment.

Case study 2. Patient, 80, fell down when the bus he was in came to a sudden stop due to a traffic accident. He suffered a large hematoma but no fracture.
The accident happened 1 and a half year after NMR treatment.
A significant increase in BMD was found in the control DXA measurement.

Case study 3. Patient, 87, stumbled in a hole in the ground and suffered a severe hematoma, but no fracture.
The fall happened more than a year after the NMR treatment.
A significant increase in BMD was found in the control DXA measurement.

Case study 4. Patient, 78, fell on the street, no fracture.
It was 3 years after the NMR treatment.
No control DXA measurement was made.

Case study 5. Patient, 75, was injured in a traffic accident 2 years after NMR treatment and she had no fractures.
No significant difference in the BMD was found in control DXA measurement.

Case study 6. Patient, 80, had a fall in her house. She had a large hematoma at the hip, but no fracture.
The fall happened more than 2 years after the NMR treatment.

Case study 7. Patient, 75, was involved in a traffic accident and suffered various hematomas and bruises, but no fracture.
It happened 3 years after the NMR treatment.
A significant increase in BMD was found in the control DXA measurement.

Case study 8. Patient, 78, had a fall in her house, she had no fracture.
It happened more than 3 years after the NMR treatment. Before the NMR treatment, she had suffered fractures of the forearm and multiple vertebral fractures.
A significant increase in BMD was found in the control DXA meaurement.

Case study 9. Patient, 85, fell on the street and had a large hematoma at the hip but no fracture.
It happened more than 1 year after the NMR treatment.

Case study 10. Patient, 70, was injured in a car accident. She suffered a lot of bruises, but no fractures.
It happened more than 1 year after the NMR treatment.

Case study 11. Patient, 71, fell from a tree. He suffered many bruises and contusions, but no fracture.
It happened more than 2 years after the NMR treatment.

Events like these are very common in the elderly population and the risk of falling increases with age and physical function: about one third of healthy people aged 65 or older and half of the over 80-year-olds fall at least once a year.

Therefore, the authors believe that this case report study provides important information, although the number of cases is rather small. All reported cases are well documented and show that NMRT can be the new non-pharmaceutical method that can reduce the risk of fractures.

A thorough analysis shows, that one of these patients, an 83-year-old woman who fell down the stairs, suffered no hip fracture even though she had fallen directly on the hip. A large hematoma on the hip was clear evidence of severe trauma. Other cases showed a reduction in fracture risk even after several years of NMR treatment. Due to the delayed onset of action of NMRT, it might be that the two cases of fractures occurred within the first 3 months of MBST treatment. This cannot be assessed as an indicator of failed therapy.
There have been few studies regarding osteoporosis so far. These studies show that MBST is a bone targeted therapy that stimulates bone formation and increases BMD values.
There are studies on MBST treatment of osteoporosis, and these encourage expectations that MBST can be a useful alternative or addition to medical therapy in patients with osteoporosis.
Particularly important is the fact that MBST has no risk of side-effects, which makes it suitable as a treatment in combination with exercise and vitamin D3 in a strategy to prevent fractures.

Nuclear magnetic resonance therapy in osteoporosis reduces the risk of fractures in accidents/downfalls – case report study
D. Krpan, W. Kullich, Clinical Cases in Mineral and Bone Metabolism, 2017, 14(2), 235–238.

Indication back pain – low back pain – degenerative changes of the spine, ruptured or herniated intervertebral discs

Therapeutic efficacy in case of chronic specific back pain

Chronic back pain is a major problem in the population. In many cases, treatment is only symptomatically. In practice, therefore, physiotherapeutic measures are often supplemented with additional forms of therapy.
Changes of voltage in collagene structures due to mechanical changes of stress cause the transport of electrical signals in and out of tissue structures and thus have a positive effect on the metabolic situation.
Studies show the stimulating influence of nuclear magnetic resonance therapy on the proliferation of chondrocytes and osteoblasts (Temiz-Artmann et al., 2005) and suggest the regeneration of cartilage-like structures.

The results of the study were published in 2005 and 2006 in a lecture and in 2 publications in internationally recognized peer-reviewed journals.

Chronic low back pain is primarily a consequence of segmental dysfunctioning and muscle pain, usually associated with degenerative or post-traumatic changes in the affected part of the spine. The clinical examination of all patients that was included in the study is therefore very important. Examination was performed using Waddell's signs: sensitivity to light pressure, pressure pain, compression pain of the lumbar spine under axial stress, pain through rotation of lumbar spine, pain when lifting the stretched leg, local muscle weakness, sensitivity disorders when lifting the stretched leg, non-verbal communication of pain. Mobility was assessed using the finger-to-floor distance test and the Schober index. Vertebral and paravertebral structures in palpation were examined, followed by a segmental functional examination and an examination of the hips and statics. The clinical examination was supported by radiological and computer tomographic examination methods.

Doz. Dr. Kullich and colleagues of the Ludwig Boltzmann Department in the SKA of PVA Saalfelden, Austria, have therefore compared the effects of a complementary application of MBST® therapy of 1 hour per day in double-blind, placebo-controlled randomized form in combination with physiotherapy.
The findings were presented aforehand in a lecture at the annual conference of the Austrian Society for Rheumatology and Rehabilitation in Vienna (Kullich et al., 2005) and are currently in print. The results of 62 patients (30 with MBST treatment, 32 with only physiotherapy and placebo treatment) show a clear, statistically significant superiority of the combination therapy compared to physiotherapy alone with placebo treatment in almost all parameters, such as the Visual Analogue Pain Scale or the disability score according to Oswestry, both 1 week after the beginning of therapy and after 3 months (Kullich et al., 2006).

Patients and methodology

Placebo-controlled, double-blind, randomized, multipoint, mono-centric survey over a period of 3 months. 62 patients (36 men and 26 women aged 18–71 years, mean age = 48.1 years) with chronic low back pain. The multidisciplinary rehabilitation concept, which was used in the treatment of all patients, consisted of a standardised in-patient physiotherapy programme combined with a series of treatments with 1 hour of therapy per day for 9 consecutive days in an MBST® magnetic resonance therapy system: Version KSRT-Key K1B, type MBST® 600 KSRT, serial number 12100015, MedTec Medizintechnik GmbH, Wetzlar, Germany.
Double-blind randomization into two groups was achieved using blinded computer chip cards.

- Group I: magnetic resonance field active (active MBST®-group; n = 30),
- Group II: magnetic resonance field inactive (placebo group; n = 32)

Examinations were made at the beginning of the study (day 0), as well as 1 week and 3 months after treatment with the following parameters:

- 10-segments Visual Analogue Scale (VAS),
- Oswestry-Low-Back-Pain-Disability Questionaire according to Fairbank et al. 1980,
- Roland & Morris Disability Questionnaire

Results

A standardized multidisciplinary therapy significantly improved the Roland-Morris (RM) overall score for chronic low back pain during a 3-week rehabilitation. RM overall score increased again after the therapy in both groups, placebo and MBST®. Nevertheless, the value of the MBST® group remained significantly below baseline. The Roland & Morris Disability Questionnaire showed that everyday activities could be improved by an additional MBST® therapy.
Group I achieved a better result than group II in several sections of the Oswestry Disability Questionnaire (such as walking, sitting). This is also noticeable in the overall score of group I, which with $p < 0.001$ at the measurement dates of 1 week and 3 months showed a significantly better result than the placebo group.
Of great importance for back pain patients should be the fact that there were major advantages in the section “personal care”. 73.7% of the patients of group I reported improved conditions in this section after 3 months and 0% reported a worsening.
The pain measurements (VAS) show a clear reduction of pain in both groups (MBST® and placebo group) after only 1 week. 3 months after therapy, the peak pain in both groups was still improving significantly. However, a significant reduction of stress pain after 3 months was only observed in the MBST® group.

Conclusion

Due to it being very common, low back pain is of great importance for social medicine, resulting in considerable health economic costs. Standards for the evaluation of a therapeutical success are: back specific functioning, pain, ability to work and satisfaction of the patient.
The additional MBST® can cause a sustainable improvement of the painful chronic low back pain. MBST® is an interesting, easy-to-use treatment method that can be used as additional therapy in the rehabilitative treatment of low back pain. Positive effects over a period of 12 weeks were evident. MBST is therefore an additional therapy procedure for the rehabilitation of patients with low back pain, which significantly further improves the significant success of in-patient rehabilitation of disorders of the spine. In addition, no side-effects of MBST therapy were observed in this controlled study.

magnetic resonance therapy improves rehabilitation success in the case of chronic low back pain [KernspinResonanzTherapie verbessert den Rehabilitationserfolg bei chronischem Kreuzschmerz]
W. Kullich, N. Fagerer, K. Machreich, H. Schwann, Lecture at the Annual Conference of the Austrian Society for Rheumatology and Rehabilitaiton, November 25–26, 2005, Vienna, Skriptum - Wiener medizinische Wochenschrift, 11–12.

Electromagnetic nuclear resonance field on patients with Low Back Pain
W. Kullich, H. Schwann, J. Walcher, K. Machreich, Journal of Back and Musculoskeletal Rehabilitation, 19, 2006, 79–87.

Impact of magnetic resonance therapy on sickness absence of patients with nerve root irritation following a lumbar disc problem

The Orthopaedic Hospital Speising, CEOPS, Department of Orthopaedic Pain Therapy together with the Department of Radiodiagnostics of the Medical University of Vienna and the St. Pölten Regional Hospital carried out a further study about complementary medical intervention using nuclear magnetic resonance therapy in patients with nerve root irritation due to a lumbar disc herniation.
Test parameters were: variance analyses, time effects, results related to drug groups ZP1 / ZP2, physical functions SF-36, Roland-Morris-Score, VAS scale, neurostatus, pain medication and rehabilitation as well as days of sick leave.

Results

Consistently significant positive results have been observed in MBST treatment of herniated discs, especially in the lower lumbar spine. Those patients who were treated with active field using the magnetic resonance therapy device had significantly fewer days of sick leave.
Sick leave before therapy was 14.7 days, after therapy 5.8 days. In contrast, the number of sick leave days of patients in the control group was 7.6 days before therapy and 13.8 days after therapy. The authors: “the cost-effectiveness analysis showed that the direct costs of nuclear magnetic resonance therapy were compensated in varying degrees depending on the occupational group. For workers, 16.9 days of sick leave compensated for the direct and indirect costs of magnetic resonance therapy for workers, 11.4 days for salaried employees and 9.1 days for civil servants.”

Conclusion

By measuring the number of days of sick leave, the study was able to confirm that pain relief and thus a health economical benefit can be achieved by a relatively cheap, alternative technique.

Impact of magnetic resonance therapy on sickness absence of patients with nerve root irritation following a lumbar disc problem
G. Salomonowitz H. Salfinger, J. Hahne, M. Friedrich, Radiology technology, University of Applied Sciences, Vienna, Austria.

Nuclear magnetic resonance therapy in lumbar disc herniation with lumbar radicular syndrome: effects of the intervention on pain intensity, health-related quality of life, disease-related disability, consumption of pain medication, duration of sick leave and MRI analysis.
H. Salfinger, G. Salomonowitz, K. M. Friedrich, J. Hahne, J. Holzapfel, M. Friedrich, Eur Spine J, 24,2015, 1296–1308, doi: 10.1007/s00586-014-3601-7.

Case studies low back pain

Further support for the the efficacy of magnetic resonance therapy for back problems is shown by The osteopath Roland Opel presented some very impressive case studies of treatments of acute herniated discs at the conference for orthopaedists, surgeons and sports physicians in Wetzlar in March 2017. These were documented in the form of MRI images prior to therapeutic application and 8 weeks after MBST treatment and support other results regarding the efficacy of magnetic resonance therapy.

Patient, 42 years, farmer

- The patient’s first records date back to 2013.
- He complained of severe pain in the lumbar spine with paresthesia in both legs and had to take strong painkillers several times a day in order to cope with everyday life.
- A disc herniation was diagnosed, which was quickly treated with 9 hours of MBST (treatment card lumbar spine hip).
- Due to severe osteoporotic changes of the spine, a second nuclear magnetic resonance therapy with 10 treatment hours on the ODM treatment couch was carried out in 2014.
- Patient has had no complaints since March

Patient, 46 years, busdriver

- Pain in the area of the cervical spine with severe respiratory problems.
- Physiotherapy and manual therapy as well as the constant use of painkillers did not bring any relief.
- Diagnosis after x-ray: chest kyphosis.
- In the further course of the differential diagnosis an NPP in cervical spine vertebrae 3 was found.
- 9h MBST treatment.
- Free of symptoms after 7th treatment session.
- The patient is still very satisfied with the progress, he has no problems in his work and his hobby skiing.

Patient, 29 years, Bachelor Health Management

- The young patient first consulted the practice with massive seizure-like pain in 2014.
- Diagnosis showed a severe impairment of the right leg with numbness of the right foot.
- Treatment was carried out with 9h therapy card for intervertebral discs.
- The walking pattern improved continuously in the course of the therapy, together with considerable reduction of pain.
- Two days after the last treatment session she went on her annual holiday and took a flight to the Dominican Republic. She could enjoy this flight without any problems.
- Later, her mother (49 years) was also treated with 9 hours MBST because of an NPP in the area of the cervical spine. She was also completely free of symptoms 3 weeks later.
- In 2016, her 21-year old sister came to the practice with an NPP in the range of C4 C5. She was also treated with a 9h therapy card for intervertebral discs. Also in this case, there were no more complaints after 3 weeks.

Patient, 57 years, self-employed

- Patient lives in Valencia, Spain.
- He had heard about the therapy from his sister, who had also been treated successfully. At the end of 2014, he was treated with a 9h therapy card for intervertebral discs on the nuclear magnetic resonance therapy couch.
- There were three NPPs in the range L3 to L5. Already during the last treatment session the patient was free of symptoms.
- In February 2017 an NPP in C2 C3 was treated with the same procedure. He was free of pain after 7 treatment sessions.

Final assessment by the chiropractor and osteopath Opel:

- Due to my treatment successes and my experience with magnetic resonance therapy, I was able to notice that the intervertebral disc treatment cards are highly effective in the efficiency of the treatment of NPPs and significantly exceed the treatment success of the spinal hip and the spinal shoulder treatment cards.
- Personally, no other treatment method is known to me that triggers such a rapid and highly significant therapeutic success so quickly and sustainably by the activated regeneration process.
- The treatment success in case of herniated discs, the efficacy, the very fast effect of magnetic resonance therapy and the long-term result cannot be surpassed.

Treatment of acute herniated discs with magnetic resonance therapy at the MRI Therapy Center Riesa
[Behandlung von akuten Bandscheibenvorfällen mit der Kernspin-Behandlung im Kernspinresonanztheraphiezentrum Riesa]
R. Opel, Lecutre at the MBST-Anwendertagung Wetzlar, Congress Center Rittal Arena, March 3–4, 2017.

These case descriptions are clearly not evidence in the sense of evidence-based science, but the observations from daily practice are an impressive complement to the results obtained in placebo-controlled randomized studies.

Evaluation of the results of completed studies

The review of the available scientific material on the efficacy of MBST therapy showed a consistently very positive and stable picture.
In the pre-clinical and clinical areas sufficiently clear data is available, i. e. presented at scientific congresses or published in accepted journals, so that an evaluation of efficacy was unproblematic.

There can therefore be no doubt about the efficacy of the discussed therapy method with the application of nuclear magnetic resonance on human bone and cartilage cells, thus with a positive effect on various forms of osteoarthritis and bone metabolism (e. g. in cases of fractures or osteoporosis). Taking into account the fact that even today therapy is still oriented primarily on the experience of clinically active physicians in combination with publications mainly in peer-reviewed scientific journals (“evidence-based medicine”), the available extensive material consisting of case studies, prospective studies, practice reports and controlled studies – double-blind, randomized and placebocontrolled or evaluated against a standard therapy – represents an extremely solid basis that can not be doubted.

This clearly distinguishes the present form of therapy from other therapy attempts with, for example, static or simple pulsating magnetic fields, whose therapeutic effect is discussed controversially in literature due to the very heterogeneous experimental approach.

Since the technology described here is a completely new therapeutic approach, a comparison with previous experiences made in the field of magnetic field therapy, is neither possible nor permissible. Overall, however, it has to be said that the proof of therapeutic efficacy of MBST therapy has been clearly demonstrated.

4. Summarising evaluation of magnetic resonance technology

The review and evaluation of the magnetic resonance therapy (MBST®) was based on the documents provided by MedTec Medizintechnik GmbH, Wetzlar, in the form of numerous studies conducted and published in vivo and in vitro, publications in peer-reviewed journals, posters and lectures at international conferences as well as expert opinions in the human and veterinary field.

As has been shown by numerous research groups on the basis of very extensive preclinical experiments, clinical studies and studies carried out according to international standards on both cell cultures and animals, there is no doubt that the special fields in the context of the application of MBST trigger biological effects, such as an influence on cell metabolism, which cannot be explained with sham or placebo effects.

A possible harmful effect was also tested in cell cultures and could not be observed on the basis of the results.

So far, a therapeutic, clinically relevant efficacy in patients with the following indications has been proven:

- degenerative changes of the musculoskeletal system such as osteoarthritis and osteoporosis
- disorders of growth, metabolism and blood circulation in the bones
- degenerative and painful spine conditions (e. g. low back pain)
- injuries to muscles, tendons and ligaments
- acute and chronic sports and accident injuries
- triggering verifiable regenerative processes in organs

Pain and harmful side effects have not become known to this day. Seldomly short-term minor pain intensifications, which are to be evaluated as a generally known positive therapeutic reaction, or reactions in the form of a pleasant feeling of warmth or tingling may occur.

On the symptomatic level, consistent reports about a reduction of pain exist. This can be explained against the background of recent scientific findings from basic research/electrophysiology with an influence on voltage-dependent Ca ion channels and by the change in intracellular Ca2+ concentrations by nuclear magnetic resonance, since a direct relationship between ion channels and intracellular Ca with the transmission and processing of pain is proven, but also by change/regulation of pain-maintaining mitogen activated protein kinases under nuclear spin resonance therapy.

Overall, it can be said that the data available provides proof of the therapeutic efficacy of MBST therapy in the scientific and medical sense.

In addition, all available scientific data shows that MBST magnetic resonance technology has a demonstrable influence on cells, i.e. on the fundamental biological organisational units that make up almost all known organisms. In this sense, it is definitely possible to transfer the principle of action from already examined cells to differentiated cells and thus other tissues. This is evident from the research results and scientific data obtained so far over the last 20 years of intensive research activity.

The different human and animal cell types combine to form certain tissues. In medicine, tissue is an organic material that consists of a group of identical or differentiated cells that have a common function or structure. The basic tissues include muscle tissue, epithelial tissue, connective tissue and nerve tissue, as well as the extracellular matrix (ECM). The extracellular matrix is a very complex environment consisting of various fibres embedded in a basic substance. The fibrous elements are collagen fibers, reticular fibers and elastic fibers. The basic substance is made up of glycosaminoglycans, proteoglycans, adhesion proteins, water and electrolytes.

All scientific data obtained so far shows that the effect of MBST magnetic resonance technology on basic tissue and the ECM allows a cell- or tissue-oriented transfer of the principle of action. MBST nuclear magnetic resonance technology, for example, directly and actively influences the energy metabolism of cells and various signal cascades. The energy is mainly provided in the form of ATP (adenosine triphosphate). The human organism needs the energy obtained for the synthesis and renewal of endogenous substances and for the maintenance of homeostasis, among other things. By cell regeneration, the physician understands the body's ability to reject irreparable cells and heal damaged tissue with the help of newly produced cells. This process is involved in the course of cell division and takes place be either once, cyclically or permanently. Through natural cell regeneration, the body repairs minor damage to organs or parts of tissue with newly produced cells. Many diseases, especially degenerative diseases, limit the ability of human cells to regenerate. This is where the therapeutically used nuclear spin technology comes in. The MBST magnetic resonance therapy system was developed to enable a targeted transfer of energy into specific tissues. Among other things, the aim is to increase metabolism and thus trigger the body's own repair mechanisms or regeneration processes.

There are no differences in the principle of action depending on the MBST magnetic resonance therapy device or on the entire MBST magnetic resonance therapy system, since the principle of action is guaranteed by the patented technology used in all MBST magnetic resonance therapy devices. This clearly shows that the MBST magnetic resonance therapy principle can be applied to tissue-specific indications that shall be treated.

PMCF – studies in progress and future studies

In addition to the already mentioned completed investigations and
studies, further studies are in progress and planned for the future. In detail, these are as follows:

Studies in progress

1. Egg, Magit: Research project over the course of 3 years, planned completion 2018 / 2019; Title of the research project: "Effect of NMR nuclear magnetic resonance therapy on the circadian clock and the hypoxia signalling pathway" – short title: NMR, Hif and Clock

2. Dr Mazin Al Janabi: The title of the study is "MBST, magnetic resonance therapy in Osteoporosis"; This study will also have a double-blind, placebo-controlled and randomized setting and include 60 patients.

Further studies in planning

1. Steinecker-Frohnwieser, Lohberger, Kullich:
   Animal study, start 3rd quarter 2017, planned duration until 3rd quarter 2018
   Determination of an miRNA expression profile using an ex vivo cartilage model and nanostring technology under the influence of therapeutic nuclear magnetic resonance (miRNA determination = new method for research into the regulation of cartilage and bone structure)

2. Dr. René Toussaint:
   The following study is planned together with the Verwaltungs-BG in order to establish MBST therapy in the accident insurance of athletes (first step) and the legal accident insurance (2nd step). Title of the study: “The influence of MBST® therapy (magnetic resonance therapy) on the post-traumatic healing process of injuries in competitive athletes”

References

2018:

1) The therapeutic nuclear megnetic resonance changes the balancein intracellular calcium and reduces the IL-1ß induced increase if NF-$_K$B aktivity in chondrocytes

B. Steinecker-Frohnwieser[1], W. Kullich[1], A. Mann[2], H.-G. Kress[2], L. Weigl[2]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Medical University, Vienna, Department of Special Anaesthesia and Pain Therapy
Clinical and Experimental Rheumatology, 36, 294–301

2017:

1) Wissenschaftliche Bewertung der MBST-Kernspinresonanztechnologie hinsichtlich ihres therapeutischen Potentials und des Nachweises der klinischen Wirksamkeit

Prof. Dr. W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria

2) „Aus der Praxis für die Praxis“ – Fachvortrag „Neues Wirkprinzip: Therapie mit Kernspinresonanz“

Prof. Dr. W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Seminar „Spezielle Schmerztherapie“ zur Erlangung des Schmerzdiploms der Österreichischen Ärztekammer, Part 2: June 2017, Salzburger Schmerzinstitut, Salzburger Gesellschaft für Allgemeinmedizin, Vorarlberger Ärztekammer

3) Nuclear magnetic resonance therapy in osteoporosis reduces the risk of fractures in accidents/downfalls – case report study

D. Krpan[1], W. Kullich[2]; [1]Poliklinika K-CENTAR, Zagreb, Croatia; [2]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria

4) KSRT Untersuchungen 2016 und 2017 – Aussichten

W. Kullich, B. Steinecker; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria

5) MBST und die Circadiane Uhr: Auswirkungen der Kernspinresonanztherapie auf die Circadiane Uhr und den Hypoxie-Signalweg

R. Oliva, F. Benscheidt, A. M. Sandbichler, M. Egg; Institute of Zoology, University of Innsbruck, Austria
Lecture, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

6) MBST – KernspinResonanzTherapie Organregeneration unter MBST-Einfluss

Dr. J. Overbeck; Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

7) Behandlung von Bandscheibenvorfällen im Kernspintheraphiezentrum Riesa

R. Opel; Kernspintherapiezentrum Riesa, Germany
Lecture, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

8) MBST Ergebnisse aus der Zellforschung

Dr. W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

9) „Von der Idee zur Innovation“ – 20 Jahre Kernspinresonanz

A. Muntermann; MedTec Medizintechnik GmbH, Wetzlar, Germany
Lecture, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

10) Abrechnungsproblematik im Gesundheitswesen, MBST und die GoÄ

H. Schott; Lawyer, Essen, Germany
Lecture, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

11) Grenzen und Chancen des Heilmittelwerbegesetzes

S. Kierer; Lawyer, HFBP Rechtsanwälte, Frankfurt/Giessen/Berlin/Hanover, Germany
Workshop, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

12) MBST – Mehrwert Praxismarketing

Guido Finkes; MedTec Medizintechnik GmbH, Wetzlar, Germany
Workshop, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

13) Die optimale IGeL-Strategie

Dr. J. Overbeck; Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Workshop, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

14) „Von der Idee zur Innovation" – Funktionsprizip und Wirkschlüssel der Kernspinresonanz-technologie

A. Muntermann; MedTec Medizintechnik GmbH, Wetzlar, Germany
Workshop, Wissenschaftliche Fortbildungsreihe, Anwenderkongress Wetzlar, 3–4 March 2017

15) Behandlung der durch Osteoarthrose bedingten klinischen Symptome mittels Kernspinresonanztherapie (MBST®) beim Hund – eine randomisierte Studie [Treatment of the clinical symptoms caused by osteoarthritis using nuclear magnetic resonance (MBST®) in dogs – a randomized trial]

M. Mucha[1], I. Virac[1], C. Lang[1], K. Wittek[1], A. Tichy[2,] B. Bockstahler[1]; **[1]Section for Physical Therapy and Rehabilitation, Small Animal Surgery, Department for Small Animals and Horses, and Platform Bioinformatics and Biostatistics; [2]Department for Biomedical Sciences, University of Veterinary Medicine, Vienna, Austria**
Wien Tierärztl Monat, Vet Med Austria, 104, p. 61–128

16) Multi Award Winner German medical health company MedTec presented newest therapy options for osteoarthritis at Asia Health Exhibition 2017

Medical Device ASIA, Vol. 9, No. 2, March-April 2017, p. 8–9

17) The therapeutic nuclear megnetic resonance changes the balancein intracellular calcium and reduces the IL-1ß induced increase if NF-$_K$B aktivity in chondrocytes

B. Steinecker-Frohnwieser[1], W. Kullich[2], A. Mann[3], H.-G. Kress[4], L. Weigl[5]; [1]Cluster for Arthritis and Rehabilitation, Ludwig Boltzmann Department for Rehabilitation of Internal Diseases; [2]Cluster for Arthritis and Rehabilitation, Ludwig Boltzmann Department for Rehabilitation of Internal Diseases; [3]Medical University, Vienna, Department of Special Anaesthesia and Pain Therapy; [4]Medical University, Vienna, Department of Special Anaesthesia and Pain Therapy; [5]Medical University, Vienna, Department of Special Anaesthesia and Pain Therapy Scandinavian Journal of Rheumatology, 2017

18) Innovative medicine technology – Made in Germany, The solution of the problems for Today and For the future

A. Muntermann
Lecture, Medical Symposium, MBST-Centre, Bangalore, India, 15 June 2017

19) MBST nuclear magnetic resonance therapy, 15 years of practical experience in therapeutic application

Dr. Joachim Overbeck; Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, Medical Symposium, MBST-Centre, Bangalore, India, 15 June 2017

20) Innovative medicine technology – Made in Germany, The solution of the problems for Today and For the future

A. Muntermann
Lecture, Medical Symposium, Damian Klinik, Warsaw, Poland, 21 June 2017

21) MBST-Kernspinresonanztherapie, 5 Jahre Praktische Erfahrung in der therapeutischen Anwendung

Dr. Peter Zelenay
Lecture, Medical Symposium, Damian Klinik, Warsaw, Poland, 21 June 2017

22) Nuclear magnetic resonance (MBST-NMR) therapy affects the circadian clock of zebrafish cells

R. Oliva, A. M. Sandbichler, M. Egg; Institute of Zoology, Department of Ecophysiology, University of Innsbruck, Austria
Lecture, SCIENTIFIC SMÖRGÅSBORD, Gothenburg, Sweden, 3–6 July 2017

23) Nuclear magnetic resonance therapy MBST – The New PossibilityTreatment of Musculoskeletal Diseases and Sports Injuries

D. Krpan
Lecture, HIP & KNEE CONGRESS, Orthopedic Surgery, Sport Medicine, Geriatric, Pain management, Bellevue Medical Center, Beirut, Lebanon, 5/6 May 2017

24) Regenerationsbeschleunigung

Dr. C. Buck
Doctor of German National Team Athletics, team doctor soccer SSV Ulm, VFB Stuttgart, Basketball league ratiopharm Ulm
Sportärztezeitung, Konservative Therapie & Rehabilitation, 03/2017, p. 36–38

25) Mbst-therapy as an effective method of treatment of patient of syndrome related to dorsopathy

A. V. Kutenev
Candidate of medical sciences, associate professor of the department of gerontology of the faculty of advanced training, of medical workers of the Medical institute of the FSAEI HE »Peoples' friendship university of Russia«
ОВРЕМЕННАЯ МЕДИЦИНА, НЕВРОЛОГИЯ / РЕВМАТОЛОГИЯ.РЕАБИЛИТАЦИЯ, №1(5) / АПРЕЛЬ / 2017 г

26) The concept of an integrated holistic approach in the rehabilitation of patients with degenerative diseases of themusculoskeletal system

I. V. Kitaev
Chief doctor Clinic of the Joints and Spine ArtroMedCenter, Russia, Saratov, Oksana Plastinina, Doctor rheumatologist Clinic of the Joints and Spine ArtroMedCenter, Russia, Saratov
СБОРНИК НАУЧНЫХ ТРУДОВ, Межрегиональной, научно-практической конференции, »РЕАБИЛИТАЦИЯ И ПРОФИЛАКТИКА В СОВРЕМЕННОЙ, МЕДИЦИНЕ« Десятая Муза, Саратов-Москва, Десятая Муза, Саратов-Москва, 2017

27) Alternative »soft methods« in the therapy of degenerative diseases of joints

I. V. Kitaev
Chief doctor Clinic of the Joints and Spine ArtroMedCenter, Russia, Saratov, Oksana Plastinina, Doctor rheumatologist Clinic of the Joints and Spine ArtroMedCenter, Russia, Saratov
СБОРНИК НАУЧНЫХ ТРУДОВ, Межрегиональной, научно-практической конференции, »РЕАБИЛИТАЦИЯ И ПРОФИЛАКТИКА, В СОВРЕМЕННОЙ МЕДИЦИНЕ«, Десятая Муза, Саратов-Москва, 2017

28) Hüftkopfnekrose ausgeheilt. Kombination aus Schulmedizin und Alternativmedizin erfolgreich

P. Krapf
Orthopedist, Trier, Germany
Orthopädie & Rheuma, 20 (5), p. 62

2016:

1) In Painful Shoulder Disease, Inpatient Rehabilitation has Long Term Benefits with or without Therapeutic Nuclear Magnetic Resonance: A Randomized Controlled Clinical Trial

W. Kullich[1], B. Stritzinger[1], M. Mustak-Blagus[2], A. Falkenbach[3], J. Rus-Machan[4], T. Berger[5], B. Steinecker-Frohnwieser[1]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Rehabilitation Centre of the PVA, Groebming, Austria; [3]Rehabilitation Centre of the PVA, Bad Ischl, Austria; [4]Rehabilitation Centre of the PVA, Bad Aussee, Austria; [5]Rehabilitation Centre of the PVA, Saalfelden, Austria
Journal of Novel Physiotherapy and Physical Rehabilitation, 3(1), 2016, p. 61–66, DOI: http://doi.org/10.17352/2455-5487.000037

2) Therapeutische Anwendung der Kernspinresonanz bei Osteoporose

W. Kullich[1], I. Lukenda[2], B. Stritzinger[1], J. Overbeck[2,3], D. Krpan[2]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Poliklinika K-CENTAR, Zagreb, Croatia; [3]Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Bericht nat.-medizinische Vereinigung Salzburg, Vol. 18, Salzburg, 2016, p. 7–17

3) Kernspinresonanztherapie bei Arthrosen

Dr. W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, 35. Rheumatagung Saalfelden, Ludwig Boltzmann Cluster für Arthritis und Rehabilitation Sonderkrankenanstalt der PVA, Saalfelden, Austria, 24/25 June 2016

4) Neues Wirkprinzip: Therapie mit Kernspinresonanz

Dr. W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Seminar „Spezielle Schmerztherapie“ zur Erlangung des Schmerzdiploms der Österreichischen Ärztekammer, Teil 2: June 2016, Veranstalter: Salzburger Schmerzinstitut, Salzburger Gesellschaft für Allgemeinmedizin, Vorarlberger Ärztekammer
Lecture, June 2016

5) Non-invasive treatment for osteoarthritis, osteoporosis & sports injuries

Dr. J. Overbeck[1], Dr. W. Kullich; [1]Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany; [2]Ludwig Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Workshop, Africa Health Congress, Johannesburg, South Africa, 8–10 June 2016

6) Introduction to NMR therapy and its use as an effective treatment of osteoarthritis and osteoporosis

Dr. J. Overbeck; Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, Africa Health Congress, Johannesburg, South Africa, 9 June 2016

7) Research and the Effects of the Therapeutic Application of Nuclear Magnetic Reonance (NMRT) at the cellular level

Dr. W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, Africa Health Congress, Johannesburg, South Africa, 9 June 2016

8) magnetic resonance therapy for OA & Osteoporosis Workshops

Dr. J. Overbeck; Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Workshop, Africa Health Congress, Johannesburg, South Africa, 10 June 2016

9) Spitzenmedizin im Handball – Bessere Versorgung durch kombinierten Einsatz verschiedener Therapien bei akuten Muskelverletzungen

Dr. René Toussaint, Practising Orthopaedic Specialist for Sports Medicine
Sportärztezeitung, 02/2016, p. 38–39

2015:

1) Treatment of the clinical symptoms caused by osteoarthritis using nuclear magnetic resonance (MBST®) in dogs in a randomized trial

M. Müller, DVM[1], I. Virac[1], C. Lang[1], K. Wittek, DVM[1], A. Tichy, MA, DSc[2], B. Bockstahler DVM, PD[1]; [1]Department for Small Animals and Horses, Small Animal Surgery, Section for Physical Therapy and Rehabilitation, University of Veterinary Medicine, Vienna, Austria; [2]Department for Biomedical Sciences, Platform Bioinformatics and Biostatistics, University of Veterinary Medicine, Vienna, Austria

2) Inaugural-Dissertation zur Erlangung des doctor rerum medicinalium der Medizinischen Fakultät der Westfälischen Wilhelms-Universität Münster: Auswirkungen der Kernspinresonanztherapie auf die Dynamik der Leberregeneration.

N. Budny; Clinic for General and Visceral Surgery, Department Surgery Research, University Hospital Münster, Germany
October 2015

3) Modulation of NF-kB activity by the therapeutic Nuclear Magnetic Resonance (NMR) to explain pain reduction in patients with osteoarthritis

B. Steinecker-Frohnwieser[1], W. Kullich[1], A. Mann[2], B. Stritzinger[1], H. G. Kress[2], L. Weigl[2]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Department for Special Anaesthesia and Pain Management, Medical University, Vienna, Austria
Posterpresentation, International Pain Congress of the European Pain Federation EFIC, Vienna, Austria, 2–5 September 2015

4) Non-pharmacological treatment of osteoporosis with Nuclear magnetic resonance therapy (NMR-Therapy)

D. Krpan[1], B. Stritzinger[2], I. Lukenda[1], J. Overbeck[1,3], W. Kullich[2]; [1]Poliklinika K-CENTAR, Zagreb, Croatia; [2]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [3]Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Final study report

5) Non-pharmacological treatment of osteoporosis with Nuclear magnetic resonance therapy (NMR-Therapy)

D. Krpan[1], B. Stritzinger[2], I. Lukenda[1], J. Overbeck[1,3], W. Kullich[2]; [1]Poliklinika K-CENTAR, Zagreb, Croatia; [2]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [3]Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Periodicum Biologorum, Vol. 117, No. 1, p. 161–165

6) A new concept of integrated holistic approach in treatment of chronic musculoskeletal diseases – The "BAR" method

Prof. Dr. sc. D. Krpan, Poliklinika K-CENTAR, Zagreb, Croatia
Periodicum Biologorum, 117, No. 1, p. 119–124

7) Effects of Therapeutic-NMR (MBST-Nuclear Magnetic Resonance) on the Circadian Clock and the Hypoxic Signaling Pathway in Zebrafish Cells

R. Oliva
Master thesis for the academic grade Master of Science (MSc), Faculty of Biology, Institute for Ecophysiology, Leopold Franzens University, Innsbruck, Austria

2014:

1) Nuclear magnetic resonance treatment (MBST®) of clinical symptoms caused by osteoarthritis: a double-blinded placebo-controlled study in dogs

M. C. Müller, K. Wittek, B. A. Bockstahler; Department for Small Animals and Horses, Small Animal Surgery, Section for Physical Therapy and Rehabilitation, University of Veterinary Medicine, Vienna, Austria
Posterpresentation, International Symposium in Animal Musculoskeletal Practice, Coventry, UK, 29–30 November 2014

2) The influence of nuclear magnetic resonance therapy (NMRT) and interleukin IL1-β stimulation on Cal 78 chondrosarcoma cells and C28/I2 chondrocytes

B. Steinecker-Frohnwieser; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, Scientific Symposium: Microbiome Research / Personalized Medicine, Graz, Austria, 17–18 July 2014

3) Nuclear magnetic resonance therapy. The new opportunity in the treatment of chronic skeleton diseases and sport injuries

D. Krpan; Poliklinika K-CENTAR, Zagreb, Croatia
Lecture, Russian-Slowenian Science Meeting, Terme Olimia, Podčetrtek, Slovenia, June 2014

4) Neues Wirkprinzip: Therapie mit Kernspinresonanz

W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, Kurs „Spezielle Schmerztherapie", Schmerzdiplom der österreichischen Ärztekammer, Leogang, Austria, 19 June 2014

5) Application of Nuclear magnetic resonance therapy as treatment of degenerative diseases of the locomotor system

I. Mařík, A. Maříková, R. Myslivec; Ambulantní centrum pro vady pohybového aparátu s.r.o, Prague, Czechia
Lecture, 19th Kubat's Podiatric day, Prague, Czechia, 8 March 2014

6) German company develops the first casual therapy for osteoporosis and circulatory disorders of bone

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2014, p. 15

7) Therapeutic nuclear magnetic resonance revolutionisses medicine in high-performance sport

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2014, p. 15

8) Causal and Painfree: Cell Regeneration Made in Germany as a Treatment Innovation for Veterinary Medicine and Dermatology

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2014, p. 55

9) Causal Treatment of degenerative Joint Diseases is Possible only with MBST®-Nuclear magnetic resonance therapy

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2014, p. 15

10) Top 100 2014: Innovationsasse: Ranga Yogeshwar präsentiert Deutschlands Innovationselite

F. Bantle, M. Blath, H. Borges, B. Goebel, D. Hess, R. Heubeck, S. Olschner, U. Pesch, S. Rauch, R. Weiand-Schütt
Redline, Munich 2014, p. 100–103

11) Nuclear magnetic resonance therapy in lumbar disc hernition with lumbar radicular syndrome: effects of the intervention on pain intensity, health-related quality of life, disease-related disabitity, consumption of pain medication, duration of sick leave and MRI analysis

H. Salfinger[1], G. Salomonowitz[2], K. M. Friedrich[2], J. Hahne[1], J. Holzapfel[1], M. Friedrich[1]; [1]Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria; [2]University Clinic for Radiodiagnostics, Medical University, Vienna, Austria
Eur Spine J, 2015, 24, p. 1296–1308, DOI 10.1007/s00586-014-3601-7

2013:

1) One-year-survey with multicenter data of more than 4,500 patients with degenerative rheumatic diseases treated with therapeutic nuclear magnetic resonance

W. Kullich[1], J. Overbeck[2], H. U. Spiegel[3]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany; [3]Clinic for General and Visceral Surgery, Department Surgery Research, University Hospital, Muenster, Germany
Journal of Back and Musculoskeletal Rehabilitation, 2013, 26, p. 93–104, DOI 10.3233/BMR 2012-00362

2) Funktion und Ästhetik – All in One

Vis. Prof. Dr. Dr. A. Valentin, Dr. rer. nat. K. M. Valentin; Zahnmedizinische Klinik am Wasserturm, Mannheim, Germany
Cosmetic dentistry, 3-2013

3) Only MBST® can treat degenerative bone and joint diseases causally

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2013, p. 9

4) Skin's youth code cracked for the first time! Sustained skin regeneration only possible with SpinRepair®

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2013, p. 9

5) Regenerative Cell Stimulation with MBST®Veterinary Replaces Surgery for Cartilage and Bone Demage in Veterinary Medicine

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2013, p. 9

6) Causal treatment method avoids long downtime and surgery

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2013, p. 9

7) Therapie mit Kernspinresonanz – Nachhaltige Verbesserung von Arthroseschmerzen (Multizentrische Beobachtungsstudie an 4.518 Patienten) - (Abstract)

W. Kullich, B. Steinecker; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria

Traum und Wirklichkeit. Schmerztherapie im Spannungsfeld zwischen Ethik und Ökonomie, ÖSG-Vorträge, Leykam, 2013, p. 43–44

8) Therapie mit Kernspinresonanz – Nachhaltige Verbesserung von Arthroseschmerzen (Multizentrische Beobachtungsstudie an 4.518 Patienten)

W. Kullich, B. Steinecker; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria

Posterpresentation, 21. Wissenschaftliche Tagung der Österreichischen Schmerzgesellschaft, Winner of the Posteraward, Klagenfurt, Austria, 9–11 May 2013

9) Intracellular Calcium Is Influenced by Nuclear magnetic resonance therapy (NMRT) in Cal-78 Chondrosarcoma Cells

B. Steinecker-Frohnwieser[1], L. G. Weigel[2], H. G. Kress[2], W. Kullich[1]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Department for Special Anaesthesia and Pain Management, Medical University, Vienna, Austria

Lecture, ÖGR Jahrestagung, 2013

10) Intracellular Calcium Is Influenced by Nuclear magnetic resonance therapy (NMRT) in Cal-78 Chondrosarcoma Cells

B. Steinecker-Frohnwieser[1], L. G. Weigel[2], H. G. Kress[2], W. Kullich[1]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Department for Special Anaesthesia and Pain Management, Medical University, Vienna, Austria

Journal für Mineralstoffwechsel, 2013, 20(4), p. 161–162

11) Intracellular Calcium is influenced by the Nuclear magnetic resonance therapy in Cal-78 chondrosarcoma cells

B. Steinecker-Frohnwieser[1], L. Weigl[2], W. Kullich[1]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Department for Special Anaesthesia and Pain Management, Medical University, Vienna, Austria

Bone – Abstracts, ECTS 2013, Lissabon, 2013, 1, p. 248

12) Nachhaltige Wirkung der Kernspinresonanztherapie bei Arthrosen zeigen multizentrische Daten von über 4.500 Patienten

B. Stritzinger, B. Steinecker, W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria

Journal für Mineralstoffwechsel, 2013, 20(4), p. 159

13) Multizentrische Daten von über 4.500 Patienten mit degenerativ rheumatischen Erkrankungen bestätigen nachhaltige Wirkung der Kernspinresonanztherapie

W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria

Posterpresentation, 61. Jahrestagung der Vereinigung Süddeutscher Orthopäden und Unfallchirurgen, Baden-Baden, Germany, 1–4 May 2013

14) Nachhaltige Wirkung der Kernspinresonanztherapie bei Arthrosen zeigen multizentrische Daten von über 4.500 Patienten

B. Stritzinger, B. Steinecker, W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria

Lecture, 21. Wissenschaftliche Tagung der Österreichischen Schmerzgesellschaft ÖSG, 9–11 May 2013

15) Nachhaltige Wirkung der Kernspinresonanztherapie bei Arthrosen zeigen multizentrische Daten von über 4.500 Patienten

W. Kullich, B. Stritzinger, B. Steinecker; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Posterpresentation, 1. LBG Meeting for Health Sciences, Vienna, Austria, 2 December 2013

16) Hat die therapeutische Anwendung der Kernspinresonanz bei Arthrosen einen nachhaltigen Effekt? Beobachtungsstudie an 4.518 Patienten

W. Kullich, B. Stritzinger, J. Overbeck; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
06/2013

17) MBST – Nuclear magnetic resonance therapy. The new opportunity in the treatment of chronic skeleton diseases and sport injuries

D. Krpan; Poliklinika K-CENTAR, Zagreb, Croatia
Lecture, Wissenschaftliches Meeting, Bukarest, Romania, September 2013

18) MBST®– Analysis of the scientific studies and its relevance to the daily application

Dr. J. Overbeck; Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, The Park Hotel, New Delhi, India, 7 June 2013

19) MBST® – Nuclear magnetic resonance therapy, Analysis of the Scientific Studies and its Relevance to the Daily Application

Dr. J. Overbeck; Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, East Delhi Gynae Forum, Delhi, India, 7 June 2013

20) Magnetic resonance therapy

Dr. J. Overbeck; Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, 32nd Annual Conference of North Zone Chapter of The Indian Orthopaedic Association, Srinagar, India, 1 June 2013

21) MBST®– Nuclear magnetic resonance therapy on Gonarthrosis, Long-Term Effects

W. van Laack; FH Aachen
Abstract, Veranstaltungskatalog der Safety and Security, InnovationsAllianz der NRW-Hochschulen, Brussels, Belgium, 18 June 2013

22) Langfristige Reduktion des Schmerzes bei verschiedenen Arthrosen nach Behandlung mit Kernspinresonanz

W. Kullich[1], B. Steinecker[1], J. Overbeck[2]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Schmerznachrichten, 4/2013, p. 20–23

23) Clinical Efficiency of Nuclear magnetic resonance therapy in Osteoarthritis

W. Kullich, B. Stritzinger, B. Steinecker; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Posterpresentation, First LBG Meeting for Health Sciences 2013, Vienna, Austria, 2 December 2013

24) Innovative medical technology – Made in Germany

A. Muntermann, A. Oelsner; MedTec Medizintechnik GmbH, Wetzlar, Germany
Lecture, Dr. Sulaiman Al Habib Krankenhaus, Riyadh, Saudi Arabia, 26 November 2013

25) MBST-Nuclear magnetic resonance therapy – innovative medical technology made in Germany

A. Muntermann, A. Oelsner; MedTec Medizintechnik GmbH, Wetzlar, Germany
Lecture, National Guard Krankenhaus, Riyadh, Saudi Arabia, 27 November 2013

26) Innovative medical technology – Made in Germany

A. Muntermann, A. Oelsner; MedTec Medizintechnik GmbH, Wetzlar, Germany
Lecture, Saad Specialist Hospital, Dammam, Saudi Arabia, 28 November 2013

27) Nuclear magnetic resonance therapy. A Short Analysis of the Scientific Studies focused on the Spine

Assoc. Prof. I. Mařík[1], M. Schmitz[2], A. Oelsner[2]; [1]Ambulant Centre for defects of Locomotor apparatus, I. l. c., Prag, Tschechien; [2]MedTec Medizintechnik GmbH, Wetzlar, Germany
Lecture, 15th Prauge-Lublin-Sydney Symposium, Children's Rehabilitation Center of Orthopaedics and Traumatology Ogonyok, St. Petersburg, Russia, 15–22 September 2013

28) Multizentrische Daten von über 4.500 Patienten mit degenerativ rheumatischen Erkrankungen bestätigen nachhaltige Wirkung der Kernspinresonanztherapie

W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Sonderausgabe der Zeitschrift für Orthopädie und unfallchirurgische Praxis (Kurzreferate VSOU), Deutscher Ärzteverlag, 2013, p. 305–306

29) Intracellular Calcium is influenced by the Nuclear magnetic resonance therapy in Cal-78 chondrosarcoma cells

B. Steinecker-Frohnwieser[1], L. Weigl[2], W. Kullich[1]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; [2]Department for Special Anaesthesia and Pain Management, Medical University, Vienna, Austria
Lecture, ECTS 2013, Lissabon, Portugal, 18–21 May 2013

30) Functional ability of the skeleton and how we can improve it by MBST

D. Krpan; Poliklinika K-CENTAR, Zagreb, Croatia
Lecture, Kroatischer Nationalkongress für Osteoporose, Opatia, Croatia, April 2013

31) (N)MRT – Nuclear magnetic resonance therapy, Analysis of the Scientific Studies and its Relevance to Sport Injuries and its Ramifications

Dr. J. Overbeck; Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, Connective Tissues in Sports Medicine, University of Ulm, Germany, 12–14 April 2013

2012:

1) MRT-magnetic resonance therapy Analysis of the scientific studies and its relevance to the daily application

Dr. J. Overbeck, Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, Spring Orthopedic Symposium, Prague, Czechia, 22–23 March 2012

2) MBST®-Therapeutische Kernspinresonanztherapie bei degenerativen Erkrankungen des Stütz- und Bewegungsapparates

Dr. J. Overbeck, Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, Orthopädenkongress porada, Hotel NH Olomouc, 16–18 May 2012

3) Nuclear magnetic resonance therapy for Knee Joint Osteoarthrosis: is there any clinical or Radiological Beneficial Effect? Double Blind Randomised Control Study

J. P. Peehal[1], F. W. Smith[2], S. L. Baker[3]; Department of Orthopaedics, Positional MRI Centre, Aberdeen, UK
J. Bone Joint Surg Br, 2011, no. 93-B, SUPP III 308

4) Effekte der Kernspinresonanztherapie auf Krankenstand bei Patienten mit Nervenwurzelirritation infolge eines lumbalen Bandscheibenvorfalls

G. Salomonowitz[1], H. Salfinger[2], J. Hahne[1], M. Friedrich[3]; [1]University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; [2]Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; [3]Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria
Zeitschrift für Orthopädie und Unfallchirurgie, 149, p. 575–581, DOI: http://dx.doi.org/10.1055/s-0031-1280121

5) Statisch, dynamisch, gepulst – was bringen Magnetfelder in der Schmerztherapie

G. Salomonowitz[1], H. Salfinger[2], J. Hahne[1], M. Friedrich[3]; [1]University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; [2]Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; [3]Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria
Springer Verlag, 10/2012

6) MBST-Nuclear Megnetic Resonance Therapy on Gonarthrosis – Long-Term-Effects
W. van Laack, G. Froning; Institute for Bioengineering (IfB), Laboratory Biomechanics, University of Applied Sciences Aachen, Campus Juelich, Orthopaedic Practice and Center for outpatient arthroscopic operations, Herzogenrath b. Aachen, Germany
Safety & Security Innovations Allianz der NRW-Hochschulen e. V., 2012

7) Analyse der Langzeitwirkung der MBST® KernspinResonanzTherapie bei Gonarthrose
W. van Laack, G. Froning; Institute for Bioengineering (IfB), Laboratory Biomechanics, University of Applied Sciences Aachen, Campus Juelich, Orthopaedic Practice and Center for outpatient arthroscopic operations, Herzogenrath b. Aachen, Germany

8) MBST-Publications for Wikipedia – Article magnetic resonance therapy
Wikipedia 2012

9) MBST-Publications for Wikipedia – Niederfeld-Magnetresonanz
Wikipedia 2012

10) MBST-Publications for Wikipedia – Therapeutische Kernspinresonanz
Wikipedia 2012

11) Osteoarthritis Research News – Major Study Corroborates Medical Evidence of Therapeutic Magnetic Resonance in Osteoarthritis
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2012, p. 21

12) Pioneering Cell Regeneration for Dermatology and Cosmetics Revolutionary Therapeutic Application of Magnetic Resonance for Wound Healing and a Youthful Skin
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2012, p. 14

13) An Effective Alternative for the Treatment of Osteoporosis and Bone Disease magnetic resonance therapy Provides Hope to Millions of Osteoporosis Patients
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2012, p. 5

14) New Revolutionary Procedure for Veterinary Medicine Therapeutic Application of Magnetic Resonance Heals Cartilage and Bone Without Operation
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2012, p. 15

15) MBST – Nuclear magnetic resonance therapy. The new opportunity in the treatment of chronic skeleton diseases and sport injuries
D. Krpan; Poliklinika K-CENTAR, Zagreb, Croatia
Lecture, Symposium Best practices in the health evaluation of elite athletes – post Olympic analyses, Belgrad, Serbia, October 2012

16) Leitfaden Naturheilverfahren für die ärztliche Praxis
A.-M. Beer, M. Adler (Hrsg.), Munich 2012, p. 296

2011:

1) MBST – Treatment of chronic skeleton diseases
D. Krpan; Poliklinika K-CENTAR, Zagreb, Croatia
Lecture, Symposium The new methods in the treatment of degenerative diseases, Ljubljana, Slovenia, April 2011

2) 30 Jahre Boltzmann Institut und 30. Rheumatagung in Saalfelden
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Jatros Orthopädie, 5/2011, p. 68

3) Chronisches Lumbalsyndrom – Kann die Kernspinresonanz den Rehabilitationserfolg verlängern?

W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture

4) Analyse der Langzeitwirkung der MBST® KernspinResonanzTherapie bei Gonarthrose

W. van Laack, G. Froning; Institute for Bioengineering (IfB), Laboratory Biomechanics, University of Applied Sciences Aachen, Campus Juelich, Orthopaedic Practice and Center for outpatient arthroscopic operations, Herzogenrath b. Aachen, Germany
Orthopädische Praxis, 47, 11/2011, p. 536–543

5) Effekte der Kernspinresonanztherapie auf Krankenstand bei Patienten mit Nervenwurzelirritation infolge eines lumbalen Bandscheibenvorfalls

G. Salomonowitz[1], H. Salfinger[2], J. Hahne[1], M. Friedrich[3]; [1]University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; [2]Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; [3]Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria
Z Orthop Unfall, 2011, 149(5), p. 575–581, DOI: 10.1055/s-0031-1280121

6) MBST – The new treatment of osteoarthritis and osteoporosis

D. Krpan; Poliklinika K-CENTAR, Zagreb, Croatia
Lecture, ISCEM 2011 und 5. Kroatischer Kongress für Endokrinologie mit internationaler Beteiligung, Pula, Croatia, October 2011

7) Kernspinresonanz beeinflusst Arthroseschmerz

W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Posterpresentation, 19. Jahrestagung der Österreichischen Schmerzgesellschaft, 26–28 May 2011

8) Hope for millions of osteoporosis patients – Magnetic resonance used therapeutically shows highly significant results in the fight against osteoporosis

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2011, p. 12

9) Cartilage regeneration in osteoarthritis patients through nuclear magnetic resonance therapy

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2011, p. 6

10) Bone demage in veterinary medicine treated with nuclear magnetic resonance therapy Up until now veterinary practitioners have been searching unsuccessfully for an effective and non-evasive treatment method for bone and cartilage demage for large and small animals.

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2011, p. 6

11) Magnetic resonance therapy cracks the code of youthful skin

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2011, p. 6

12) Next Generation of medical Technology – Therapeutic Effect of NMR-Therapy against Osteoarthritis Proven

Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2011, p. 60

13) Zellulite-Behandlung mit Kernspin

B. Schlüler-Voss[1], E. Voss[2]; [1]Bel Etage Cosmetics, Leverkusen, [2]EVBC-GmbH, Leverkusen, Germany, 2011

14) Zellulite – Behandlung mit Kernspin – Abschlussbericht

E. Voss, EVBC-GmbH, Leverkusen, Germany, 2011

15) Beinflussung des Haarwachstums durch Kernspin

B. Schlüler-Voss[1], E. Voss[2]; [1]Bel Etage Cosmetics, Leverkusen; [2]EVBC-GmbH, Leverkusen, Germany, 2011

16) Stimulation Haarwachstum mit Kernspin
E. Voss; EVBC-GmbH, Leverkusen, Germany, 2011

17) Positive Effects of the Therapeutic Use of Nuclear Magnetic Resonance in Treating Sports Horses Suffering from Ganglia
B. Steinecker-Frohnwieser, W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden and Groebming, Austria

18) MBST – Nuclear magnetic resonance therapy. The New Possiblity of Osteoarthritis and Osteoporosis Treatment
Prof. Dr. SC. D. Krpan; Poliklinika K-CENTAR, Zagreb, Croatia
Balneoclimatologia, Dijagnostica I Leˆcenje Osteoporoze, May 2011, Vol. 35, p. 61–66

19) MBST – Nuclear Magentic Resonance Therapy. The new possibility of osteoarthritis and osteoporosis treatment
D. Krpan; Poliklinika K-CENTAR, Zagreb, Croatia
Lecture, Internationales Symposium für Osteoporose, Niška Banja, Serbia, May 2011

20) Therapeutischer Einsatz der Kernspinresonanz bei verschiedenen Arthroseformen
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, 30. Rheumatologische Fortbildungstagung, Saalfelden, Austria, 17–18 June 2011

21) MBST-Kernspin – Innovative Medizintechnik – Jogging für die Zelle
A. Muntermann; MedTec Medizintechnik GmbH, Wetzlar, Germany
Lecture, 30. Rheumatologische Fortbildungstagung, Saalfelden, Austria, 17–18 June 2011

22) Therapeutischer Einsatz der Kernspinresonanz bei verschiedenen Arthroseformen
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, 30. Rheumatologische Fortbildungstagung, Saalfelden, Austria, 17–18 June 2011

23) Intrazelluläre Ca2+-Regulation als möglicher Angriffspunkt der KSRT
L. Weigl; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria, Department for Special Anaesthesia and Pain Management, Medical University, Vienna, Austria
Lecture, 30. Rheumatologische Fortbildungstagung, Saalfelden, Austria, 17–18 June 2011

24) Einfluss der Kernspinresonanz auf Arthrose-relevante Faktoren
B. Steinecker-Frohnwieser; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, 30. Rheumatologische Fortbildungstagung, Saalfelden, Austria, 17–18 June 2011

2010:

1) Modulation of VEGF and Cytokines by the Therapeutic Nuclear Magnetic Resonance
B. Steinecker-Frohnwieser, L. Weigl, N. Fagerer, G. Weberhofer, W. Kullich, H. G. Kress; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria, Department for Special Anaesthesia and Pain Management, Medical University, Vienna, Austria
Presentation, Jahreskongress der Österreichischen Gesellschaft für Rheumatologie und Rehabilitation, Vienna, Austria, 25–27 November 2010

2) Break-Through in Orthopaedics – Causal Solution to Osteoarthritis and Osteoporosis
Arab Health, Dubai, featureorthopaedics, January 2010, p. 28–29

3) Innovation in the therapy of musculoskeletal disorders – Magnetic nuclear resonance therapy has been well established over the last year in the conservative therapy for musculoskelatal disorders in Germany
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2010, p. 40

4) Influence of NMR therapy on metabolism of Osteosarcoma and Chondrosarcoma Cells – Nuclear magnetic resonance (NMR) with weak magnetic fields has been shown to stimulate repair prozesses in cardilage and to influencepain signalling.
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2010, p. 40

5) The Therapeutic effects of nuclear magnetic resonance in degenerative joint diseases – Introduction Osteoarthritis (OA) of the hand and finger joints is the main cause of difficulties in the execution of activitis in daily life
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2010, p. 40

6) The regenerative Cell Stimulation for Cartilage and Bones in Veterinarymedicine Musculoskelatal disorders are a common occurrence in veterinary medicine
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2010

7) Medical Progress in The Treatment of Arthritis
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2010, p. 40

8) Worldwide interest in new Technology from Germany: Therapeutic magnetic resonance therapy
Arab Health, Dubai, The official magazine of the Arab Health Exhibition, January 2010, p. 54

9) Nachweis der Wirksamkeit der MBST®-Kernspinresonanztherapie bei arthroseerkrankten Hunden mit einem Lebensalter zwischen 2 und 15,5 Jahren
H. Klaiber
Animal experimental study with dogs, interim report, Physio-Therapie für Tiere, 2010

10) Multi Bio Signal Therapy – The Münster experience. Tierexperimentelle Studie zur Untersuchung der MBST®-KernspinResonanzTherapie auf die Regenerationsfähigkeit der Leber. Veröffentlichungsankündigung, 09/2010
U. Spiegel; Clinic for General and Visceral Surgery, Department Surgery Research, University Hospital Muenster, Germany

11) Behandlung von Gesichtsfalten mit der MBST®-Kernspinresonanztechnologie. SpinRepair – Abschlussbericht
B. Schlüler-Voss[1], E. Voss[2]; [1]Bel Etage Cosmetics, Leverkusen, Germany; [2]EVBC-GmbH, Leverkusen, Germany, 2010

12) MBST – The new concept of the treatment of chronic skeleton diseases
D. Krpan; Poliklinika K-CENTAR, Zagreb, Croatia
Lecture, Orthopädische Tage, Maribor, Slovenia, December 2010

13) Impact of magnetic resonance therapy on sickness absence of patients with nerve root irritation following a lumbar disc problem
G. Salomonowitz[1], H. Salfinger[2], J. Hahne[1], M. Friedrich[3]; [1]University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; [2]Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; [3]Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria

14) Nuclear magnetic resonance therapy in lumbar disc herniation with lumbar radicular syndrome: effects of the intervention on pain intensity, health-related quality of life, disease-related disability, consumption of pain medication, duration of sick leave and MRI analysis
H. Salfinger, G. Salomonowitz, K. M. Friedrich, J. Hahne, J. Holzapfel, M. Friedrich; Centre of Excellence for Orthopaedic Pain Management Speising, Vienna, Austria

2009:

1) NFAT-Modulation in Knochen- und Knorpelzellen durch therapeutische Kernspinresonanz

W. Kullich, L. Weigl, B. Steinecker, H. G. Kress; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria, Department for Special Anaesthesia and Pain Management, Medical University, Vienna, Austria
Lecture and posterpresentation, Deutscher Kongress für Orthopädie und Unfallchirurgie, Berlin, Germany, 21–24 October 2009

2) Bessert Schmerz und Funktion: Kernspin-Therapie an die Arthrose

Medical Tribune, 44. year, No. 1/2, 9 January 2009, p. 9

3) Hat die MBST®-Kernspin-Resonanz-Therapie einen Einfluss auf die post-traumatische Gonarthrose im Kaninchenmodell? – 6 Wochen trial – Eine tierexperimentelle Studie

T. Brockamp, Inaugural-Dissertation for doctor medicinae of the medical faculty of the Westfälische Wilhelms-University Muenster, University Clinic Muenster, Clinic for Trauma and Regenerative Surgery, Germany

4) Influence of NMR therapy on Ca2+ signalling and gene expression in osteosarcoma- and chondrosarcoma cell lines

L. G. Weigl, B. Steinecker-Frohnwieser, C. Höller, E. Sipos, H. G. Kress, W. Kullich; University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria
Regional Biophysics Conference, Linz, Austria, 10–14 February 2009

5) Influence of NMR Therapy on Metabolism of Osteosarcoma- and Chondrosarcoma Cell lines

B. Steinecker-Frohnwieser, L. Weigl, C. Höller, E. Sipos, W. Kullich, H. G. Kress; University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria
Bone – Official Journal of the International Bone and Mineral Society, No. 44-2, p. 295

6) Influence of NMR Therapy on Metabolism of Osteosarcoma- and Chondrosarcoma Cell lines.

B. Steinecker-Frohnwieser, L. Weigl, C. Höller, E. Sipos, W. Kullich, H.G. Kress; University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria
Presentation, 36th European Symposium on Calcified Tissues, ECTS Congress, Vienna, Austria, 23–27 May 2009

7) Wissenschaftlicher Arbeitsbericht der Ergebnisse von den Zellkulturversuchen des Jahres 2009

B. Steinecker, W. Kullich; University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria
Scientific Study Report

8) Von der Diagnose-Apparatur zur Therapie-Anwendung – KernspinResonanz eine neue Behandlung für Knorpelaufbau

W. Schwägerl
Article, Ärzte Woche, 7 May 2009, p. 22

9) Fit für den Sport: Training, Aufwärmen, Heilen

Prof. Dr. R. Weinstabl, Vienna, Austria

2008:

1) Arthrose und Schmerztherapie mit Kernspin

Wirtschaftsmagazin für den Orthopäden, 6/2008, p. 16

2) Therapeutischer Einsatz der Kernspinresonanz bei Arthrosen

W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, Deutscher Kongress für Orthopädie und Unfallchirurgie, Berlin, Germany, 22–25 October 2008

3) Arthrosetherapie mit Kernspinresonanz: Verfahren kann reparative Prozesse im Knorpel anregen und Schmerzsignal-Transduktionskaskaden beeinflussen

W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Orthopädische Nachrichten, Kongressausgabe, Dt. Kongress für Orthopädie und Unfallchirurgie, Berlin, Germany, 22–25 October 2008, p. 12

4) Behandlung der Osteoporose mit MBST® KernSpin

T. Handschuh, C. Melzer; Waldkrankenhaus Bad Dueben, Clinic for Orthopaedics, Germany
Orthodoc, 5/2008, p. 1–4

5) Funktionsverbesserung bei Fingergelenksarthrosen durch therapeutischen Einsatz der Kernspinresonanz

W. Kullich, M. Ausserwinkler; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Posterpresentation, 56. Jahrestagung der Vereinigung Süddeutscher Orthopäden e. V., Baden-Baden, Germany, 1–4 May 2008; awarded with a posterprize

6) Funktionsverbesserung bei Fingergelenksarthrosen durch therapeutischen Einsatz der Kernspinresonanz

W. Kullich, M. Ausserwinkler; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Orthopädische Praxis, 44, 6/2008, p. 287–290

7) Einfluss der Kernspinresonanz-Therapie auf die Regulation des NFAT-Pathways in Osteo- und Chondrosarcomzelle

B. Steinecker, L. Weigl, W. Kullich, H. G. Kress; [1]University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; [2]Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; [3]Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria
Presentation, Tagung der Österreichischen Gesellschaft für Rheumatologie, Vienna, Austria, November 2008

8) Einfluss der Kernspinresonanz-Therapie auf die Regulation des NFAT-Pathways in Osteo- und Chondrosarcomzelle

B. Steinecker, L. Weigl, W. Kullich, H. G. Kress; University Clinic for Radiodiagnostics, Medical University, Vienna, Austria; Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria; Centre of Excellence for Orthopaedic Pain Management, Speising, Vienna, Austria
Zeitschrift für Mineralstoffwechsel, 11/2008, p. 201

9) MBST Kernspin-Resonanz-Therapie – Erfolgreicher Einsatz auch im Leistungssport

Praxis Physiotherapie, 1/2008

10) Funktionsverbesserung bei Fingergelenksarthrose durch Kernspinresonanz

W. Kullich, M. Ausserwinkler; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Jatros Orthopädie, offizielles Organ der ÖGO, No. 4/2008, p. 29

11) MBST® KernSpin: Innovation in der Therapie von Erkrankungen des Bewegungsapparates

DOV-Magazin, Deutscher Orthopäden Verband e. V., Ausgabe May/June 2008, p. 4–6

12) Functional improvement in finger joint osteoarthritis with therapeutic use of nuclear magnetic resonance

W. Kullich, M. Ausserwinkler; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Varia, 05/2008

13) Behandlung von Handarthrosen mit Hilfe der Kernspinresonanzfrequenz

W. Kullich, M. Ausserwinkler; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Varia, 05/2008

14) Ergebnisse der Genexpressions-Untersuchungen unter dem Einfluss der Kernspinresonanz

W. Kullich, B. Steinecker; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Vortrag, MedTec Medizintechnik GmbH, Präsentation von MBST-Studienergebnissen, Wetzlar, Germany, 10 April 2008

15) Die MBST-Therapie und ihr Einfluss auf die molekulare Physiologie von Osteocyten, Chondrocyten und PC12-Zellen

B. Steinecker[1], W. Kullich[1], L. Weigl[2]; [1]Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; Orthopaedic Pain Management, Orthopaedic Hospital Speising, Vienna, Austria
Lecture, MedTec Medizintechnik GmbH, Präsentation von Studienergebnissen, Wetzlar, Germany, 10 April 2008

2007:

1) Anwendung der Kernspinresonanz als neue Therapiemöglichkeit bei Gonarthrose

N. Fagerer, W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Arzt & Praxis, No. 927, May 2007, p. 180–182

2) Kernspinimpulse therapeutisch genutzt

Unfallchirurgiezentrum Valentin, Vienna, Austria, 2007

3) magnetic resonance therapy and Bone Health

Dr. J. Overbeck, Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, Kings College Hospital, Bone Health Group, London, UK, December 2007

4) A new Technique how it works!
Personal Experiences and Studys - London Bone Research Group

Dr. J. Overbeck, Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany
Lecture, Bone Health Group, London, UK, December 2007

5) Discriminatory-Gene-Expression-Analysis – von menschlichen dermalen Fibroblasten nach MBST-Behandlung mit Agilent Whole-Genome-Oligo-Microarrays. The Microarray Technology is the Analysis of a Snapshot of a Biological Process

Prof. Dr. G. M. Artmann; Cell & Tissue Technolgy, Juelich, Germany, 2007

6) Studie zur Untersuchung der Wirksamkeit der Kernspinresonanztherapie bei arthroskopisch gesicherter Chondromalazie des Kniegelenks bzw. Gonarthrose

O. Gorschewsky; Sportorthopädie Bern, Switzerland, 2007

7) Effekte der Nuklearmagnetischen Resonanztherapie auf die Haut- und Knochenzellen auf Genomebene

Prof. Dr. G. M. Artmann; Cell & Tissue Technology, Juelich, Germany, 2007

8) Pilotstudie zur Untersuchung der MBST®-KernspinResonanzTherapie auf die Regenerationsfähigkeit der Leber – Zwischenbericht 2007

J. P. Hölzen, R. Thanos, S. Stöppeler, H. U. Spiegel, M. G. Krukemeyer; Clinic for General and Visceral Surgery, Department Surgery Research, University Hospital Münster, Germany

9) Chronische Gelenkprobleme: Kernspinimpulse therapeutisch genutzt

Dr. P. Valentin; Unfallchirurgiezentrum, Klosterneuburg, Austria
Ärztewoche, 13 December 2007, p. 14

10) Anwendung der Kernspinresonanz bei degenerativ-rheumatischen Erkrankungen
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, 5. MBST-Anwendertagung, Wetzlar, Germany, 24 November 2007

11) Die therapeutische Anwendung der KernspinResonanz bei Gonarthrose, Low back pain und Fingerpolyarthrosen
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, Tagung Evaluation und Forschung in der Rehabilitation, Groebming, Austria, 13 September 2007

12) KernspinResonanz in der Therapie der Gonarthrose
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, LBI Clustertreffen, Bad Tatzmannsdorf, Austria, 22 June 2007

13) Therapeutische Anwendung der KernspinResonanz bei Fingerpolyarthrosen
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, LBI Clustertreffen, Bad Tatzmannsdorf, Austria, 22 June 2007

14) Einfluss der KernspinResonanz auf die Genexpression bzw. das elektrische Verhalten von Osteocyten, Chondrocyten und PC12 Zellen
B. Steinecker; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, LBI Clustertreffen, Bad Tatzmannsdorf, Austria, 22 June 2007

15) Neue Formen der Arthrose-Behandlung
J. Josiliewicz
Lecture, Ben-Gurion-University of the Negev, Be'er Scheva, Israel, April 2007

2006:

1) In-vitro characterization of Nuclear magnetic resonance therapy (MBST®) in the hippocampus slice preparation of rats
Prof. Dr. W. Dimpfel; NeuroCode AG, Germany
Contract research, Stdy No NCAG 06/06H, 08/09, 2006

2) Kann die therapeutische Anwendung der Kernspinresonanz die Dauer des Rehabilitationserfolges bei chronischem Lumbalsyndrom verlängern?
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, 3. MBST-Fortbildungsveranstaltung und Anwendertagung, Wetzlar, Germany, 11 November 2006

3) Therapeutische Anwendung der KernspinResonanz
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, Jour fix, SKA der PVA Saalfelden, Austria, 13 September 2006

4) Einsatz der MBST-KernspinResonanzTherapie in der Rehabilitation
W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture, 1. Clustersymposium, Medical University Vienna, Austria, 30 May 2006

5) Additional outcome improvement in the rehabilitation of chronic low back pain after nuclear resonance therapy
W. Kullich, H. Schwann, K. Machreich, M. Ausserwinkler; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Rheumatologia, 1/2006, p. 7–12

6) Does have low-energy NMR an effect on moderate gonarthrosis

H. Jansen, T. Brockamp, J. R. J. Paletta, S. Ockamn, M. J. Raschke, R. H. Meffert; University Clinic Muenster, Clinic for Trauma and Regenerative Surgery, Germany
Lecture and Posterpresentation, The 52nd Annual Meeting of the Orthopaedic Research Society, 19–22 March 2006, Chicago, USA

7) Hat Kernspin-Resonanz Einfluss auf die experimentell induzierte Arthrose im Kaninchen-modell?

H. Jansen[1], J. Paletta[2], S. Ochman[1], M. J. Raschke[1], R. H. Meffert[1]; [1]University Clinic Muenster, Clinic for Trauma and Regenerative Surgery, Germany; [2]Clinic for Orthopaedics and Rheumatology, University Clinic Gießen Marburg, Germany
Deutscher Orthopädenkongress für Orthopädie und Unfallchirurgie, Berlin, Germany, 2–6 October 2006

8) Expression des Vascular Endothelial Growth (VEGF) im Frühstadium der Gonarthrose im Kaninchenmodell

H. Jansen[1], R. H. Meffert[1], F. Birkenfeld[2], M. J. Raschke[1], W. Petersen[1], T. Pufe[2]; [1]University Clinic Muenster, Clinic for Trauma and Regenerative Surgery, Germany; [2]Institute for Anatomy, Christian-Albrechts University, Kiel, Germany
Deutscher Orthopädenkongress für Orthopädie und Unfallchirurgie, Berlin, Germany, 2–6 Oktober 2006

9) Welchen Effekt hat die MBST®-Kernspin-Resonanz-Therapie auf die Morphologie des Knorpels bei Kniegelenks-Arthrose im Kanichenmodell

R. Meffert, T. Brockamp, J. Paletta; University Clinic Muenster, Clinic for Trauma and Regenerative Surgery, Germany

10) Bewertung der KernspinResonanzTherapie MBST hinsichtlich ihres therapeutischen Potentials

Prof. Dr. W. Dimpfel; Rudolf-Buchheim-Institute for Pharmakology, Justus-Liebig-University Giessen, Department 11 Medicine, Germany, March 2006

11) Magnetische Strahlung lässt Knorpel regenerieren – MBST®-Kernspinresonanztherapie als sinnvolle Ergänzung in der Orthopädie

W. Klapsch; Spittal, Austria
Ärztewoche, 7 December 2006, p. 14

12) The effect of MBST®-NuclearMagneticResonanceTherapy with a complex 3-dimensional electromagnetic nuclear resonance field on patients with Low Back Pain

W. Kullich, H. Schwann, J. Walcher, K. Machreich; Ludwig Boltzmann Cluster für Rheumatologie, Balneologie und Rehabilitation, Ludwig Boltzmann Department für Rehabilitation, Saalfelden, Austria
Journal of Back and Musculoskeletal Rehabilitation, 19, 2006, p. 79–87

13) MBST (NMR) Wirkung auf Hautfibroblasten in vitro – Eine Studie der extrazellulären Matrix (ECM)

Prof. Dr. G. M. Artmann; Cell & Tissue Technolgy, Juelich, Germany
Contract research, 2006

14) Proteome-level effects in a skin cell model after MBST application (NMR-Stimulation)

Prof. Dr. G. M. Artmann; Cell & Tissue Technolgy, Juelich, Germany
Final report, 2006

15) Decrease in Extracellular Collagen Crosslinking after NMR Magnetic Field Aplication in Skin Fibroblasts

I. Digel, E. Kurulga, P. Linder, P. Kayser, D. Porst, K. Zerlin, G. M. Artmann, A. Temiz-Artmann; Laboratory for Medical and Molecular Biology, Aachen, University of Applied Sciences, Juelich, Germany, 2006

16) Chronisches Lumbalsyndrom – Kann die Kernspinresonanz den Rehabilitationserfolg verlängern?

W. Kullich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture

17) Pilotstudie zur Untersuchung der MBST®-KernspinResonanzTherapie auf die Regenerationsfähigkeit der Leber – Zwischenbericht 02/2006

U. Spiegel; Klinikum und Poliklinik für Allgemeinchirurgie, Abteilung Chirurgische Forschung, Universitätsklinikum Münster, Deutschland, 2006

19) Tierexperimentelle Studie zur Untersuchung der MBST®-KernspinResonanzTherapie auf die Regenerationsfähigkeit der Leber – Abschlussbericht 09/2006

U. Spiegel; Clinic for General and Visceral Surgery, Department Surgery Research, University Hospital Muenster, Germany

20) Pilotstudie zur Untersuchung der MBST Kernspin-Resonanz-Therapie auf die Regenerationsfähigkeit der Leber

J. P. Hölzen, R. Thanos, S. Stöppeler, H. U. Spiegel, M. G. Krukemeyer; Clinic for General and Visceral Surgery, Department Surgery Research, University Hospital Muenster, Germany
Internal report, MedTec Medizintechnik GmbH, Wetzlar, Germany, 2006

2005:

1) Study of NMR effects on skin aging and wrinkle formation

Prof. Dr. G. M. Artmann; Cell & Tissue Technolgy, Juelich, Germany
Auftragsforschung, 2005

2) Effects of NMR on Skin Fibroblasts – Extracellular matrix related study

Prof. Dr. G. M. Artmann; Cell & Tissue Technolgy, Juelich, Germany
Auftragsforschung, 2005

3) KernspinResonanzTherapie verbessert den Rehabilitationserfolg bei chronischem Kreuzschmerz

W. Kullich, N. Fagerer, K. Machreich, H. Schwann; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; Rehabilitation Centre of the PVA, Saalfelden, Austria
Lecture, Jahrestagung der Österreichischen Gesellschaft für Rheumatologie und Rehabilitation, Vienna, Austria, 25–26 November 2005

4) KernspinResonanzTherapie verbessert den Rehabilitationserfolg bei chronischem Kreuzschmerz

W. Kullich, N. Fagerer, K. Machreich, H. Schwann; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; Rehabilitation Centre of the PVA, Saalfelden, Austria
Skriptum – Wiener medizinische Wochenschrift, p. 11–12

5) Gutachten

Prof. Dr. P. Jakob; Department of Experimental Physics 5, Institute of Physics, University of Wuerzburg, Germany, May 2005

6) MBST®-NuclearMagneticResonanceTherapy improves rehabilitation outcome in patients with low back pain.

W. Kullich, H. Schwann, J. Walcher, K. Machreich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria
Lecture and Posterpresentation, EULAR-Congress, Vienna, Austria, 8–11 June 2005

7) MBST®-NuclearMagneticResonanceTherapy improves rehabilitation outcome in patients with low back pain.

W. Kullich, H. Schwann, J. Walcher, K. Machreich; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; Rehabilitation Centre of the PVA, Saalfelden, Austria
The EULAR Journal, Annals of the rheumatic diseases, EULAR-Congress, Vienna, Austria, 8–11 June 2005

8) The effect of MBST®–NuclearResonanceTherapywith a complex 3-dimensional electromagnetic nuclear resonance fiel on patients with Low Back Pain

W. Kullich[1], H. Schwann[2], J. Walcher[2], K. Machreich[2]; Ludwig Boltzmann Cluster for Rheumatology, Balneology and Rehabilitation, Department for Rehabilitation, Saalfelden, Austria; Rehabilitation Centre of the PVA, Saalfelden, Austria

9) Die MBST®-KernspinResonanzTherapie bei aktivierter Coxarthrose einer 14-jährigen cerebralparetischen Patientin

W. Klapsch; Spittal/Drau, Austria
Lecture, Jahrestagung der Österreichischen Gesellschaft für Orthopädie, Innsbruck, Austria, 2005

10) Stationäre Naturheilkunde: Handbuch für Klinik und Rehabilitation

A.-M. Beer (Hrsg.), Munich/Jena, Germany, 2005, p. 169

11) Prospektive Untersuchung über 1 Jahr zur Wirksamkeit der MBST®-KernspinResonanzTherapie bei der konservativen Therapie der Gonarthrose

B. Auerbach, A. Yacoub, C. Melzer; Waldkrankenhaus Bad Dueben, Clinic for Orthopaedics; Orthopaedic Pracitce, Taucha, Germany
Lecture and Posterpresentation, 1. gemeinsamer Kongress Orthopädie – Unfallchirurgie, Berlin, Germany, 19–22 October 2005

12) Wirkung von Kernspinresonanz auf die Zellwachstumsrate, Apoptose und Lebensdauer von menschlichen Chondrozyten (Knorpelzellen) und Osteoblasten (Knochenzallen in vitro

A. Temiz-Artmann[1], P. Linder[1], P. Kayser[1], I. Digel[1], G. M. Artmann[1], P. Lücker[2]; [1]Laboratory for Medical and Molecular Biology, Aachen, University of Applied Sciences, Juelich, Germany; [2]Prof. Dr. Lücker Consulting GmbH, Gruenstadt, Germany

13) NMR In Vitro Effects on Proliferation, Apoptosis, and Viability of Human Chondrocytes and Osteoblasts

A. Temiz-Artmann[1], P. Linder[1], P. Kayser[1], I. Digel[1], G. M. Artmann[1], P. Lücker[2]; [1]Laboratory for Medical and Molecular Biology, Aachen, University of Applied Sciences, Juelich, Germany; [2]Prof. Dr. Lücker Consulting GmbH, Gruenstadt, Germany
Methods and Findings Exp. Clin. Pharmacol., 2005, 27(5), p. 391–394

14) NMR Effects on Skin Aging and Wrinkle Formation – Part 1 – Collagen-related effects

Prof. Dr. G. M. Artmann; Cell & Tissue Technolgy, Jülich, Deutschland, 2005

15) Wirkungen von Nuclear Magnetic Resonance Feldern auf Hautfibroblasten – Zwischenbericht

G. M. Artmann, A. Temiz-Artmann, P. Linder, P. Kayser, I. Digel; Laboratory for Medical and Molecular Biology, Aachen, University of Applied Sciences, Juelich, Germany

16) Pilotstudie zur Untersuchung der MBST®-KernspinResonanzTherapie auf die Regenerations-fähigkeit der Leber – Zwischenbericht 05/2005

U. Spiegel; Clinic for General and Visceral Surgery, Department Surgery Research, University Hospital Münster, Germany

15) Pilotstudie zur Untersuchung der MBST®-KernspinResonanzTherapie auf die Regenerations-fähigkeit der Leber – Vivantes Fachbereich Patalogie 12/2004

U. Spiegel; Clinic for General and Visceral Surgery, Department Surgery Research, University Hospital Münster, Germany; Clinic Neukoeln, Vivantes, Fachbereich Patalogie, Prof.Dr. H. Herbert FRCPath, Germany 2006

2004:

1) Effekt der MBST®-KernspinResonanzTherapie auf in vitro kultivierte Chondrozyten und Osteoblasten

Prof. Dr. G. M. Artmann; Cell & Tissue Technolgy, Juelich, Germany, 2004

2) Klinisch-Pharmakologisches Gutachten im Auftrag der Investitionsbank Hessen zur Frage der Wirksamkeit der KernspinResonanzTherapie bei verschiedenen orthopädischen Indikationen

Prof. Dr. med. P. Lücker; FACP, Doctor for pharmacology and toxicology, October 2004

2003:

1) Prospektive Untersuchung zur Wirksamkeit der MBST®-KernspinResonanzTherapie bei der konservativen Therapie der Gonarthrose

B. Auerbach, A. Yacoub, C. Melzer; Waldkrankenhaus Bad Dueben, Clinic for Orthopaedics, Germany
Lecture, Deutscher Orthopädenkongress, Berlin, Germany, November 2003

2) Prospektive Untersuchung der Wirksamkeit der MBST®-Kernspin-Resonanz-Therapie bei der Behandlung der Gonarthrose

B. Auerbach, C. Melzer; Waldkrankenhaus Bad Dueben, Clinic for Orthopaedics, Germany

3) Prospektive Untersuchung zur Wirkungsweise der MBST®-KernSpinResonanzTherapie bei Ganzkörperbehandlung als mögliche nicht medikamentöse Therapie bei Osteoporoseerkrankung

Dr. W. Klapsch; Spital/Drau, Austria, 2003

4) Erste wissenschaftliche Studie zur therapeutischen Anwendbarkeit von Kernspinresonanz (MBST®-KernspinResonanzTherapie) an Knorpelstrukturen in vivo

I. Froböse; German Sports University, Cologne, Germany; MedTec Medizintechnik GmbH, 09/2003

5) Scientific Evaluation of the Effectiveness of whole-body MBST® Nuclear magnetic resonance therapy for Treatment of Osteoporosis

J. Overbeck[1], A. Urban[2], G. Gerhardt[3], ReAktiv Treatment Center, Wetzlar, Germany; [1]Practising Orthopaedic Specialist and Researcher, Deggendorf, Germany; [2]Worms, Germany; [3]Wendelsheim, Germany; 2003.

6) Prospektive Untersuchung zur Wirksamkeit der Kernspin-Resonanz-Therapie (MBST) bei der Behandlung von Gonarthrose

M. Schlapp[1], M. Schmitz[1], W. Klappsch[2], A. Muntermann[1], IEB-Institut zur Erforschung neuer Behandlungsmethoden[1]

7) MBST®-KernspinResonanzTherapie als mögliche nicht medikamentöse Therapie bei Osteoporose

S. Grumbrecht; Department for Diagnostic Radiology, Justus-Liebig-University, Giessen, Germany
Article, May 2003

8) MBST®-KernspinResonanzTherapie als mögliche nicht medikamentöse Therapie bei Osteoporose

W. Klapsch; Spittal/Drau, Austria
Article, October 2003

9) MBST-Kernspinresonanztherapie – Wirkung im Gewebe

W. Klapsch; Spittal/Drau, Austria
Lecture, Jahrestagung der Österreichischen Gesellschaft für Orthopädie, Graz, Austria, 2003

10) Die MBST-Kernspinresonanztherapie bei aktiver Coxarthrose einer 14-jährigen cerebraparetischen Patientin

W. Klapsch; Spittal/Drau, Austria
Lecture, Jahrestagung der Österreichischen Gesellschaft für Orthopädie, Graz, Austria, 2003

2002:

1) MBST® Kernspinresonanztherapie Therapieoption bei degenerativen und traumatischen Gelenksveränderungen

W. Klapsch; Spittal/Drau, Austria
Lecture, Jahrestagung der Österreichischen Gesellschaft für Orthopädie, Graz, Austria, p. 124, 2002

2000:

1) Pulsierende elektromagnetische Wellen

G. Breitgraf, I. Froböse; German Sports University, Cologne, Germany
Lecture, Deutscher Orthopädenkongress, Wiesbaden, October 2000

2) Evaluation der Effektivität dreidimensionaler pulsierender elektromagnetischer Felder der MultiBioSignalTherapie (MBST®) auf die Regeneration von Knorpelstrukturen

I. Froböse, U. Eckey, M. Reiser, C. Glaser, F. Englmeier, J. Assheuer, G. Breitgraf; German Sports University, Institute for Rehabilitation, Cologne, Germany; University of Munich, Clinic Großhadern, Department for Diagnostic Radiology, University of Munich, Department for Anatomy, Institute for Radiology, Cologne, Germany, ReAgil Therapy centre
Orthopädische Praxis, 8/2000, p. 510–515

1999:

1) Erste wissenschaftliche Studie zur therapeutischen Anwendbarkeit von Kernspinresonanz (MBST®-KernspinResonanzTherapie) an Knorpelstrukturen in vivo!

I. Froböse, U. Eckey, M. Reiser, C. Glaser, F. Englmeier, J. Assheuer, G. Breitgraf; German Sports University, Institute for Rehabilitation, Cologne, Germany; University of Munich, Clinic Großhadern, Department for Diagnostic Radiology, University of Munich, Department for Anatomy, Institute for Radiology, Cologne, Germany, ReAgil Therapy centre

1998:

1) Langzeitkontrolle der MultiBioSignalTherapie MBST®

G. Breitgraf, M. Krösche, Therapiezentrum der MultiBioSignalTherapie, Cologne
Final report, December 1998

Further references:

Barker, S. L. (2010?): Nuclear magnetic resonance therapy in Knee Osteoarthritis: A Double Blind Randomised Controlled Trial. Woodend Hospitel, Aberdeen. Unpublished.

Gökşen, N.; Çaliş, M.; Doğan, S.; Çaliş, H. T.; Özgöçmen, S. (2016): Magnetic resonance therapy for knee osteoarthritis: a randomized, double blind placebo controlled trial. European journal of physical and rehabilitation medicine, 52(4), 431.

Gossan, N. et al (2013): The Circadian Clock in Murine Chondrocytes Regulates Genes Controlling Key Aspects of Cartilage Homeostasis. Arthritis & Rheumatism, 2013: 2334–2345.

Hellwig, N.; Plant, T. D.; Janson, W.; Schäfer, M.; Schultz, G.; Schaefer, M. (2004): TRPV acts as proton channel to induce acidification in nociceptive neurons. J of Biol Chem, 279, 34553–34561.

Jakob, P. (2005): Gutachten zur Validierung der von MedTec angebotenen Geräte. Physikalisches Institut der Universität Würzburg.

Jansen, H.; Frey, S. P.; Paletta, J.; Meffert, R. H. (2011): Effects of low-energy NMR on posttraumatic osteoarthritis: observations in a rabbit model. Archives of orthopaedic and trauma surgery, 131(6), 863–868.

Kimmel, C. B.; Ballard, W. W.; Kimmel, S. R.; Ullmann, B.; Schilling, T. F. (1995): Stages of embryonic development of the zebrafish. Developmental Dynamics, 1995: 253–310.

Krone, W.; Müller-Wieland, D.; Weber, M. (1996): Internistisches Gutachten zur allgemeinen Bewertung der Magnetfeldtherapie zur Vorlage beim Sozialgericht Köln.

Li, Q. F.; Wang, X. R.; Yang, Y. W.; Lin, H. (2006): Hypoxia upregulates hypoxia inducible factor (HIF)-3alpha expression in lung epithelial cells: characterization and comparison with HIF-1alpha. Cell Research, 2006: 548–558.

Miloshevsky, G. V.; Jordan, P. C. (2004): Water and ion permeation in bAQP1 and GlpF channels: A kinetic Monte Carlo study. Biophysical J, 87, 3690–3702.

Pagé, E. L.; Robitaille, G. A.; Pouysségur, J.; Richard, D. E. (2002): Induction of hypoxia-inducible factor-1alpha by transcriptional and translational mechanisms. The journal of biological chemistry, 2002: 48403–48409.

Penta, K.; Sawyer, S. T. (1995): Erythropoietin induces the tyrosine phophorylation, nuclear translocation and DNA binding of STAT1 and STAT5 in erythroid cells. The Journal of Biological Chemistry, 1995: 31282–31287.

Pomes, R.; Roux, B. (2002): Molecular mechanism of H+ conduction in the single-file water chain of the gramicidin channel. Biophysical J, 82, 2304–2316.

Postlethwait, J. H. et al. (1998): Vertebrate genome evolution and the zebrafish gene map. Nature Genetics, 1998: 345–349.

Prosser, R. A.; Gilette, M. A. (1989): The mammalian circadian clock in the suprachiasmatic nuclei is reset in vitro by cAMP. The Journal of Neuroscience, 1989: 1073–1081.

Reiser, H.-P.; Dimpfel, W.; Schober, F. (1995): The influence of magnetic fields on human brain activity. Eur J Med Res, 1, 27–32.

Sancar, A. (2000): Cryptochrome: the second photoactive pigment in the eye and its role in circadian photoreception. Annual review of biochemistry, 2000: 31–67.

Sancar, A. (2003): Structure and Function of DNA Photolyase and Cryptochrome Blue-Light Photoreceptors. Chemical reviews, 2003: 2203–2237.

Skene, D. J.; Arendt, J. (2006): Human circadian rhythms: physiological and therapeutic relevance of light and melatonin. Annals of Clinical Biochemistry, 2006: 344–353.

Spence, R.; Gerlach, G.; Lawrence, C.; Smith, C. (2008): The behaviour and ecology of the zebrafish, Danio rerio. Biological Reviews of the Cambridge Philosophical Society, 2008: 13–34.

Taghva, A.; Silvetz, R.; Ring, A.; Kim, K. A.; Murphy, K. T. et al. (2015): magnetic resonance therapy Improves Clinical Phenotype and EEG Alpha Power in Posttraumatic Stress Disorder. Trauma, 20(4):e27360. doi: 10.5812/traumamon.27360.

Takahashi, J. S.; Hong, H. K.; Ko, C. H.; McDearmon, E. L. (2008): The genetics of mammalian circadian order and disorder: implications for physiology and disease. Review, Nature Genetics Review, 2008, 764–775.

Thorstensson, C. A.; Petersson, I. F.; Jacobson, L. T.; Boegard, T. L.; Roos, E. M. (2004): Reduced functional performance in the lower extremity predicted radiographic knee osteoarthritis five years later. Annals of Rheumatic Diseases, 2004: 402–407.

Thompson, C. L.; Sancar, A. (2002): Photolyase/cryptochrome blue-light photoreceptors use photon energy to repair DNA and reset the circadian clock. Oncogene, 2002: 9043–9056.

Tian, H.; McKnight, S. L.; Russel, D. W. (1997): Endothelial PAS domain protein 1 (EPAS1), a transcription factor selectively expressed in endothelial cells. Genes & development, 1997: 72–82.

Wright, K. P.; Hughes, R. J.; Kronauer, R. E.; Dijk, D. J.; Czeisler, C. A. (2001): Intrinsic near-24-h pacemaker period determines limits of circadian entrainment to a weak synchronizer in humans. Proceedings 41 of the National Acadamy of Sciences of the United States of America, no. 98, 17027–17032.

Yamazaki, S.; Numano, R.; Abe, M.; Hida, R.; Takahasi, R.; Ueda, M.; Block, G. D.; Sakaki, Y.; Menaker, M.; Tei, H. (2000): Resetting central and peripheral circadian oscillators in transgenic rats. Science, 2000: 682–685.

Vitas / Qualifications of the authors

Univ.-Doz. Dr. Werner Kullich

Born March 8, 1956

1974 Studied pharmacy at the University of Innsbruck

1975 Studied biology at the University of Salzburg

Doctorate in Philosophy 1983

Since July 1983 employed as biologist at the Ludwig Boltzmann Institute for Rehabilitation of Internal Diseases; planning and execution of scientific projects, including statistical evaluations in the fields: rehabilitation research, rheumatology, inflammation, cardiovascular risk factors

2 study visits at the Biological Institute of the Austrian Research Centre Seibersdorf, 1984 and 1985

Study visit at the Institute of Immunology of the University of Vienna 1987

Since 1994 lectures on inflammatory mechanisms and messenger substances of the immune system at the University of Salzburg

10.4.2002: Habilitation at the Faculty of Natural Sciences of the University of Salzburg / teaching licence as university lecturer / assistant professor

From 2004 administrative and scientific director of the Ludwig Boltzmann Institute for Rehabilitation of Internal Diseases, Saalfelden, now Department for Rehabilitation of the Cluster for Arthritis and Rehabilitation

335 scientific papers in German and foreign journals

308 lectures at national and international congresses

Years of scientific research on the effects of therapeutic nuclear magnetic resonance and magnetic field therapy on the cellular level and several clinical studies using MBS therapy in patients with musculoskeletal disorders

Reviewer for the following journals:

Hindawi Publishing: Arthritis

Hindawi Publishing: Evidence-Based Complementary and Alternative Medicine

Journal of Physical and Rehabilitation Medicine

Awards/prizes:

Poster Award of the Austrian Rheumaliga, Sauerbrunn, March 1988

Poster Award of the Austrian Rheumatism League, Vienna, December 1988

State Prize for Rheumatism Research of the Federal Ministry of Health and Public Service, Vienna, 1989

Prize of the Dr. Kolassa Foundation for Rheumatism Research, Vienna, 1991

State Prize for Basic Research in the Field of Rheumatology of the Federal Ministry of Science and Research, Vienna, 1992

Prize of the Dr. Kolassa Foundation for Rheumatism Research, Eisenstadt, 1995

State Prize for Rheumatism Research of the Federal Ministry of Health and Consumer Protection, Vienna, 1995

Poster Award of the Society for Physical Medicine and Rehabilitation, Salzburg 1996

Award of the Austrian Society for Internal Medicine for a lecture at the 29th Annual Meeting, Salzburg, 1998

Poster Award of the Austrian Society for Rheumatology, Graz, 1999

Poster Award at the 56th Annual Meeting of the Association of Southern German Orthopaedists, Baden-Baden, 2008

Science Prize 2013 for Pain Research of the Austrian Pain Society, Klagenfurt, 2013

Poster Award at the 21st Scientific Conference of the Austrian Pain Society, Klagenfurt, 2013

Scientific memberships:

Full member of the Austrian Society for Rheumatology and Rehabilitation since 1983

Full member of the Salzburg Natural and Medical Sciences Association since 1990

Full member of the International Society of Pteridinology since 1992

Member of the Medizinische Enzymforschungsgesellschaft e.V., Germany 1993–2005

Member of the Working Group for Rehabilitation of the ÖGR since 1999; Secretary since July 2009

Member of the Advisory Board of the Salzburger Schmerzinstitut since 2001

Member of the working group for music research at the University of Salzburg

Scientific Advisory Board Member of WGFE (Wissenschaftliche Gesellschaft zur Förderung der Enzymtherapie), Germany 2007–2010

Full member of the Association of Southern German Orthopaedists 2008–2010

Member of the Austrian Pain Society since July 2009

Member of the European Pain Federation (EFIC) since July 2009

The author of the clinical evaluation (expert opinion), Mr. Univ.-Doz. Dr. Werner Kullich, head of the Ludwig Boltzmann Department for Rehabilitation of the Cluster for Arthritis and Rehabilitation, Saalfelden, Austria, has no conflict of interest with the contents of this report.

The clinical evaluation was commissioned, evaluated and deemed correct by MedTec Medizintechnik GmbH, Wetzlar, Germany.

Wetzlar, April 16, 2018

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Axel Muntermann
President and Managing Director of MedTec Medizintechnik GmbH

Prof. Dr. habil. med. Christian Melzer

My curriculum vitae with a selection of publications is attached. The scientific lectures and supervised and completed dissertations are not listed. If desired, these can also be presented.

The publications deal with clinical studies using biostatic methods and database research. The principles of medical writing apply. In accordance with the regulatory requirements of MBST magnetic resonance therapy, I contribute to the practical design and implementation of the medical device system.

Since 2003 I have had knowledge in the technique and application of MBST magnetic resonance therapy and know standard therapy procedures and alternative treatment methods through decades of scientific and clinical work. Further details can be found in the curriculum's career history.

The author of the clinical evaluation (expert opinion), Prof. Dr. habil. med. Christian Melzer, has no conflict of interest with the contents of this report.

The clinical evaluation was commissioned, evaluated and deemed correct by MedTec Medizintechnik GmbH, Wetzlar, Germany.

Wetzlar, April 16, 2018

……

Axel Muntermann
President and Managing Director of MedTec Medizintechnik GmbH

Curriculum vitae

Prof. Dr. habil. Med. Christian Melzer

Position: Former Medical Director of the MediClin Hospital for Orthopaedics in Bad Düben (near Leipzig)

Treatment spectrum/special trainings:

Treatment of orthopaedic diseases, trauma surgery, modern osteosynthesis procedures, hand surgery, foot surgery, sports injuries, treatment of cartilage damage including cartilage cell transplantation, orthopaedic rheumatology, spinal diseases, paediatric orthopaedics, minimally invasive surgery in the area of spine and in the implantation of endoprostheses, arthroscopic surgery of all joints, endoprosthetics of all joints, treatment of tumors

Study:

1971 - 1978 Study of medicine and two semesters of psychology at the Johannes-Gutenberg-University Mainz

Clinical/scientific background:

1978 – 1980 General surgical assistant at the Paulinenstift in Wiesbaden with Dr. R. Barthel and Prof. Dr. R. Loth

1980 – 1986 Orthopaedic assistant physician at the Hannover Medical School with Prof. Dr. H. J. Refior

1981 Doctorate (Dr. med.) at the Johannes Gutenberg University in Mainz on the topic: Excretion of N-acetyl-tryptophane in liver insufficiency; detection by one-dimensional thin-film chromatography

1983 Acceptance as orthopaedic specialist

1986	Acceptance as instructor for orthopaedic sonography by the German Society for Orthopaedics and Traumatology
1986	Appointed as senior physician
18.12.1987	Qualification as Hygiene Officer Physician
1988	Establishment of a consultation-hour for shoulder complaints in Hanover
1989	Change from Hanover to Gießen to the Orthopaedic Clinic of the Justus-Liebig-University with further activities as senior physician
1989	Establishment of a consultation-hour for shoulder complaints in Giessen
1990 – 1998	Consultant at the Paediatric Clinic of the Justus-Liebig-University Giessen
1991 – 1998	Consultant at the Giessen Paediatric Centre and co-founder of an interdisciplinary paediatric-orthopaedic consultation for children with spina bifida and hydrocephalus at the Justus-Liebig-University Giessen Clinic
1992	Acceptance as seminar leader for the training in the sonographic diagnostics of the postural and locomotor apparatus by the German Society for Ultrasound in Medicine
22.05.1992	Qualification for Sports Medicine.
1993	Habilitation in orthopaedics
1995 – 1998	Senior Physician and Deputy Clinic Director of the Orthopaedic Clinic of the Justus-Liebig-University Giessen
05.05.1995	Qualification for Chiropractic Therapy
28.08.1995	Facultative further education "Special Orthopaedic Surgery
02.01.1998	Qualification for Physical Therapy
since 1999	Medical Director and Chief Physician of the Orthopaedic Hospital Bad Düben - Waldkrankenhaus
15.03.1999	Full authorization for further education in the field of orthopaedics (4 years)
14.04.1999	Specialization Rheumatology
since May 1999	Expert of the arbitration board of the Saxon State Medical Association and the North German Medical Chambers in Hanover
15.07.1999	Member of the examination board Orthopaedics/Rheumatology of the Saxon State Medical Association.
23.09.1999	Full authorization as supervisor for further education in rheumatology (2 years)
16.02.2000	Authorization as supervisor for further education in physical therapy (1 year)

15.05.2000	Authorization as supervisor for the facultative further training Special orthopaedic surgery in its entirety (2 years)
05.09.2001	Appointment as Associate Professor at the Justus-Liebig-University Giessen
16.12.2002	Qualification Radiation Protection
30.05.2006	Specialist for Orthopaedics and Trauma Surgery
07.07.2006	Authorization as supervisor for further training in orthopaedics and trauma surgery (4 years)
12.09.2006	Qualification Paediatric Orthopaedics
22.09.2006	Member of the examination board for paediatric orthopaedics of the Saxon State Medical Association
since 2007	Member of the quality committee for orthopaedics/accident surgery at the Saxon State Medical Association

Societies:

Deutsche Gesellschaft für Orthopädie und Orthopädische Chirurgie [German Society of Orthopaedics and Orthopaedic Surgery] (DGOOC)

Deutsche Gesellschaft für Unfallchirurgie [German Society for Trauma Surgery] (DGU)

Berufsverband der Fachärzte für Orthopädie und Unfallchirurgie [Professional Association of Specialists in Orthopaedics and Trauma Surgery]

Deutsche Vereinigung für Schulter- und Ellenbogenchirurgie [German Association for Shoulder and Elbow Surgery] (DVSE; Member of the Founding Board)

Deutsche Gesellschaft für Ultraschall in der Medizin [German Society for Ultrasound in Medicine] (DEGUM)

Vereinigung für Kinderorthopädie [Association for paediatric orthopaedics]

Deutsche Arbeitsgemeinschaft für Fußchirurgie [German Foot Surgery Association] (DAF)

Gesellschaft für Orthopädisch-Traumatologische Sportmedizin [Society for Orthopaedic Traumatological Sports Medicine] (GOTS)

German Society for Sports Medicine [Deutsche Gesellschaft für Sportmedizin] (DGS)

Rheumatism Centre at Leipzig University Hospital [Rheumazentrum am Universitätsklinikum Leipzig]

Association of South German Orthopaedic Surgeons [Vereinigung Süddeutscher Orthopäden] (VSO)

North German Orthopaedic Association [Norddeutsche Orthopäden-Vereinigung] (NOV)

Publications:

1) Melzer, Ch., Vent, J.:
Vergleichende prospektive Untersuchungen zu Nebenwirkungen von DIMERX$_R$ und AMIPAQUE$_R$ bei Myelographie.
Z.Orthop. 121 (1983), 497

2) Melzer, Ch, Refior, H. J.:
Makroskopische und mikroskopische Autopsiebefunde an der Rotatorenmanschatte. Eine Untersuchung an 100 Schultergelenken.
Hefte zur Unfallheilkunde 163 (1984), 202–203

3) Melzer, Ch., Refior, H. J.:
Makroskopische und mikroskopische Untersuchungen an der Rotatorenmanschette.
In: Chapchal, G. (Hrsg.) Verletzungen und Erkrankungen der Schulterregion.
Thieme, Stuttgart, New York 1984, 68

4) Melzer, Ch., Refior, H. J.:
Biomechnische und pathomechanische Grundlagen der fibularen Bandläsionen im Wachstumsalter
In: Hackenbroch, M. H., Refior, H. J., Jäger, M., Plitz, W. (Hrsg.) Funktionelle Anatomie und Pathomechnik des Sprunggelenkes.
Thieme, Stuttgart, New York 1984, 111–114

5) Melzer, Ch., Refior, H. J.:
Fibulare Bandläsionen im Kindesalter.
Orthop. Praxis 9 (1985), 722–728

6) Refior, H. J., Melzer, Ch.:
Pathologie und Pathomechanik der Rotatorenmanschette.
In: Refior, H. J., Plitz, W., Jäger, M., Hackenbroch, M. H. (Hrsg.) Biomechanik der gesunden und kranken Schulter.
Thieme, Stuttgart, New York 1985, 132–136

7) Melzer, Ch., Refior, H. J.:
Radiologische differenzierte Diagnostik der Periarthropathia humero-scapularis.
In: Czurda, R., Klare, G., Schwägerl, W. (Hrsg.) Schmerzsyndrom der oberen Extremität.
Buchreihe für Orthopädie und orthopädische Grenzgebiete 13 (1986), 57–61

8) Refior, H. J., Melzer, Ch.:
Pathologie der Rotatorenmanschette.
In: Czurda, R., Klare, G., Schwägerl, W. (Hrsg.) Schmerzsyndrom der oberen Extremität.
Buchreihe für Orthopädie und orthopädische Grenzgebiete 13 (1986), 97–101

9) Melzer, Ch., Krödel, A.:
Langzeitergebnisse nach operativer Behandlung der rezidivierenden Schulterluxationen in der Technik nach Eden-Hybinette-Lange.
Unfallchirurg (1986), 375–379

10) Melzer, Ch, Krödel, A., Refior, H. J.:
Klinische und röntgenologische Spätergebnisse nach operativer Behandlung der habituellen Schulterluxation in der Technik nach M. Lange.
Z. Orthop. 124 (1986), 703–706

11) Melzer, Ch., Refior, H. J.:
Die Retentionsbehandlung der instabilen Luxationshüfte im Fettweisgips.
In: Chapchal, G. (Hrsg) Kongenitale Dysplasien und Defekte der unteren Extremitäten.
Thieme, Stuttgart 1986, 48–49

12) Krödel, A., Melzer, Ch.:
Langzeitergebnisse nach operativer Versorgung der habituellen Schulterluxation in der Technik nach Edin-Hybinette-Lange.
In: Blauth, W., Ulrich, H.-W. (Hrsg.) Spätergebnisse in der Orthopädie.
Springer, Berlin, Heidelberg, New York, London, Paris, Tokyo 1986, 39–41

13) Melzer, Ch., Krödel, A., Refior, H. J.:
Der Wert der Arthrographie in der Diagnostik traumatischer und degenerativer Veränderungen der periartikulären Strukturen des Schultergelenkes.
Unfallchirurg 89 (1986), 243–247

14) Melzer, Ch., Stürz, H.:
Zur operativen Technik chondraler und osteochondraler Ausrisse des fibularen Bandapparates im Wachstumsalter.
Unfallchirurg 90 (1987), 456–465

15) Melzer, Ch., Carl, Ch.:
Sonographische Diagnostik des Säuglingshüftgelenkes.
Münch. med. Wschr. 129 (1987), 793–795

16) Melzer, Ch., Stürz, H., Refior, H. J.:
Sportbedingte osteochondrale Ausrisse des fibularen Bandapparates im Kindesalter.
Hefte zur Unfallheilkunde 189 (1987), 1026–1929

17) Refior, H. J., Krödel, A., Melzer, C.:
Examinations of the Pathology of the Rotator Cuff.
Arch. Orthop. Trauma Surg. 106 (1987), 301–308

18) Refior, H. J., Melzer, Ch.:
Läsionen der langen Bizepssehne – Diagnostik und Therapie.
Praktische Sport-Traumatologie und Sportmedizin 4 (1987), 42–47

19) Melzer, Ch., Stürz, H., Refior, H. J.:
Sportbedingte osteochondrale Ausrisse des fibularen Bandapparates im Kindesalter.
Unfallchirurg (1987), 1026–1029

20) Melzer, Ch., Refior, H. J.:
Die Behandlung der instabilen Luxationshüfte im Säuglings- und Kleinkindesalter nach einer modifizierten FETTWEISS-Methode
Z.Orthop. 126 (1988), 195–199

21) Melzer, Ch., Krödel, A.:
Sonographische Beurteilung der Rotatorenmanschette nach Rekonstruktion kompletter Rupturen.
Fortschr. Röntgenstr. 149 (1988), 408–413

22) Melzer, Ch., Sauer, B., Enenkel, Th.:
Sonographische Diagnostik der periartikulären Strukturen des Schultergelenkes.
Ultraschall Klin. Prax. 3 (1988), 173–179

23) Krödel, A., Melzer, Ch.:
Die Wertigkeit heterologener Knochentransplantate in der operativen Therapie der habituellen Schulterluxation.
Z.Orthop. 126 (1988), 79–84

24) Melzer, Ch.:
Diagnostik und Therapie der Tendinosis calcarea.
In: Resch, H. I., Spermer, G., Beck, E. (Hrsg.), Verletzungen und Erkrankungen des Schultergelenkes.
Hefte zur Unfallheilkunde 206 (1989), 64–68

25) Melzer, Ch.:
Nutzen und Gefahren der Sonographie des Säuglingshüftgelenkes.
Kritische Analyse von 3 Beobachtungen mit Hüftgelenksdysplasie und Hüftgelenksluxation trotz vorausgegangener sonographischer Diagnostik.
pädiat. prax. 38 (1989), 101–109

26) Melzer, Ch., Manz, P., Krödel, A., Stürz. H.:
Operative Therapy for Recurrent Shoulder Dislocation with Special Regard to longterm Clinical und Radiological Results Using M. Lange Technique.
Arch. Orthop. Trauma Surg. 108 (1989), 107–111

27) Melzer, Ch.:
Stellungnahme zu dem Beitrag Hüftscreening bei Neugeborenen
Z.Orthop. 127 (1989), 265–266

28) Melzer, Ch., Refior, H. J.:
Modifikation of Fettweis Method for Treatment of Unstable Hip Dislocations in Infancy and Early Childhood.
Orthopedics/Rheumatology Digest 4 (1989), 25–26

29) Melzer, Ch., Wirth, C. J.:
Komplette Rotatoerenmanschetten-Läsionen bei Sportlern.
Sportverletzung Sportschäden 3 (1989), 81–87

30) Melzer, Ch., Busche, Th.:
Hüftendoprothesenlockerung unter dem Bild einer Appendizitis.
Chir.praxis 40 (1989), 611–614

31) Melzer, C., Kohn, D., Lazovic, D., Wirth, C. J.:
Stellenwert der Sonographie, Arthrographie und Arthroskopie in der Diagnostik der Schultererkrankungen.
Arthroskopie 2 (1989), 128–133

32) Melzer, Ch.:
Verringert ein sonographisches Hüft-Screening die Zahl der spät erkannten Hüftgelenksdysplasien?
Niedersächs. Ärzteblatt 19 (1989), 19–22

33) Melzer, Ch:
Diagnostik und Therapie der Tendinosis calcarea.
In: Resch, H., Spermer, G., Beck, E. (Hrsg.), Verletzungen und Erkrankungen des Schultergelenkes.
Hefte zur Unfallheilkunde 206 (1989), 64–68

34) Melzer, C., Wülker, N.:
Potential mistakes in hip joint sonography.
Arch. Orthop. Trauma Surg. 109 (1990), 126–130

35) Melzer, Ch.:
Ist der Aufwand eines sonographischen Neugeborenen-Hüftscreenings gerechtfertigt?
gynäkol prax. 14 (1990), 253–258

36) Melzer, Ch., Stürz, H.:
Klassifikation fibularer Bandläsionen im Wachstumsalter.
In: Rahmanzadeh, R., Breyer, H.-G. (Hrsg.): Verletzungen der unteren Extremitäten bei Kindern und Jugendlichen.
Springer 1990, 320–323

37) Melzer, Ch., Krödel, A.:
Ergebnisse nach operativ versorgten Rotatorenmanschettenrupturen.
In: Hedtmann, A. (Hrsg.): Degenerative Schultererkrankungen.
Enke, Stuttgart 1990, 106–108

38) Wirth, C. J., Kohn, D., Melzer, Ch., Markl, A.:
Wertigkeit diagnostischer Maßnahmen bei Weichteilerkrankungen und Weichteilschäden des Schultergelenks.
Unfallchirurg 93 (1990), 339–345

39) Gosse, F., Melzer, Ch., Wirth, C. J.:
Sportbedingte osteochondrale Ausrisse des fibularen Bandapparates bei Kindern.
Hefte zur Unfallheilkunde (1990)

40) Melzer, Ch., Wülker, N.:
Indikation zur Rekonstruktion bei sportspezifischen kompletten und inkompletten Läsionen der Schulterrotatorenmanschette.
Hefte zur Unfallheilkunde 212 (1990), 321–322

41) Melzer, Ch., Stürz, H.:
Klassifikation fibularer Bandläsionen im Wachstumsalter.
In: Rahmanzadeh, R., Breyer, H.-G. (Hrsg.), Verletzungen der unteren Extremitäten bei Kindern und Jugendlichen.
Springer, Berlin 1990, 320–323

42) Melzer, Ch., Krödel, A.:
Ergebnisse nach operativ versorgten kompletten Rotatorenmanschettenrupturen.
In: Hedtmann, A. (Hrsg.), Degenerative Schultererkrankungen.
Enke, Stuttgart 1990, 106–108

43) v. d. Boom, H., Melzer, Ch.:
Operative Behandlung der idiopathischen Hüftkopfnekrose.
In: Stuhler, Th. (Hrsg.), Hüftkopfnekrose.
Springer, Berlin, Heidelberg 1991, 459–464

44) Melzer, Ch., Stürz, H., Sniezynski, R.:
Langzeit-Ergebnisse nach offener Einstellung der sog. angeborenen Hüftluxation.
Orthop. Prax. (1991), 361–365

45) Wülker, N., Melzer, Ch., Wirth, C. J.:
Shoulder surgery for rotator cuff tears.
Acta Orthop. Scand. 62 (1991), 142–147

46) Melzer, Ch.:
Das sonographische Korrelat der Sehnendegeneration.
Ultraschall Klin. Prax 6 (1991), 160

47) Melzer, Ch., Ludwig, F. J.:
Morphologische Grundlagen der Säuglings-Hüft-Sonographie.
Ultraschall Klin. Prax. 6 (1991), 230

48) Melzer, Ch.:
Untersuchungen zur Winkel- und Linientreue bei der Anwendung von Linear- und Sektorappliktionen am Säuglings-Hüftgelenk
Ultraschall Klin. Prax. 6 (1991), 242

49) Melzer, Ch, v. d. Boom, H., Manz, P.:
Operative treatment of femoral head necrosis.
Arch. Orthop. Trauma Surg. 111 (1992), 85–90

50) Melzer, Ch.:
Tendinosis calcarea.
In: Kohn, D. M., Wirth, C. J. Hrsg.): Die Schulter – Aktuelle operative Therapie.
Thieme, Stuttgart 1992, 65–69

51) Melzer, Ch., Finkewitz, U., Wirth, C. J.:
Comparative sono-morpholical investigations of periarticular structures of the shoulder joint – an experimental study.
J. Bone Joint Surg. (Br.) 74. B, Supp. I (1992), 20–21

52) Melzer, Ch.:
Morphologische Grundlagen der Säuglings-Hüft-Sonographie.
In: Anderegg, A., Despland, P., Henner, H., Otto, R. (Hrsg)
Ultraschalldiagnostik 91 (1992), 264–267

53) Melzer, Ch., Finkewitz, U., Wirth, C.J.:
Comperative sono morphological investigations of periarticular structures of the shoulder joint – an experimental study.
J. Bone Joint Surg. 74, B, Suppl. I (1992), 20–21

54) Wülker, N., Wirth, C.J., Melzer, Ch:
Klinische und sonographische Ergebnisse nach Rekonstruktion von Rotatorenmanschettenrupturen.
Orthop. Prax. 28 (1992), 556–560

55) Melzer, Ch.:
Besteht ein Zusammenhang zwischen dem sonographischen und röntgenologischen Bild des Säuglingshüftgelenkes?
Ultraschall Klin. Prax. 7 (1992), 137

56) Melzer, Ch.:
Ultraschalldiagnostik.
In: Jäger, M., Wirth, C. J. (Hrsg.): Praxis der Orthopädie, 2. Aufl.
Thieme, Stuttgart 1992

57) Melzer, Ch.:
Morphologische Grundlagen der Säuglings-Hüftsonographie.
In: Anderegg, A., Despland, P., Henner, H., Otto, R. (Hrsg.)
Ultraschalldiagnostik 91 (1992), 264–267

58) Melzer, Ch., Fingewitz, U.:
Vergleichende sonomorphologische Untersuchungen der periartikulären Strukturen des Schultergelenkes. Eine experimentelle Studie.
Ultraschall Klin. Prax. 8 (1993), 83–87

59) Melzer, Ch.:
Das zentrale echogene Band bei der Schulter-Sonographie – Ein Artefakt-Phänomen?
Ultraschall Klin. Prax. 8 (1993), 195

60) Melzer, Ch.:
Röntgenbild – Sonographie – Anatomie (Ein Vergleich).
In: SGUMB, Arbeitsgruppe Bewegungsapparat und SVUPP (Hrsg.): Angeborene Hüftdysplasie und Luxation vom Neugeborenen bis zum Erwachsenen.
Schilt u. Lüdin, Luzern Muttenz 1993, 69–77

61) Melzer, Ch., Sniezynski, R.:
Langzeitergebnisse der offenen Reposition der angeborenen Hüftluxationen.
Thieme Copythek, Stuttgart, New York 1993

62) Melzer, Ch.:
Problem: Knochenblock – Stabilisation.
In: Jerosch, J., Steinbeck, J.: Aktuelle Konzepte der Diagnostik und Therapie des instabilen Schultergelenkes.
Shaker, Aachen 1994, 199–213

63) Melzer, Ch., Möhring, B., Bachmann, G.:
Anatomische Großflächenschnitte des Schultergelenkes im Vergleich mit der Sonographie und Kernspinromographie.
Bildgebung 61, Supp. 2 (1994), 40

64) Melzer, Ch.:
Die Bedeutung der Ossifikationsvorgänge des Säuglingshüftgelenkes für die sonographische Diagnostik.
Bildgebung 61, Supp. 2 (1994), 37

65) Melzer, Ch.:
Besteht ein Zusammenhang zwischen dem sonographischen und röntgenologischen Bild des Säuglingshüftgelenkes?
Ultraschall Klin. Prax. 8 (1994), 253–257

66) Melzer, Ch., Radtke, V.:
Wie effizient ist die sonographische Vorsorgeuntersuchung des Säuglinshüftgelenkes? Erhebungen im Bundesland Hessen.
Hessisches Ärzteblatt 55 (1994), 141–144

67) Melzer, Ch.:
Behandlung der Schulterinstabilität durch Knochenblock-Verfahren.
In: Jerosch, J., Steinbeck, J. (Hrsg.): Aktuelle Konzepte der Diagnostik und Therapie des instabilen Schultergelenkes.
Shaker, Aachen 1994

68) Melzer, Ch., Wallny, T., Wirth, C. J., Hoffmann, S.:
Frozen shoulder-treatment and results.
Arch. Orthop.Trauma Surg. 114 (1995), 79–82

69) Melzer, Ch.:
Artefakte bei der Schultersonographie.
In: Graf, R., Schulter, P. (Hrsg.): Sonographie am Stütz- und Bewegungsapparat bei Erwachsenen und Kindern. 2. Aufl.
Chapman & Hall 1995, 81–93

70) Melzer, Ch.:
Ergebnisse der kombinierten Eingriffe am Pfannendach und proximalen Femur in der Dysplasiebehandlung.
In: Stücker, R., Reichelt, A. (Hrsg.): Die kindliche Hüfte.
Sympomed, München 1995, 44–50

71) Michaelis, G., Melzer, Ch., Biscoping, J., Hempelmann, G.:
Maschinelle Autologe Transfusion (MAT) während orthopädischer Eingriffe bei Kindern.
Anästhesist 44 (1995), 501–507

72) Melzer, Ch.:
Der Oberarmkopfbruch beim alten Menschen.
Akt. Traumatologie 25 (1995), 136–142

73) Melzer, Ch.:
Das Phänomen des Erkerdefizites im sonographischen Bild des Säuglingshüftgelenkes.
Ultraschall 16 (1995), 8

74) Melzer, Ch., Sauer, A., Langenbach, M.:
Sonographische Therapie-Kontrollen im Vergleich zweier unterschiedlicher Abspreiz-Behandlungsmethoden.
Ultraschall 17 (1996), 34

75) Melzer, Ch., Bader, D.:
Periostlappen-Plastik bei chronischer fibularer Kapselbandinstabilität.
In: Süssenbach, F., Maaz, B., Gierse, H., Bergmann, E.G. (Hrsg.): Das obere Sprunggelenk – angeborene und erworbene Schäden.
ecomed, Landsberg 1996, 212–221

76) Melzer, Ch., Sauer, B., Langenbach, M.:
Sonographische Therapie-Kontrolle im Vergleich zweier unterschiedlicher Abspreiz-Behandlungsmethoden.
Ultraschall 17 (1996), 34

77) Backofen, D., Melzer, Ch., Ludwig, F.-J.:
Radiologische Nachuntersuchungen der Spotorno-Femurkomponente.
Akt. Traumatol. 26 (1996), 156–166

78) Ludwig, F.-J., Melzer, Ch., Backofen, D.:
Kriterien zur radiologischen Beurteilung zementfreier Hüftendoprothesen am Beispiel des Spotorno-Schafts.
Unfallchirurg 99 (1996), 750–757

79) Melzer, Ch.:
Korrelation Sono und Röntgen.
Orthopäde 26 (1997), 43–48

80) Bachmann, G. F., Melzer, Ch., Heinrichs, C. M., Möhring, B., Rominger, M. B.:
Diagnosis of rotator cuff lesions: comparison of US and MRT on 38 joint specimens.
Eur. Radiol. 7 (1997), 192–197

81) Krieger, E., Melzer, Ch.:
Orthopädie.
In: G. Kühl, D. Siepmann, H. Sobotta, J. Bauer, K. Fischer (Hrsg.), Klinikleitfaden Kinderkrankenpflege.
G. Fischer, Lübeck 1997

82) Wallny, T., Melzer, Ch., Wagner, U., Wirth, C. J., Schmitt, O.:
Die „primäre“ Schultersteife: Krankheitsdauer und Therapievergleich.
Z.Orthop. 135 (1997), 222–227

83) Melzer, Ch.:
Liegen der sonographischen und Röntgen-Diagnostik des Säuglingshüftgelenkes unterschiedliche Normwerte zugrunde?
Ultraschall in Med. 18 Suppl. (1997), 53–54

84) Melzer, Ch.:
Ist die senkrechte Kontur des Os ilium Bedingung für den Hüfttyp I des Säuglingshüftgelenkes?
Ultraschall in Med. 19 (1998), 37

85) Günther, K. P., Stoll, S., Schmitz, A., Niethard, F.U., Altenhofen, L., Melzer, Ch., Kries, v. R.:
Erste Ergebnisse aus der Evaluationsstudie des sonographischen Hüftscreenings in der Bundesrepublik Deutschland.
Z. Orthop. 136 (1998), 508–512

86) Melzer, Ch.:
Korrelation zwischen Sonografie und Röntgenbild.
In: Konermann, W., Gruber, G., Tschauner, C. (Hrsg.), Die Hüftreifungsstörung.
Steinkopf, Darmstadt 1999

87) Melzer, Ch.:
Langzeitergebnisse nach offenen Repositionsverfahren.
In: Konermann, W., Gruber, G., Tschauner, C. (Hrsg.), Die Hüftreifungsstörung.
Steinkopf, Darmstadt 1999

88) Schleicher, I., Melzer, Ch., Haas, H., Kordelle, J.:
Die Behandlung des kongenitalen Klumpfußes.
Orthopädie-Technik 5 (2001), 318–325

89) Ludwig, F.-J., Melzer, Ch., Grimmig, H., Daalmann, H. H.:
Kulturelle Adaptation des Lequesne-Index für Hüft- und Kniegelenkserkrankungen im deutschen Sprachraum.
Rehabilitation 41 (2002), 249–257

90) Grimmig, H., Melzer, C., Ludwig, F.-J., Daalmann, H. H.:
Der routinemäßige Einsatz der Lequesne-Index zur Ergebnismessung in der orthopädischen Rehabilitation bei Hüft- und Knieerkrankungen.
Z. Orthop: 140 (2002), 452–459

91) Heyde, C. E., Gosse, A., Müller, G., Melzer, Ch.:
Eine arthroskopisch gestützte Technik zur bikortikalen Refixation bei Ausrissen der Eminentia intercondylica.
Arthroskopie 15 (2002), 79–82

92) Auerbach, B., Melzer, Ch.:
Die Behandlung der Gonarthrose mit hochvernetzter Hyaluronsäure – Ergebnisse einer prospektiven randomisierten Studie.
Zentralblatt für Chirurgie 127 (2002), 895–899

93) Melzer, Ch.:
Radiologische Diagnostik.
In: Wirth, C. J., Zichner, L. (Hrsg.): Orthopädie und Orthopädische Chirurgie, Band Schulter (Hrsg. Gohlke, F., Hedtmann, A.)
Thieme, Stuttgart, New York 2002

94) Melzer, Ch., Werner, A.:
Proximale Humerusfrakturen beim Erwachsenen.
In: Wirth, C. J., Zichner, L. (Hrsg.): Orthopädie und Orthopädische Chirurgie, Band Schulter (Hrsg. Gohlke, F., Hedtmann, A.)
Thieme, Stuttgart, New York 2002

95) Wuisman, P., Melzer Ch.:
Tumoren des Schultergürtels und des Schultergelenkes.
In: Wirth, C. J., Zichner, L. (Hrsg.): Orthopädie und Orthopädische Chirurgie, Band Schulter (Hrsg. Gohlke, F., Hedtmann, A.)
Thieme, Stuttgart, New York 2002

96) Melzer, Ch.:
Klumpfuß.
In: Döhler, J. R. (Hrsg.): Lexikon Orthopädische Chirurgie.
Springer, Berlin, Heidelberg 2002, 97–99

97) Heyde, C.-E., Kayser, R., Jungmichel, D., Melzer, Ch.:
Die Grenzen der Sonographie in der Diagnostik der Achillessehnenruptur im Muskelsehnenübergang anhand einer Kasuistik.
Sportverletzung Sportschäden 17 (2003), 39–43

98) Schleicher, I., Kordelle, J., Jürgensen, I., Haas, H., Melzer, Ch.:
Die Schenkelhalsfraktur bei alten Menschen – Bipolare Hemiendoprothese vs. Totalendoprothese.
Unfallchirurg 6 (2003), 467–447

99) Kilian, U., Melzer, Ch.:
Pyoderma gangraenosum.
Arthroskopie 17 (2004), 100–103

100) Auerbach, B., Heyde, C. E., Melzer, Ch.:
Chronischer Leistenschmerz beim Marathonläufer: Knochenapposition am Ansatz des M. rectus abdominis am Ramus superior ossis pubis – eine Kasuistik.
Sportverletzung Sportschäden 19 (2005), 94–97

101) Ludwig, F.-J., Ünlü, A. I., Melzer, C., Daalmann, H. H.:
Effekte der stationären medizinischen Rehabilitation bei Rückenschmerzpatienten
Z.Orthop. 144 (2006), 569–576

102) Rödiger, A., Melzer C.:
Results of a 10-year follow-up after implantation of the BICON-PLUS cup
In: Friedrich, N. F., Santore, R. F. (Hrsg.): 25 Years of Biologic Fixation K. Zweymüller
Urban & Fischer, München, Jena 2007