



A new concept of integrated holistic approach in treatment of chronic musculoskeletal diseases

The “BAR” method

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INTRODUCTION

Chronic skeletal diseases, among which Osteoarthritis and Osteoporosis are most common, represent one of the biggest public health issues of our civilization. The complications associated with these diseases are big financial burden not only for the patient and their family but for the whole society. Despite this, skeletal diseases were ignored for many years and considered as a consequence of natural aging. The therapy was only partial and symptomatic and prevention was neglected. Unfortunately, even today the situation has not changed much. After certain increase of interest for osteoporosis initiated mostly by pharmaceutical industry, during the nineties of the last century and at the beginning of this century, recently the interest is losing again partly due to disappointment in the effects of drugs. Additionally, significant scientific activities done in last twenty years, confirm that osteoporosis is much more complex problem than that was previously thought, which on certain way discourage industry to invest more in that field.

Regarding osteoarthritis, nothing has really changed for years. The opinion that there is not more can be done then symptomatic and temporally treatment, because we cannot regenerate cartilage, still dominate. So, different methods of physical therapy and implantation of the prosthesis in severe cases are still the most common therapeutic option. Such a clinical practice to bone and joint diseases is mostly due to lack of basic education about the physiology of the skeleton and biological mechanisms that affect the skeleton. Until recently the skeleton was not even considered an organ, so it is not surprising that there is still no specialization in clinical medicine to deal with musculoskeletal disease. Orthopedics, physical medicine, rheumatology, nephrology and endocrinology only deal with parts of this large and complex organ, so it is no wonder that the clinical approach is only partial. The most probably, it is due to the fact that in skeletal disease symptoms occur late and early changes cannot be detected by the standard diagnostic methods. Thus, in osteoarthritis, the pain that is the most common reason for a first visit to doctor, occurs when the cartilage is already so damaged that the functional ability of the joint has decreased. Since cartilage has no nerves, there is no pain or other symptoms until an inflammatory reaction of soft tissue in the joint occurs due to an overload. Therefore, in most cases the diagnosis of osteoarthritis is set at the occurrence of

complications and not in the beginning of the disease. Since the physical therapy and medication could not affect the cause of the disease or restore the normal function of the joint, the treatment was only symptomatic and temporary. Very often gradual deterioration would occur and the surgical implantation of endo-prosthesis would be left as the only solution. But neither this resolves the problem. In the best case, the function of some joints would be improved, but in vast majority the damage affects the whole skeleton, therefore the surgery cannot be the final solution, and cannot cure the patient.

Regarding osteoporosis, the clinical approach is mostly limited to pharmacological therapy which cannot rebuild the bone, and in the most of patients cannot show long term effects. In addition, the drugs have side effects, some of which cannot be predicted or detected, so it is possible that long-term use of drugs rather than improve, worsen the quality of the bone and result in severe fractures. Furthermore, most patients with osteoporosis have a certain degree of osteoarthritis, thus the reduced functional capacity of the skeleton is a consequence of the joint effect of various etio-pathogenetic factors and therefore drugs are not be able to reduce the problem.

Hence, a logical question arises. Why is it that despite the progress in the understanding of biological mechanisms that affect the skeleton and the introduction of new technologies and methods, there is no significant improvement of treatment of the chronic skeletal diseases, as is the case in some other areas of medicine? Why there is still missing a substantially program of prevention by which we will be able to significantly reduce the serious consequences and the costs of treatment, as is achieved for example in the treatment of hypertension, dyslipidemia, diabetes and malignant diseases?

The most probably the answer is the fact that the necessary changes in the approach and concept of treatment must be made. The skeleton is not just a collection of bones and joints, then complex organ with multiple functions, metabolic and bio-mechanic, which are linked in whole. Therefore, changes in one part of the skeleton are transmitted to the whole skeleton. For example, knee osteoarthritis is not only knee disease, because it leads to significant disturbance of bio-mechanics and thus overload of the other joints with consecutive osteoarthritis in these joints. Therefore, possible knee replacement cannot solve the problem as a whole. It will reduce pain in operated knee, but not correct completely bio-mechanics and cure the patient in generally. Less known fact is that due to the disturbed bio-mechanical balance, which is a result of osteoarthritis, the bone quality deteriorates and the risk of fractures increases. In such cases, because of the calcifications that follow osteoarthritis, often we will not find low mineral density on the bone densitometry and we will not recognize osteoporosis, although that is the case. After all, it is well known that in almost 50% of minor trauma fractures, that are a sure sign

of poor bone quality, meaning osteoporosis, we have normal results of bone densitometry.

So, there is plenty of evidence which suggest that something must be changed in the approach to chronic bone and joint diseases. Fortunately, in recent years, driven by an increasing interest from industry and better funding of research, there is a major breakthrough in understanding the biology of skeleton. Also there was a significant increase in the treatment options with the introduction of new drugs and technologies. Now it is up to clinicians and the whole society to take the new scientific knowledge and technological possibilities and apply them into clinical practice.

THE “BAR” METHOD – A NEW CONCEPT IN THE TREATMENT OF CHRONIC OSTEOARTICULAR DISEASES

Why do we need a new concept of treatment?

Based on scientific studies and clinical experience, we can say the following:

1. Skeleton is a complex organ which must be consider as a whole. It consists of a number of bones and joints and at least three types of tissues: bone, cartilage and muscle-fibrotic tissue.
2. Skeleton is affected by many factors which can be divided into genetic, bio-mechanical and metabolic. Since the structure of the bone is constantly changing through a process of bone remodeling we can say that bone structure and quality is the result of all of these factors.
3. Function of the skeleton as a whole depends on the structure and quality of all its parts. Therefore it is always necessary to implement integrated treatment for the skeleton as a whole.
4. Diagnostic methods that we have available cannot accurately determine the condition of the skeleton. Therefore it is necessary to make an assessment of the condition with a combination of several methods to predict the risks and dynamics and on these bases plan the treatment. This requires good knowledge about the biology of the skeleton and possibilities of the diagnostic and therapeutic methods. It is important to improve the education of physicians in this area since it is deficient.
5. Since it is not possible for the same therapeutic agent or drug to act on all parts of the skeleton, it is necessary to implement a combination of several methods when conducting the treatment.
6. The common clinical practice to the treatment of chronic bone and joint disease does not yield satisfactory results and does not accept any of the above facts. Therefore it is necessary to change the approach and introduce a new concept.

What requirements must the new concept of treatment meet?

1. Take into consideration everything that has been confirmed so far through scientific studies and clinical experience.
2. Introduce the new methods and technologies which will respect individual differences of patients and thus act on improving the bio-mechanics, metabolic balance, mobility and initiate tissue regeneration processes, as much as possible.

What is the “BAR” method?

“BAR” stands for: B – biomechanics A – analgesia R – regeneration. It is an integrated, holistic approach to the treatment using a combination of methods to improve the “bio-mechanics” and to provide a good and regular bio-mechanical stimulus for the bones. It relieves the pain and improves mobility. It also stimulates the regeneration of cartilage and bone formation.

We can improve bio-mechanics through the use of appropriate daily exercise (“Tae do”). Correction of bio-mechanical balance is achieved with the usage of Iso-kinetic dynamometry and digital podometry.

Treatment of pain in general is the treatment of the skeleton as a whole, because the pain is only a signal indicating chronic lesions. Therefore, measures that improve the bio-mechanics and encourage the regeneration of cartilage can reduce pain as well. But, since these effects take time, sometimes certain additional procedures need to be implemented in the cases where the patient suffers from severe pain. For this we can use a variety of methods and drugs (NSAR, analgesics), physical therapy and surgical treatment. It is important however to emphasize that these measures will have only a temporary effect if a complete “BAR” program is not carried out.

Particularly importance has methods that encourage the regeneration of cartilage and bone formation, because that treats an origin of the problem resulting in a long-term effect. So far we have not had methods or technologies that can regenerate cartilage, but in recent years such opportunities have appeared. One of these is MBST – the therapeutic nuclear magnetic resonance.

So, “BAR” method is a concept, not a method limited just on one or few procedures, and must be individually adjusted. Strategic procedures which provide a holistic principle to skeleton and which are recommended in all cases are: specific exercise, such as “Tae do” program, isokinetic dynamometry and therapeutic nuclear magnetic resonance (MBST). Since isokinetic dynamometry and new methods of regenerative medicine are presented in separate chapters, in this chapter will be discussing the two key methods of “BAR” concept which is less known: “Tae do” exercise and Therapeutic nuclear magnetic resonance (MBST).

“TAE DO” EXERCISE

Despite a fact that exercise is commonly recommended to patients, there is no much attention paid to the type of exercise which is the most suitable for skeleton disease. Usually, it is considered as less important. But, due to significant improvement of our knowledge of bone metabolism and clinical experience, it's clear that exercise is crucial in prevention and treatment of skeleton disease, but it is not irrelevant what kind of exercise is practicing.

The basic principles which exercise need to meet

In order for any exercises to be effective in the prevention and treatment of osteoporosis, they must fulfill certain conditions:

1. The exercises must cause the intermittent contraction of the muscles, which achieves the alternating action of forces on the bone, which is an important stimulus for bone remodeling. Muscles contractions stimulate bone cells giving the information where bone need to be improved. That is, since, the muscles are attached to the bones, the forces of pulling and pressure, which are transferred to the bone on every contraction of the muscle, stimulate the reconstruction of the bone, transferring “information to the bones” that they need to be “strengthened” in that place.
2. The more muscles be engaged by causing them to contract, the more bones will be stimulated in the right way.
3. The movements in the exercises must be strictly controlled, since the exercises are primarily aimed at patients whose bones are weakened in terms of their biomechanical strength (osteoporosis), or some other metabolic bone disease and most of them also have degenerative and deforming changes to their joints (osteoarthritis) and there is a danger that sudden, uncontrolled movements could lead to damage to the skeleton, or even a fracture or a deterioration of the painful syndrome.
4. The exercises must be linked together in a logical system which is easy to remember, which is motivating, interesting and simple so that the patient will enjoy performing it, since even the best thought-out exercise system is useless if those at whom it is aimed are not satisfied when they perform it.

WHAT IS TAE-DO?

Tae-do is a special program of exercises which use some of the principles of the Korean martial art taekwondo, and the latest scientific experience and insights into the pathogenesis of osteoporosis. It is based on the performance of controlled movements with energy directed

contractions of the muscles in the course of certain movements. The title “tae-do” comes from words in the Korean language. “Tae” means movement with the legs or movement of the body, and “do” means the method, and in a figurative sense tae-do means an active attitude towards something, for example towards disease.

What are the advantages of Tae-do over classical exercises?

The basic principle, on which martial arts are based, is how to use the energy of the mind and body in the most rational manner in performing movements. Although the final aim of these skills is to prepare for battle with potential opponents, the techniques of the exercises based on these principles have a far wider significance, since they basically offer a way of achieving a balance between the “spirit and the body”, and to move in the most efficient way. These exercises affect the entire system of movement, starting with the brain, where the “command” is created for a certain movement, via the nerve system by which that stimulus is carried to the muscles, as the executing organs who perform the movement.

Using the techniques and principles of taekwondo, the traditional Korean martial art, tae-do influences not only the muscles and, by means of muscle contractions, the bones, but more than standard exercises it also affects the balance and improve mobility in general, which is important to reduce the risk of falls, which are particularly dangerous to those who suffering from osteoporosis, since even a minor fall may cause serious fractures.

Tae-do as a system of physical exercises is not only suitable for patients with osteoporosis, osteopenia and other metabolic bone diseases, but it is a universal system of exercises and may be undertaken by anyone regardless of their gender or age. Therefore there is no limitation regarding when to start or when to do these exercises. In view of the role of tae-do in the prevention and treatment of osteoporosis, it is best to start exercising before serious consequences of the disease become apparent, which means in all cases where osteopenia has been diagnosed. However, part of the tae-do program may be undertaken even in cases of severe osteoporosis, limited mobility or the presence of other chronic diseases, e.g. ischemic heart disease, which limits physical activity. Of course in all cases of proven osteoporosis, as well as tae-do, it is vital to undertake medicinal therapy on the basis of diagnostic procedures and the doctor's opinion.

The tae-do exercise system is run in two forms or levels:

“**The first level or “basic course of exercises”**” is aimed at patients with restricted mobility or those who are not willing to spend several hours a week going to a gym or work in a group of supervised training. It consists of a limited number of simple exercises which are repeated in a specific order. All these exercises are done sitting down; they are simple, controlled, and easy to remember and may be

done by patients who are seriously ill. They are designed so that they may be learned easily through just a few lessons with an instructor, after which the patient may do them alone at home, at work, outdoors...A disadvantage of this level of tae-do is that the exercises are intended to be carried out alone at home, and their success depends on how far the patient is determined, motivated and responsible, since success may only be expected if the exercises are carried out regularly and in the correct manner.

The second level (“advanced course”) consists of exercises to be done in groups as supervised training several times a week. The exercises consist of rhythmic repetition of simple movements that is basic taekwondo techniques of kicks, punches and blocks with energy directed muscle contractions. It can be performed with music and combined in different pattern.

Since this is training using a large number of different movement and a richer choreography, where tens of exercises alternate, this tae-do system is intended for supervised training in a gym.

NUCLEAR MAGNETIC RESONANCE THERAPY – MBST

What is MBST (nuclear magnetic resonance therapy?)

The nuclear magnetic resonance therapy – MBST, has been lately well established as the new nonsurgical therapy for musculoskeletal disorders. It is using the physical phenomenon of the nuclear magnetic resonance, well known from the MRI or NMR, the most sophisticated diagnostic procedure. A therapeutic use of the nuclear magnetic resonance for osteoarthritis, sports and accident injuries, osteoporosis, and metabolic disorders of the bones is a reasonable alternative and supplement of today's existing therapeutic spectrums as there is a tremendous need for effective therapies for these medical problems. In particular, because causal therapies are only symptomatic and are not able to achieve effect as MBST can do. Additional advantage of this method is that it has shown no side effects so far and is considered as painless.

The development of MBST and therapy equipment, which is using the nuclear magnetic resonance for the treatment of musculoskeletal disorders such as arthritis, osteoporosis and sports injuries as well as accident injuries, was by coincidence. Patients with joint pains reported, initially unexplainable, after frequently used MRI examinations repeatedly about amelioration of their pains. Doctors, biologists and physicists finally came to the conclusion that it could be the phenomenon of the MRI causing this positive effect. In several years of work in collaboration with respectable scientific institutes, company MedTec from Germany developed and patented as MBST, therapy systems which use the same physical principle as the MRI units, the nuclear mag-

netic resonance imaging, but with much weaker electromagnetic fields and radio frequencies as the MRI technology. So, from a technological point of view, the nuclear magnetic resonance therapy has been derived from the MRI. Both use the same physical phenomenon. The therapy equipment from MBST is using field strengths from 0.4 to 2.35 MilliTesla for 17 to 100 kilo Hertz in the magnetic resonance frequency. The field strength varies depending on the treatment system and regime. In an opinion of the Physikalischen Instituts der Universität Würzburg, Lehrstuhl für Experimentelle Physik 5, Prof. Dr. P. Jakob (2005), was irrevocable found that the therapy equipment MBST meet all scientific terms to create the conditions of nuclear magnetic resonance by the “fast adiabatic passage”. This is also an absolute unique selling proposition against the therapy systems with pulsating magnetic fields on the market, which therapeutically effective elements only a pulsating magnetic field represents. Three fields of different characteristics are necessary contrary to the production of nuclear magnetic resonance conditions:

- 1) Static main magnetic field
- 2) Variable sweep dB0/dt field parallel to the main magnetic field
- 3) Electromagnetic-changing field B1 (t) must be sufficient with the Larmor – condition and perpendicular to the other fields

These fields are presentable over a magnetic resonance detector and an oscilloscope and mark clearly the detectable therapeutic volume of MBST® therapy devices. The over the radio frequency modulated treatment sequences agree with the body vibration frequencies so that a stimulation of cartilage and bone tissues takes place.

Numerous studies have been performed over the effectiveness of nuclear magnetic resonance therapy in prestigious universities and research institutes who meet the evidence criteria of medical sciences. All the studies clearly confirmed the regeneration of the cartilage and stimulation of bone formation, as well as significantly clinical improvement. One of the basic study, done in prestige scientific institutions in Germany, in Achen, Julich and Grunstadt, published in *Medhodes Find Exp Clin Pharmacol* 27 by A. A. Temiz-Artmann, P. Linder, P. Kayser, I. Digel, G.M. Artmann, and P. Lückner, revealed that MBST treatment did not induce apoptosis or affect cell viability of human chondrocytes and osteoblast cultures, but showed an elevated cell proliferation rate quantified by cell count (1). It was proved also that MBST exposure stimulates production of the new collagen and decrease “old” cross linking collagen (2). The effect on the cartilage was proven on animal model as well as on the humans (3). A number of clinical studies confirmed a significant clinical improvement in the case of osteoarthritis and in the case of osteoporosis a significant increase of BMD (3-26).

CONCLUSION

Statistical analysis of number of clinical studies on patients with osteoarthritis on different joints treated with MBST - Nuclear Magnetic Resonance Therapy, after only one MBST cycle of 5 or 7 days shows:

- general improvement ranging from over 60% up to 80% and more
- pain reduction down to about 50% of the initial score
- constant decrease of pain intensity and frequency at different conditions
- All these improvements have been proved to get the maximum result at 8 weeks to 6 months after therapy but also lasting on a one year period.

Studies of osteoporosis treatment showed significant increase of BMD up to 35 %, T-score, up to 33,9 % and Z-score up to 72,46 %.

Based on the clinical experience, result of scientific and clinical trials as well as the cost and benefit analysis it is recommend, as the most rational use of MBST in the following conditions:

1. MBST program of 3 or 5 days once per year for all persons with increased risk of osteoarthritis or osteoporosis in combination with regular exercise.
2. MBST program of 5 or 7 days for all persons with osteoarthritis once per year together with exercise and pain relief therapy.
3. MBST program of 7 days twice a year in combination with physical therapy and sometimes with orthopedic therapy in the patients with severe osteoarthritis.
4. MBST program for osteoporosis 10 days in the case of osteopenia, increased risk of osteoporosis or in the case in which pharmacotherapy failed or has an increased risk of adverse effect.

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