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GREETINGS FROM THE PUBLISHER
We are delighted to once again serve as a media partner of the Isokinetic Conference this year. Our collaboration now spans 13 years, and we are proud to support such a strong international network in football medicine. For the first time, the conference will take place in Athens, and we are certain it will be a great success. Enjoy this issue, and the entire thesportgroup team wishes you an inspiring and wonderful conference.
thesportgroup Team

IMPRINT

EDITOR
thesportgroup GmbH
J.-Pierre-Jungels-Str. 6 |
55126 Mainz | Germany

Tel.: +49 6131/240 53 17
info@thesportgroup.de

DIRECTORS
Robert Erbeldinger | Joachim Messner
Trade registry: Mainz HRB 46334
International VAT-ID: DE 301342633

EDITORIAL STAFF
Masiar Sabok Sir | editor in chief

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Angelique Sarka | Art Director

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COVER
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MAGNETIC RESONANCE THERAPY

More effective than any laser – and more than just another magnetic field

DR. CHRISTOPH SCHMITZ, MD / DEPARTMENT OF ANATOMY II, FACULTY OF MEDICINE, LUDWIG-MAXIMILIANS-UNIVERSITY OF MUNICH MUNICH, GERMANY

PD ANNA SCHREINER, MD / EBERHARD KARLS UNIVERSITÄT TÜBINGEN, MEDTEC MEDIZINTECHNIK GMBH, GIEßEN

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T. CHARLES MAMISCH, MD / PH D, LIFCO AB, ENKÖPING, SWEDEN

Based on current biological findings, magnetic resonance therapy (KSRT/MBST®; sometimes also referred to as nuclear magnetic resonance therapy (NMRT) or therapeutic nuclear magnetic resonance (tNMR)) can clearly be classified as a physical therapy and works via established mechanisms of energy, redox, and inflammation regulation. Functionally, it corresponds to photobiomodulation with effects comparable to laser therapy, but overcomes its significant limitations by effectively stimulating even deep tissue structures.

PREPRINT

FROM THE PREVIOUS UNDERSTANDING OF HOW IT WORKS TO A MORE PRECISE BIOLOGICAL CLASSIFICATION

In 2025, several articles on KSRT appeared in the sportärztezeitung. These publications contributed significantly to familiarizing a broad readership in orthopedic sports medicine with the procedure and presenting its clinical applications in acute, degenerative, inflammatory, and post-traumatic diseases of the musculoskeletal system. For many users, this was their first structured contact with a form of therapy that belongs to the physical procedures but seemed to stand out from classic physical modalities. However, a specific narrative persists: KSRT is perceived less as part of established physical medicine and more as an independent and difficult-to-classify procedure. The experimental and cell biology data available today now allow for a much more precise classification, which neither relativizes previous clinical experience nor diminishes its significance, but rather anchors it more firmly in science.

MAGNETIC RESONANCE THERAPY IN THE CONTEXT OF PHYSICAL MEDICINE

From a therapeutic perspective, KSRT meets all the criteria of modern physical therapy. It is non-invasive, works without ionizing radiation, does not cause any significant tissue heating, and can be easily integrated into multimodal treatment concepts. The electromagnetic fields used are in the low-energy range and are not used for imaging, but for targeted biological stimulation. This makes therapeutic KSRT fundamentally different from diagnostic magnetic resonance imaging (MRI). While the latter uses high field strengths to obtain signals, KSRT works with much lower field strengths and specifically tuned radio frequency excitation. The aim is not to visualize tissue, but to influence cellular regulatory processes. In this respect, KSRT is in line with other physical procedures such as laser therapy, extracorporeal shock wave therapy (ESWT), or pulsed electromagnetic field therapy.

METAPHORS AND MISUNDERSTANDINGS

Historically, KSRT has sometimes been described using terms such as “resonance,” “cellular order,” or “energetic attunement / energy transfer.” Such metaphors can help to illustrate complex physical relationships, but they carry the risk of unnecessarily mystifying the therapy. The available scientific data clearly show that such an interpretation is not necessary. The effects of KSRT can be consistently explained by known biological mechanisms that have been intensively researched for years and also underlie other physical therapies. KSRT is therefore neither esoteric nor difficult to explain, but fits logically into existing concepts of physical medicine.

THE BIOLOGICAL CORE MECHANISM: ENERGY, REDOX BALANCE, AND INFLAMMATION REGULATION

Regardless of the cell type studied, KSRT consistently produces recurring biological effects. Cells respond by stabilizing their energy metabolism, improving mitochondrial function, and normalizing their redox state. At the same time, pro-inflammatory signaling pathways are dampened, particularly those associated with chronic inflammation and tissue degeneration. This combination is highly relevant clinically. Chronic musculoskeletal disorders are almost always characterized by a combination of low-grade inflammation, disturbed energy homeostasis, and limited regenerative capacity. A therapy that targets precisely these points not only addresses the symptoms but also regulates the underlying processes.

PARALLELS TO LASER AND PHOTOBIOMODULATION THERAPY

The basic principles of laser and photobiomodulation therapy are well known to readers of the sportärztezeitung. Here, too, the focus is not on local heating, but on the activation of mitochondrial processes with downstream modulation of inflammatory and regenerative mechanisms. The absorption of light energy leads to an increase in ATP production, controlled reactive oxygen signaling, and the activation of anabolic cell programs. A comparison of these effects with those of KSRT reveals remarkable similarities. In both cases, inflammatory signaling pathways are inhibited, energy metabolism is stabilized, and regenerative processes are promoted. The difference here lies not in the biological target, but in the physical approach and the spectrum of effects.

THE DECISIVE CLINICAL DIFFERENCE: PENETRATION DEPTH

The greatest practical limitation of laser therapy is its limited penetration depth. Despite optimal wavelength selection, the biologically effective amount of light decreases significantly

DR. CHRISTOPH SCHMITZ, MD

» is Full Professor and Head of the Department of Anatomy II at the Ludwig-Maximilians-University of Munich (Munich, Germany) and a member of the scientific advisory board of the sportärztezeitung.

with increasing tissue depth. Deeper structures such as the hip joint, spine, intervertebral discs, or subchondral bone areas are practically impossible to reach. This is where KSRT has a key advantage. Magnetic fields and the radiofrequency excitation used penetrate biological tissue with virtually no loss. The biologically relevant stimulation thus also reaches deep target structures with sufficient intensity, without thermal stress or radiation exposure.

DIFFERENTIATION FROM PULSED ELECTROMAGNETIC FIELD THERAPY

With the growing popularity of KSRT, the question inevitably arises as to how it differs from pulsed electromagnetic field therapy (PEMFT). Both methods are non-invasive, deeply effective, and show comparable clinical endpoints such as pain reduction and functional improvement. Nevertheless, it would be simplistic to regard KSRT merely as a variant of PEMFT. Classic PEMFT is primarily explained by time-varying magnetic fields that induce electric fields and microcurrents in the tissue. This results in effects on cell membranes, ion channels – especially calcium homeostasis– and downstream signaling pathways such as adenosine receptors and growth factors. These mechanisms explain the good evidence for PEMFT, e.g., in fracture healing and edema reduction. KSRT, on the other hand, shows an effect profile that points less to immediate membrane or current phenomena and more to a modulation of intracellular regulatory systems. Noteworthy are the consistent influence on energy metabolism, redox balance, and time-dependent biological programs. The two methods therefore do not compete with each other, but rather complement each other within multimodal therapy concepts.

CONSEQUENCES FOR CLINICAL APPLICATION

From a therapeutic perspective, KSRT can be understood as a form of deep photobiomodulation: biologically comparable to laser therapy, but without its optical limitations. ESWT is also limited in its penetration depth and cannot reach deeper structures such as the hip joint, spine, and intervertebral discs with a therapeutically relevant energy flux density. KSRT is therefore not intended as a replacement or complete alternative, but rather as a useful supplement to physically based multimodal therapy, especially where depth and volume play a decisive role. This property opens up new therapeutic possibilities within existing conservative treatment concepts, particularly for degenerative diseases of large joints, spinal pathologies, osteoporosis, and chronic inflammatory processes in bones and cartilage. In this context, it should be noted that there are KSRT / MBST® devices that can be used to treat the entire human body simultaneously if necessary (e.g., in systemic processes such as osteoporosis); this is not the case for any other physical therapy method mentioned in this article.

CONCLUSION

The articles published in 2025 have raised the profile of KSRT in the sportärztezeitung and underscored its clinical relevance. The next step is to establish a precise scientific classification. KSRT is not a marginal or difficult-to-explain special form of medicine, but rather a biologically consistent, physically rational therapy with clear parallels to photobiomodulation – enhanced by the decisive advantage of deep effectiveness. Properly understood, KSRT loses none of its fascination – on the contrary. Rather, it gains clarity, connectivity, and therapeutic credibility within modern physical medicine.

PREHABILITATION AS A POTENTIAL "OPEN WINDOW" FOR REHABILITATION

A Biopsychosocial Approach to Patient Preparation – The Influence of Nutrition and Psychosocial Factors

Building on the article "Prehabilitation as Biological Preparation of the Patient" (Schek & Erbeldinger, sportärztezeitung online, 2025), this article aims to provide insight into the potential benefits that complementary measures ("co-therapies") may offer in preparing patients for medical interventions.

Conservative therapy and its mechanisms of action can be understood in the context of prehabilitation as a kind of "open window" to rehabilitation. It can provide an initial impetus to activate the body's own adaptation and regeneration processes while simultaneously strengthening the patient's self-management. This perspective applies to both conservative and physical therapies as well as to interventional or surgical procedures.

ORTHOBIOLOGICAL THERAPIES AND PATIENT-RELATED INFLUENCING FACTORS

Orthobiological therapies such as Platelet-Rich Plasma (PRP) / ACP, Blood Clot Secretome (BCS), ACS (IL-1RA), or cell-based procedures are increasingly being used to treat musculoskeletal disorders. At the same time, clinical studies show considerable variability in treatment outcomes in some cases (Filardo et al. 2023; Andia & Maffulli 2024).

An important reason for this could be that these therapies use autologous biological products. The quality of the injected material therefore potentially depends not only on technical manufacturing processes but also on the patient's biological condition. A recent review by Montagnino et al. discusses that lifestyle factors such as exercise, diet, and certain supplements could influence platelet count and function as well as the quality of cell-based products (Montagnino et al. 2025).

However, the authors explicitly emphasize that these correlations currently appear primarily biologically plausible, while robust clinical evidence remains limited and further translational research is still needed.

BIOPSYCHOSOCIAL EXPANSION OF PREHABILITATION

Against this backdrop, an expansion of the prehabilitation approach that takes psychological and social aspects into account alongside biological factors appears sensible. Such a biopsychosocial understanding of prehabilitation also aligns with newer concepts of so-called metabolic optimization prior to orthobiological therapies. In their review, Fernandes and Rodeo describe how systemic factors such as metabolic health, chronic inflammatory processes, sleep quality, or lifestyle behaviors can influence the organism's regenerative environment (Fernandes & Rodeo 2026).

These systemic factors can influence both the quality of autologous biological products and the regenerative capacity of the target tissue. At the same time, the authors emphasize that many of these strategies are currently based primarily on preclinical or indirect evidence (Fernandes & Rodeo 2026).

MIND-BODY MEDICINE AS A POTENTIAL CO-THERAPY

In this context, the field of mind-body medicine is also discussed. Programs such as Mindfulness-Based Stress Reduction (MBSR), developed by Jon Kabat-Zinn, or the Relaxation Response described by Herbert Benson are among the best-studied structured mind-body interventions.

These programs aim to
- reduce stress responses
- improve autonomic regulatory processes
- and potentially influence immunological and neuroendocrine parameters.

A review on mind-body medicine in pain therapy describes that an eight-week MBSR program can lead to clinically relevant pain reductions in a significant proportion of participants (Paul 2023).

These findings primarily pertain to pain and stress modulation. The direct impact of such interventions on orthobiological therapies such as PRP has not yet been sufficiently investigated.

DIET AND POTENTIAL EFFECTS ON PRP

In addition to psychosocial factors, the role of diet is increasingly being discussed. A recent clinical study by Platzer et al. examined the relationship between different dietary patterns and the composition of PRP. In this study, vegan, vegetarian, and omnivorous diets were compared. The results show that certain molecular components of PRP – particularly the pro-inflammatory cytokine interleukin-6 (IL-6 – may differ between dietary groups, while cell counts in the PRP remained largely comparable (Platzer et al. 2026). These data suggest that dietary habits may influence the molecular properties of PRP, although no direct clinical recommendations can currently be derived from this. Similar considerations are also found in other studies, which suggest that dietary and lifestyle factors could influence systemic inflammatory activity and thus potentially regenerative processes (Andia & Maffulli 2024; McLarnon et al. 2024).

CURCUMIN AND OTHER PHYTONUTRIENTS

Curcumin is frequently discussed in the context of inflammatory musculoskeletal disorders and has demonstrated anti-inflammatory and signal-modulating properties in experimental studies (Nguyen et al. 2025).

Furthermore, pharmacological and experimental studies show that curcumin may have platelet-modulating or anti-platelet effects by influencing various platelet activation signaling pathways (Liu et al. 2022).

In the context of PRP, this means:
An influence of curcumin on platelet-dependent processes appears biologically plausible; however, its specific significance for PRP collection or the clinical efficacy of PRP therapies has not yet been sufficiently investigated. Similar considerations apply to other polyphenols such as resveratrol, quercetin, or anthocyanins, which may also exhibit platelet-modulating properties.

The potential influence of such substances is therefore likely to depend significantly on dosage, formulation, and timing of administration, as well as on the individual metabolic context.

NUTRITION, METABOLIC HEALTH, AND REGENERATION

Recent studies on metabolic optimization prior to orthobiological therapies indicate that systemic factors such as
- obesity
- insulin resistance
- chronic inflammatory processes
- physical inactivity
- sleep disorders

can influence tissue regenerative capacity and possibly also the efficacy of orthobiological therapies (Fernandes & Rodeo 2026). Diets with an anti-inflammatory profile – such as the Mediterranean or plant-based diets – are therefore discussed as potentially favorable conditions.

Here, too, most data are mechanistic or indirect, and clinical studies on the direct improvement of PRP outcomes are currently lacking (Montagnino et al. 2025; Fernandes & Rodeo 2026).

CONCLUSION

In summary, it can be stated that:
The preparation of patients prior to medical interventions can be viewed from a biopsychosocial perspective. Lifestyle factors such as exercise, diet, metabolic health, and stress regulation can influence the organism's biological environment and thus potentially also modulate regenerative therapies. However, the current state of the literature shows that many of these relationships are so far primarily biologically plausible and cannot yet be considered established clinical recommendations.

Prehabilitation can therefore be understood as a potential "open window" in which patients can actively contribute to optimizing their baseline condition. In this sense, it can serve as a bridge between therapy, rehabilitation, and prevention – provided that the measures are implemented within the framework of a medically sound indication and patient-centered education.

The bibliography can be found in the article at www.sportaerztezeitung.com

Robert Erbeldinger, sportärztezeitung /

Alberto Schek, MD, Paracelsus Sportmedizin & Prävention Bremen

Editor's Note

SUPPLEMENT: PRP, PROTEIN, AND SOLUBLE FIBER[1]

In the context of PRP injections, a targeted, personalized nutritional therapy appears biologically plausible and clinically sensible. In addition, we would like to emphasize that an adequate supply of proteins and essential amino acids, as well as soluble dietary fiber, forms the structural and metabolic basis of regenerative processes. This is not considered problematic[2,3] before, during, or after PRP interventions – just as it is not before surgical procedures and physical therapies.

Especially in the prehabilitation phase[4], this form of targeted nutrition[5], including cholesterol-lowering dietary strategies[1], can support the biological prerequisites for tissue adaptation and the healing response. It is suitable for any medical intervention when applied as targeted nutrition.

1 Oats and Heart Health

2 Outcomes of Cancer Surgery

3 Malnutrition in Internal Medicine

4 Prehabilitation of the Anterior Cruciate Ligament

5 Targeted Nutrition

OPTIMIZATION OF ORTHOBIOLOGICAL THERAPIES THROUGH EXERCISE, NUTRITION, AND DIETARY SUPPLEMENTS

Optimizing orthobiologic therapies with exercise, diet, and supplements
Jami Montagnino, Matthew W. Kaufman MD, Maya Shetty BS, Christopher Centeno, Michael Fredericson MD

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Orthobiological injection therapies such as platelet-rich plasma (PRP) and cell-based procedures are becoming increasingly important. For certain indications, there is evidence that these treatments can be effective. However, their therapeutic success appears to depend not only on the method itself, but also to a large extent on the quality of the autologous injectate used. This quality may be influenced by individual lifestyle factors such as physical activity, diet, and the use of dietary supplements.

Studies on PRP injections show that both the quantity and the functionality/activity of platelets contribute significantly to their effectiveness. Various lifestyle interventions may modulate these parameters. Higher training intensity appears to be associated with an increased platelet count, improved adhesion, and increased release of growth factors. Similarly, an anti-inflammatory diet can promote the overall number and activity of blood platelets. In contrast, psychological stress, certain supplements, elevated cholesterol levels, or a diet high in sugar (refined sugar) can exacerbate inflammatory processes and potentially negatively affect both platelet count and the quality of the PRP injectate.

The success of cell-based therapies is also determined by the quantity and quality of mesenchymal stromal cells (MSCs). The central goals of these forms of therapy are to slow down cell aging and promote cell proliferation and differentiation. Physical activity can support these processes by reducing cell senescence and increasing the regenerative capacity of MSCs, which is particularly important in older patients. In addition, there are numerous dietary supplements that can potentially have a positive effect on cell-based injections. However, before using them, the possible benefits and risks should be carefully weighed and discussed.

Certain foods and changes in oxygen availability can also contribute to reducing cell aging. In addition, reduced calorie intake may affect the viability and function of mesenchymal stromal cells. In summary, the current literature highlights the biological plausibility that exercise, nutrition, and supplementation can modulate the effectiveness of orthobiological injections. However, further translational research is needed to better quantify the clinical benefits and develop practical recommendations.

KEY-NOTES

- Both the quantity and activity of platelets contribute significantly to the effectiveness of orthobiological therapies.
- Stress leads to a change in platelet function.
- Exercise, nutrition, and dietary supplements can modulate the effectiveness of orthobiological injections

Michael Fredericson, MD & Matthew W. Kaufman, MD / Department of Orthopaedic Surgery, Stanford University, Redwood City, California, USA

READ FOR YOU BY TOBIAS WÜRFEL, MD

Cryotherapy

Miranda JP, et al. Effectiveness of cryotherapy on pain intensity, range of motion, swelling and function in the postoperative care of musculoskeletal disorders: a systematic review and meta-analysis of randomised controlled trials. Br J Sports Med. 2025 Oct 5:bjsports-2024109497. doi: 10.1136/bjsports-2024-109497. Epub ahead of print. PMID: 41047148.

The use of cold therapy has been an established measure in the postoperative treatment of musculoskeletal injuries and operations for many years. The aim is to relieve pain, reduce swelling, and improve range of motion at an early stage. A recent systematic review and meta-analysis has now summarized and critically evaluated the existing evidence on this topic.

The analysis included 28 randomized controlled trials comparing various forms of cryotherapy with no cold application. Pain intensity, range of motion (ROM), swelling, and functional recovery were evaluated. Overall, cryotherapy showed significant advantages in terms of pain reduction and mobility in the immediate, short-term, and medium-term postoperative phases. However, some of the effect sizes found were below the clinically relevant threshold (MCID), indicating rather moderate absolute improvements.

Small to moderate positive effects were observed in terms of range of motion, while only limited differences were observed for swelling and function. Nevertheless, the overall picture suggests that cold applications can make a supportive contribution to multimodal rehabilitation concepts – especially in the early stages of healing, when pain and tissue reaction limit the range of motion. A subgroup analysis showed that controlled cryo-compression systems tend to achieve more favorable effects than conventional applications with ice or gel packs. These devices were found to significantly reduce pain intensity (mean difference −1.03 points) and improve range of motion (mean +11.5°). These advantages are probably due to the combination of cooling and simultaneous compression, which affects both local blood flow and tissue pressure. However, it should be noted that the research situation is heterogeneous overall and the quality of the evidence was only low to moderate. In addition, almost all of the included studies refer to direct cooling methods– i.e., applications in which the cold is transferred directly to the skin via ice, gel packs, or cooling compression devices.

Other methods have hardly been investigated in the literature to date. Hyperbaric CO_2 cold therapy, in which compressed, expanding carbon dioxide is applied to the skin, is only found in individual case reports or small pilot studies. Cold air methods, in which convective heat removal is achieved by means of a fan, have also been researched only marginally to date. For both methods, there are currently no reliable randomized studies on postoperative application. Accordingly, it is not currently possible to make any well-founded statements about their effectiveness or their significance in comparison to established direct cooling methods.

Conclusion: Cryotherapy remains a useful measure in the postoperative management of musculoskeletal surgery, especially for short-term pain and swelling reduction. Although the observed effects are often below the clinically relevant threshold, they indicate a supportive effect within a comprehensive rehabilitation concept. Combinations of cold and compression appear to be somewhat more effective than simple ice applications. At the same time, the analysis reveals significant gaps in research: Indirect methods such as hyperbaric CO_2 cold therapy or cold air cooling have not yet been sufficiently investigated and should be given greater consideration in future studies in order to evaluate the entire spectrum of cryotherapy on a scientific basis.

TOBIAS WÜRFEL, MD

» Studied medicine at LUM Munich and obtained a doctorate at the Chair of Anatomy II at LMU on regenerative stem cell therapy
» Assistant physician in the Sports Orthopedics Section, TUM University Hospital Rechts der Isar, Munich
» Main areas of research: Extracorporeal shock wave therapy (ESWT) and physical procedures in orthopedics

HEALING JOINTS AND NERVES

Immune Stimulation and the New Science of Regenerative Therapies

THOMAS BUCHHEIT, MD / TRIANGLE REGEN MEDICINE AND BIOLOGICS CENTER, PLLC. CHAPEL HILL, NC, USA

The use of orthobiologic and regenerative therapies has increased dramatically over the past decade, yet misconceptions about these treatments and their target conditions remain. Although osteoarthritis (OA) is commonly conceptualized as an inflammatory disease, multiple research studies using inhibitors of cytokines such as TNF and IL-1 have failed to show effectiveness (Aitken, Laslett et al. 2018, Kloppenburg, Ramonda et al. 2018).

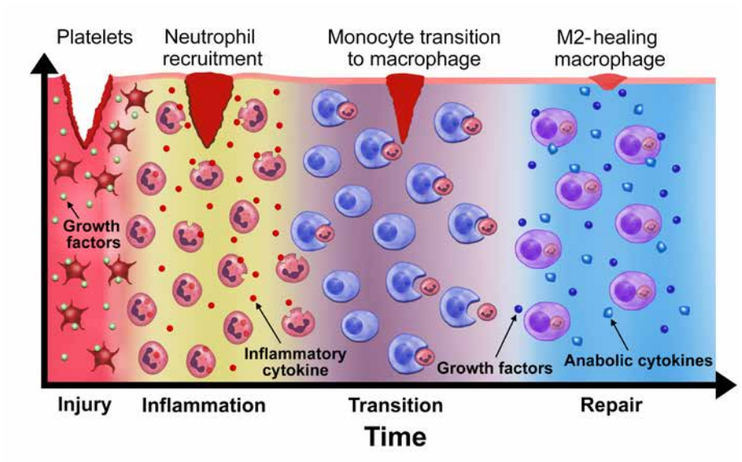


FIG. 1 The immune cascade and tissue healing following injury and orthobiologic therapies. Reproduced with permission from Bull Publishing.

Reframing OA as a chronic wound with a stalled healing immune response explains the failures of these prior cytokine studies. The osteoarthritic joint remains locked in a low-grade state of inflammation, with the release of degradative enzymes such as matrix metalloproteinases (MMPs). This non-healing wound leads to collagen breakdown, hyaluronic acid fragmentation, and persistent inflammation through a feed-forward cycle. To effectively treat chronic conditions like OA a paradigm shift from fighting inflammation to resolving it through immune stimulation is necessary. If successful healing depends on actively resolving inflammation, could orthobiologic therapies be the tools capable of triggering this process?

In Healing Joints and Nerves, this emerging paradigm shift in the treatment of OA and other chronic pain conditions is brought to life and made accessible to a broader audience.

PLATELET-RICH PLASMA

Therapeutic immune stimulation can be harnessed through orthobiologic therapies such as platelet-rich plasma (PRP) and mesenchymal stem cells (MSCs). PRP contains platelets, their growth factors, and variable concentrations of leukocytes. When the platelet dose is sufficient, this combination of factors is capable of reactivating a stalled healing cascade and reducing the pain associated with OA (Figure 1). At its core, PRP isn't an anti-inflammatory treatment. It uses acute inflammation to act as an immune stimulant. The critical role of immune activation is further supported by recent studies demonstrating that PRP is likely to be effective only when the platelet and leukocyte doses are robust (Bansal, Leon et al. 2021, Berrigan, Bailowitz et al. 2025). Variability and lack of processing standards continue to be problematic for PRP use in clinical practice.

MESENCHYMAL "STEM CELLS"

Likewise, MSCs also work through immune modulation. MSCs, originally isolated from bone marrow in the 1980s by Dr. Arnold Caplan, demonstrate the ability to differentiate into chondrocytes in cell culture. Early laboratory experiments generated great enthusiasm for the potential of cartilage regrowth, based on these in vitro studies. However, the role of MSCs in vivo differs significantly from their activity in a lab culture dish. Once injected, MSC viability lasts from 24 hours to several weeks, depending on the injection route and the rate of macrophage phagocytosis (de Witte, Luk et al. 2018, Satué, Schüler et al. 2019). Contrary to Dr. Caplan's initial hypothesis, the pain relief from MSC injections doesn't come from cartilage regrowth. Instead, pain relief results from MSCs' secreted factors (Chen, Park et al. 2015, de Witte, Luk et al. 2018) and from macrophage activation (Guo, Imai et al. 2017).

Dr. Caplan increasingly understood the immune-based mechanisms of MSCs, and he eventually authored the 2017 editorial, "Mesenchymal Stem Cells: Time to Change the Name!" (Caplan 2017). He argued we should call these cells "medicinal signaling cells" to better reflect their biological functions. Despite his pleading, MSCs are still commonly referred to as "stem cells" in the lay press and medical publications. Although MSCs have shown analgesic benefits in several clinical studies, a recent multi-center, randomized clinical trial has called into question their potential advantages over traditional treatments such as corticosteroid injection (Mautner, Gottschalk et al. 2023).

AUTOLOGOUS CONDITIONED SERUM (ACS)

Immune-based methods to resolve inflammation are also a core element of the orthobiologic therapy, autologous conditioned serum (ACS). ACS represents the physiological whole-blood secretome, encompassing the full spectrum of mediators released by all blood cells during an incubation phase- a process that mirrors the crucial phase of natural tissue healing. This generates a biologically potent composition including growth factors, cytokines, lipid mediators, neutrophil-derived factors and exosomes which leads to effective tissue regeneration and pain resolution. Therapy concepts including this particular ACS are invented by a German biotech company called Orthogen. The extended benefits are shown in over 45 clinical studies of ACS (Baltzer, Moser et al. 2009, Baltzer, Ostapczuk et al. 2013, Damjanov, Barac et al. 2018, Hang N 2025) including indications for OA, spinal and nerve tissue diseases and other pathologies. Because benefits of Orthogen-ACS appeared to extend beyond the duration of growth factors and anti-inflammatory cytokines such as IL-1, Dr. Buchheit and research teams

TAB. 1 Biological differences and similarities between the compared orthobiologic therapies. Of note, the described characteristics on ACS apply specifically to the original Orthogen-ACS protocol and according devices and may not be transferable to other products, particularly if key process steps such as the incubation phase are not included.

		ORTHOGEN-ACS	PRP	STEM CELL (CULTURE-EXPANDED)
BIOLOGICAL COMPOSITION	Cell-based therapy	Yes	Yes	Yes
	Injected substance	Mediators	Platelets (and leukocytes, depending on the product)	Mesenchymal cells
	Mediator spectrum	Full spectrum of mediators secreted from whole blood: growth factors, cytokines, exosomes, lipid mediators, neutrophil-derived proteins	Spectrum focusses on growth factors released by platelets	Spectrum focusses on, growth factors, cytokines and exosomes. released by mesenchymal cells
	Mediator release	Definite mediator release in devices during incubation	Mediator release supposed to occur after injection	Mediator release supposed to occur after injection
	Incubation phase (extended coagulation)	Yes Critical step for mediator increase and concentrations	No	No

THOMAS BUCHHEIT, MD

» Triangle Regen Medicine and Biologics Center, PLLC. Chapel Hill, NC, USA
» Adjunct Associate Professor, Duke University
» Duke Center for Translational Pain Medicine & Member International Cartilage Regeneration and Joint Preservation Society

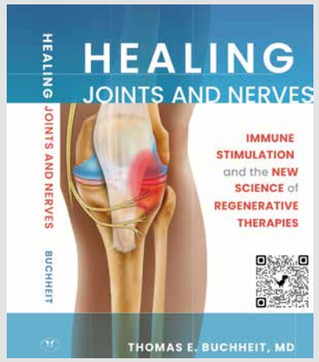
pursued additional mechanistic studies. Using laboratory models of neuropathy and chronic pain, the scientific teams demonstrated that ACS resolved inflammation, provided lasting pain relief, and even improved nerve function (Buchheit, Huh et al. 2023). The mediator profile of ACS is well characterized and recent analyses have demonstrated a marked increase in exosomes. When tested for function, the exosome contribution to ACS was significant, supporting long-term pain relief and tissue homeostasis through targeted intercellular signaling.

The unique and highly activated secretome profile including the diverse combination of factors in ACS has the ability to reduce the catabolic effects of corticosteroids (CS). Concerns about the potential negative impact of repeated CS injections have increased in recent years (McAlindon, LaValley et al. 2017). However, the side effects of CS appear to be markedly reduced with the addition of ACS. Combined treatment appears to enhance pain relief and reduce the risk of tissue injury associated with corticosteroids (Damjanov, Barac et al. 2018). By addressing acute pain instantly while simultaneously stimulating the body's natural regenerative processes, it offers both short-term relief and long-term healing that can promote lasting effects.

There is a clear paradigm shift in treating OA and other chronic pain conditions. OA isn't simply "wear and tear," nor is it primarily an inflammatory condition like autoimmune diseases. Instead, OA is a chronic wound that requires treatment through immune stimulation and activation of the healing process. Regenerative therapies such as PRP, MSCs, and ACS do not work by "fighting" inflammation. They stimulate innate, immune-based repair mechanisms through various pathways. PRP delivers growth factors. MSCs promote macrophage activation. ACS functions through high concentrations of growth factors, lipid mediators, inflammation-resolving cytokines, and exosomes. Collectively, these mechanisms restore joint balance, encourage tissue repair, and relieve pain.

HEALING JOINTS AND NERVES (HJN)

By Thomas E. Buchheit, MD, explains regenerative medicine through the lens of the immune cells that heal us after injury. One of the book's core concepts is the critical role of leukocytes, such as neutrophils and macrophages, and the immune switch needed to repair tissues and preserve cartilage health. Dr. Buchheit proposes a paradigm shift from fighting inflammation to resolving it through immune stimulation. By combining scientific explanation with patient stories, the book makes complex concepts accessible to surgeons, scientists, and curious patients. His book is a valuable resource for anyone seeking to learn about the mechanisms underlying regenerative therapies and future treatments of OA, neuropathy, and other chronic painful conditions.



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The bibliography can be found in the article at www.sportaerztezeitung.com

TREATMENT

SUPINATION TRAUMA

EMG-controlled ESWT application case in the NBA

SIMON IDEN / IDEN PHYSIO MÜNCHEN

With an incidence rate of around 20%, supination trauma is the most common injury in basketball. Pre- and rehabilitation are therefore highly significant, and structured planning and precision are recommended. The case study presented here clearly shows how the combined use of EMG and radial shock waves can accelerate the rehabilitation process and lead to lasting success.

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Aaron Nesmith, a player for the Indiana Pacers in the NBA, presented for the first time during the 2023/24 season playoffs with repetitive ankle problems, with a condition following multiple inversion traumas in the respective season. The initial diagnosis via EMG (myoact) showed clear deficits in the control of the peroneal muscles. The subsequent combination of osteopathy, manual therapy, and targeted facilitation via EMG biofeedback, led to immediate improvement and ultimately to a convincing performance by the athlete until the Eastern Conference Finals of the season. Unfortunately, I was unable to continue treating the athlete during the off-season due to my work as a physical therapist for the national basketball team at the Olympic Games in Paris.

A new assessment was therefore carried out at the beginning of the current 2024/25 season, with unsatisfactory results. The control of the peroneal muscles, i.e., M. peroneus longus, had fallen to a balance score of 38 % in a right / left comparison, with an MVA on the affected left side of 141 mV compared to a near-optimal value of 367 mV on the right side. The data was consequently forwarded to the Indiana Pacers medical team with a request to jointly develop an appropriate treatment strategy to prevent further recurrences. Unfortunately, a significant recurrence occurred on the following game day with a combination trauma and partial ruptures of the retinaculum peroneale and both peroneal tendons.

This event required a rethinking of the treatment approach in order to ensure not only a timely but also a long-term successful return to play. The team initially considered surgical intervention to restore continuity, particularly of the peroneal retinaculum, but after consultation with colleagues, this was rejected in favor of a conservative treatment approach.

CONSERVATIVE TREATMENT APPROACH & RETURN TO PLAY

In order to determine the rehabilitation process for the subsequent subacute phase after conservative treatment in the acute phase, it was imperative to perform another EMG mapping via Myoact to establish the baseline. A further expected decline in control was observed, with 87mV on the left vs. 344 mV on the right. In order to accelerate the control and reintegration of the affected muscles and to treat damaged tendon and ligament structures in a targeted manner, extracorporeal shock wave therapy (ESWT) from EMS was used. The high energy density enabled by the device is unique and was the decisive factor in this case. The athlete was advised against taking Celebrex (the standard medication in the NBA after trauma) due to reduced gene expression of scleraxis, collagen I, and III, and instead received supportive anti-inflammatory treatment with phytopharmaceuticals (curcumin and boswellia). This also ensured that the ESWT treatment in the ligament and tendon area was successful. The rest of the rehabilitation process consisted of both manual therapy and osteopathic elements to restore functional synergy, as well as training therapy measures with the aid of biofeedback training via EMG. ESWT was always used before training therapy with 3,000 – 4,000 pulses, divided between the muscular part of the peroneus longus, the retinaculum peroneale, and the peroneal tendons, at intervals of four to five days. The intensity was continuously adjusted to ensure the continuous release of substance P for the treatment to be successful. A significantly increased response and associated increased effectiveness of the subsequent training load was observed. This was graphically illustrated at regular intervals with EMG mappings comparing pre- and post-treatment, thereby confirming the long-term success of the ESWT application.

Return to play can only be successful if the athlete can restore confidence in the

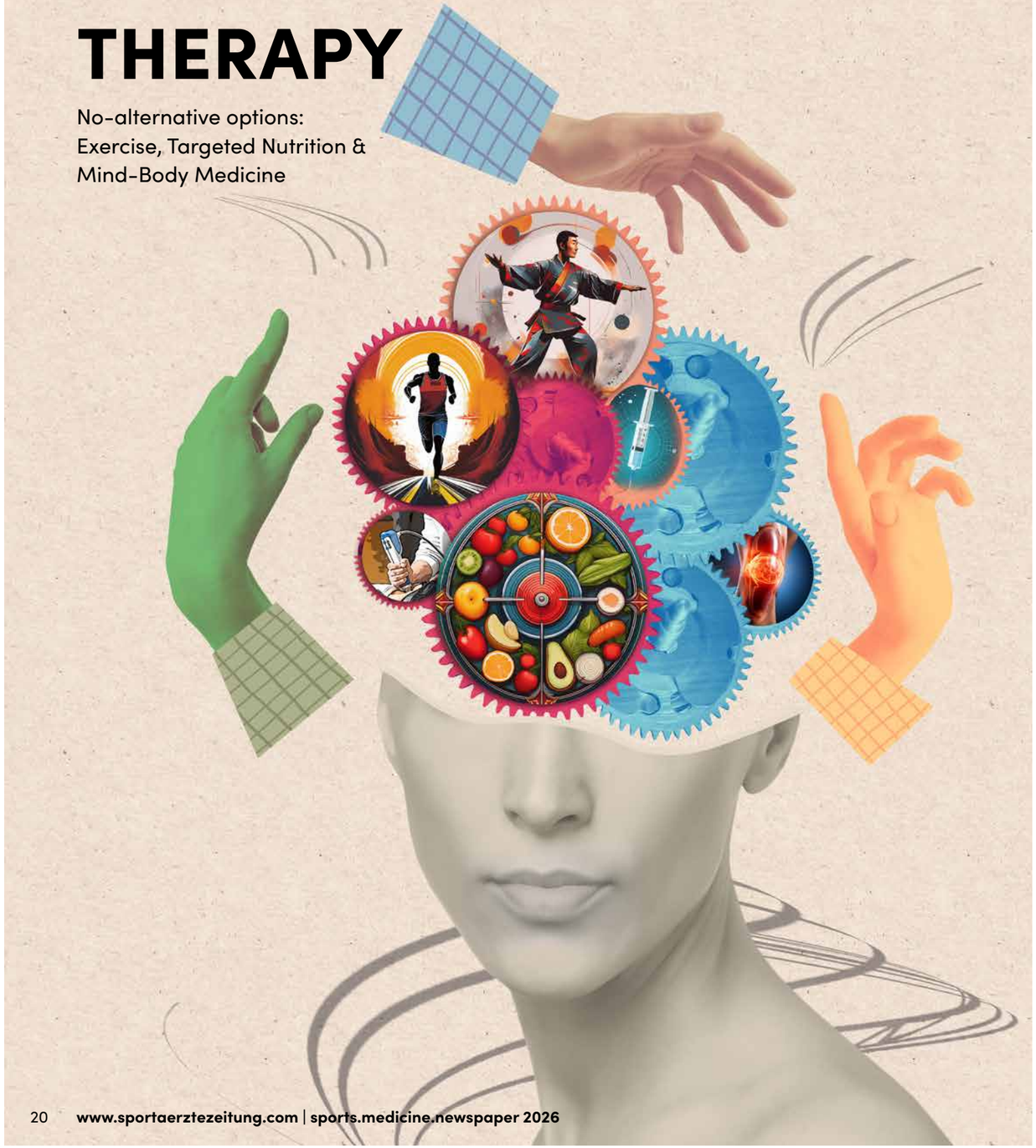
SIMON IDEN

is an osteopath and sports physiotherapist who works with NBA athletes in the USA. He has developed and implemented special treatment programs for NBA and WNBA athletes, including All-Stars such as Pascal Siakam, Lauri Markkanen, and Satou Sabally, and has been able to effectively prevent injuries by correcting biomechanical movement patterns. He is also part of the medical team for the German national basketball team, including during their World Cup victory in 2023. He is also part of the medical team for the German national basketball team, including during their World Cup victory in 2023.

injured structure. The highly competitive nature of competitive athletes in particular benefits from graphical representations of their training and success progress, ensuring compliance throughout a demanding rehabilitation program, but also helping us therapists to be honest. The most striking comparative measurement was taken after the first ESWT application, around two and a half weeks after the trauma. The success of the treatment could be clearly deduced from an increase in the balance score from 56 % to 80 % and from 133 mV to 280 mV (left) via EMG. In the following sessions, the average balance score did not fall below approximately 70 % and a continuously adequate control could be established. In general, a balance score of over 80 % is not necessarily expected or required for a basketball player due to the differentiated load requirements in the left/right comparison, as long as sufficient control in the 400 mV range is guaranteed. This was achieved after about four weeks of rehabilitation, and the player was able to participate in contact-free on-court activities again. In the following weeks, targeted load control led to the desired results, but was deliberately designed to be slow and gradual. His return to play comeback was not marked by any setbacks, enabling the athlete to play one of his best seasons to date and currently rank among the top 10 three-point shooters in the NBA. This is particularly noteworthy because successful three-point shooters depend on perfectly coordinated mechanics in their ankle joints.

INTEGRATIVE OSTEOARTHRITIS THERAPY

No-alternative options: Exercise, Targeted Nutrition & Mind-Body Medicine



The revised S3 guideline on knee osteoarthritis [1], the most important German-language recommendation for action, has provoked mixed reactions and provided ample cause for discussion with regard to the recommended treatment methods [2, 3].

However, upon careful reading, the following "strong" recommendations stand out in the summary and deserve special attention in this article:

- For more sustainable healthcare, we recommend the following: [...]
- Promotion of environmentally friendly lifestyles: Education and counseling on plant-based nutrition, active mobility (such as walking and cycling), and sustainable everyday practices.
- Prioritizing resource-saving treatment options (where therapies are equivalent): recommending non-surgical measures such as exercise therapy, behavioral modification, and weight management before considering invasive procedures. [1]

In addition to promoting an active lifestyle with a focus on mobility (e.g., walking and cycling in everyday life, taking the stairs instead of the elevator), exercise therapy is an evidence-based treatment method of undisputed fundamental importance, which should now finally be taken into account in healthcare practice. But what exactly should this exercise therapy look like? To give this originally sports medicine-related and at the same time highly translational field more contour, it is worth taking a look at the recently published systematic review and meta-analysis by Yan et al. [4]. The team of authors compared six training methods in terms of their effect on pain reduction, function, gait pattern, and quality of life. Among these, aerobic exercise (walking, running, cycling, swimming) performed best as a first-line treatment. In addition, strengthening, flexibility, and coordination exercises, as well as so-called mind-body exercises [5], were also examined and rated positively. The latter form of exercise, as part of mind-body medicine [6], which has already been considered in earlier studies on knee osteoarthritis [7, 8], can make a valuable contribution to the treatment of osteoarthritis symptoms, shifting the focus from the painful knee joint to the whole person. This is entirely in line with the holistic concept of whole-person health [9], which is also becoming increasingly important in the context of prehabilitation [10]. The affected person becomes an active part of the treatment team, which focuses on self-efficacy and teamwork and promotes adherence. Interventions from mind-body medicine can also be used when "traditional" therapeutic approaches such as aerobic exercise cannot be carried out due to physical condition or other obstacles.

TARGETED NUTRITION

In addition to exercise as therapy and behavioral adjustment in the sense of strengthening self-efficacy, the S3 guideline also explicitly mentions plant-based nutrition [1] as an important component of osteoarthritis treatment, thus emphasizing the concept of targeted nutrition [11]. Key aspects include sufficient protein intake with a targeted amino acid composition, the intake of collagen [12, 13] and fiber [14, 15], as well as supplementary systemic enzyme therapy [12, 13, 16, 17], multi-substance mixtures [18], and phytopharmaceuticals. Curcuma [19 – 24] in particular is playing an increasingly scientifically proven role in pain reduction and functional improvement in degenerative diseases such as osteoarthritis.

This knowledge deserves to be taken into account in daily care and tested in practice – not as a replacement, but as a supplement to established forms of therapy. We should seize the opportunity to further examine, apply, and critically observe such approaches in order to expand the field of conservative and regenerative medicine with valuable biological options.

MIND-BODY MEDICINE AND SHARED MEDICAL APPOINTMENTS

Mind-body medicine is considered to be of additional importance in reducing inflammatory biomarkers [25] and in the individual management of psychosocial stress [26]. Self-management and patient education are individual and closely linked to lifestyle medicine. They require targeted training and continuing education strategies for both patients and therapists. These approaches must now be consistently integrated into real-world care – analogous to the already established sports and exercise therapy. Oncology provides an interesting, differentiated, and precise approach with the concept of exercise oncology [27], while the currently evolving field of prehabilitation [10] can serve as a framework. The "open window" that is emerging in relation to prehabilitation offers the opportunity to anchor these innovative approaches in the long term. Let's take advantage of it and make the necessary changes in medical care a reality. As already emphasized in the article by Lison & Lison, there is virtually no alternative to all these developments [28].

The salutogenic potential is far from exhausted – rather, it paves the way for a new era of medical care, in line with the mind-body medicine concept coined by Professor Herbert Benson and Professor Jon Kabatt-Zinn [29] [6, 30].

The cost-efficient concept of shared medical appointments (SMA) [31, 32]

ROBERT ERBELDINGER

» Bachelor of Sports Science with a Professional Master's Degree in Sports Medicine, as well as postgraduate training in mind-body medicine (Harvard Medical School), psychoneuroimmunology, and lifestyle medicine (American College of Lifestyle Medicine)
» Publisher and editor of sportärztezeitung

ALEXANDER-STEPHAN HENZE, MD

» Board-certified specialist in orthopedics and trauma surgery with subspecialties in sports medicine and manual medicine
» Senior Physician in Sports Orthopedics and Sports and Rehabilitation Medicine at the University Hospital of Ulm
» Chair of the AGA Committee on "Prevention, Conservative Therapy, and Rehabilitation," Chair of the DVSE Commission on "Conservative Therapy," and Vice Chair of Handball Doctors Germany

PROF. GÖTZ WELSCH, MD

» Board-certified specialist in orthopedics and trauma surgery and medical director of the UKE Athleticum at the University Medical Center Hamburg-Eppendorf
» Since 2021, Professor of Orthopedic Sports Medicine at the UKE
» Head Team Physician for HSV Fußball AG
» Clinical focus is on regenerative cartilage therapy, the treatment of sports injuries, and overuse injuries

also appears to be particularly forward-looking in this context. This model of joint medical consultations [29] enables the efficient, interdisciplinary, and team-oriented implementation of mind-body approaches as well as lifestyle medicine – with patients as active members of their therapeutic process.

The bibliography can be found in the article at www.sportaerztezeitung.com.

In the recent article "Bashing Doctors Instead of Science," published in Orthopedics and Trauma Surgery 2025 15(5), the authors, Dr. Burkhard Lembeck (President of the BVOU) and Janosch Kuno (BVOU Press Officer), emphasize "that patients rightly expect their healthcare providers to exhaust all conservative therapies before resorting to surgery, even if the evidence for them is weak. This applies in particular to chronic conditions such as osteoarthritis or tendon irritation, when standard therapies do not help." Especially from this perspective, the article "Integrative Osteoarthritis Therapy" seems more relevant and important to us than ever. We look forward to further developments in this field.

"It is evident that over the past 30 years, medicine has recognized that the mysterious dynamic balance we call health encompasses both body and mind and can be strengthened through certain qualities of attention – qualities that can have a nourishing, regenerative, and healing effect. We all possess this ability – let's put it to use." Jon Kabat-Zinn from the book "Coming to Our Senses" (2005)

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MICRONEEDLING

Influence on the tissue stiffness of scar tissue in chronic pain following surgical lumbar spine procedures

INGO VOLKER REMBITZKI / INSTITUTE FOR THERAPEUTIC AREAS, HARZKLINIKUM DOROTHEA CHRISTIANE ERXLEBEN GMBH

PROF. DR. ROBERT SCHLEIP / TECHNICAL UNIVERSITY OF MUNICH, GERMANY, TUM SCHOOL OF MEDICINE AND HEALTH

EMANUEL STRÜBER, MD, ATHANASIA GEORGIOU, MYLES PISTOR / CLINIC FOR MULTIMODAL PAIN THERAPY, KRH KLINIKUM REGION HANNOVER

SALAH LAYKA, MD / NEUROSURGERY, HARZKLINIKUM DOROTHEA CHRISTIANE ERXLEBEN GMBH

Chronic pain after surgical procedures affects up to 30 – 50 % of patients who have undergone surgery and represents a significant challenge, including in follow-up care [1]. Scar tissue after lumbar spine surgery in particular can contribute to persistent pain due to increased tissue stiffness, reduced mobility, and nerve irritation [2]. The visible skin scar is only the "tip of the iceberg," as fibrotic changes can continue deep into the tissue layers and affect nerve structures [3]. The aim of this study was to investigate the influence of microneedling on objective tissue parameters and subjective pain reports.

Measurement to determine tissue stiffness, before the microneedling procedure

STUDY DESIGN AND PATIENT POPULATION

A prospective, descriptive observation was conducted. Thirty-one patients aged > 18 and < 80 years were included. All patients had chronic painful scarring for at least six months following surgery on the lumbar spine. Patients < 18 and > 80 years of age, with psychosomatic illnesses and secondary diseases that would have made it difficult to causally attribute the pain symptoms, were excluded.

- Gender: 71 % female
- Median age: 57 years
- Average BMI: 28.7 kg/m²
- Observation period: 12 days (T1–T2)

INTERVENTION

Treatment was performed using microneedling (Dermaroller®, Medical Device MC910 1.0 mm) in the area of the postoperative scar tissue with a force of approximately 2 newtons and a rolling speed of 10 cm per second.

Ten repetitions were performed in each direction on the scar tissue, as well as 0.5 mm to the right and left of the scar tissue along the scar. This application was repeated a total of three times per patient during the twelve days of inpatient stay.

MEASUREMENT METHODS & STATISTICS

Tissue stiffness: Of the five device-specific measurement parameters of the Myoton Pro, we selected the parameters Dynamic / Stiffness and Tone / Frequency in this study, as both parameters are best suited for indirectly determining tissue stiffness. The measurements were taken on the left, center, and right sides of the scar at fixed tissue markers. Indirect tissue stiffness was measured before the first treatment and one day after the last treatment. Pain intensity: A numerical rating scale (NRS 0 – 10) was used before the first and after the last intervention. The evaluation was descriptive.

Changes between T1 and T2 were represented by median values, and the NRS change was statistically tested.

RESULTS

Dynamic/Stiffness (Fig. 2)

The measurements showed the following median changes between T1 and T2:

- Left: – 8.3 N/m
- Center: – 9.7 N/m
- Right: + 3.0 N/m

Tone / Frequency (Fig. 3)

Area LWS/erector spinae – left/right and scar area in T1 and T2 (descriptive)

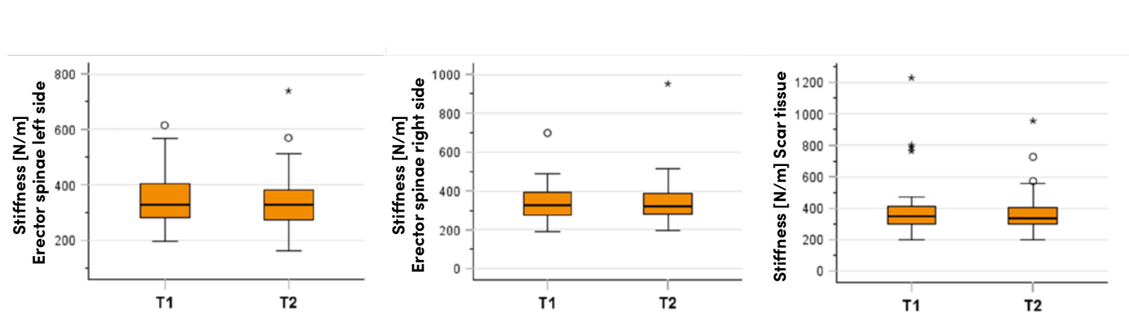


FIG. 2 Illustration of the change in dynamic stiffness (Nm²) in the scar area and to the right and left of the scar between T1 and T2.

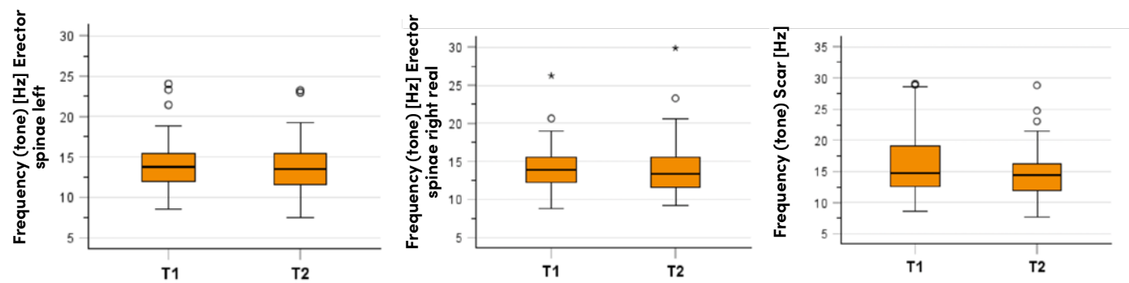


FIG. 3 The median change in tone / frequency was ~ 0.46 (Hz), representing a very slight change between T1 and T2.

INGO VOLKER REMBITZKI

» Head of the Institute for Therapeutic Divisions, Head of Outpatiens Care and Health Services, Harzklinikum Dorothea Christiane Erxleben GmbH, Academic Teaching Hospital of Otto von Guericke University Magdeburg
» Overall responsibility for outpatient medicine in the hospital network, Harzklinikum Dorothea Christiane Erxleben GmbH

Pain intensity (Fig. 4)
The median NRS was 5 points in T2, which was significantly lower than in T1 with 7 points (Wilcoxon test for paired differences, $p < 0.001$). The NRS thus showed a significant reduction in pain intensity between T1 and T2.

DISCUSSION & LIMITATIONS

The results of this study suggest that microneedling can reduce scar-associated tissue stiffness. The observed reduction in pain is consistent with previous studies, which showed an improvement in scar-related parameters in up to 74 % of patients after microneedling [4, 5].

Whether altered tissue stiffness and improved pain symptoms can also positively influence tissue mobility and thus movement economy should be the subject of further studies. The limited number of cases and the absence of a control group limit the significance of the findings. In addition, this is a very limited observation in the context of standard inpatient therapies.

CONCLUSION FOR PRACTICE

Microneedling is a minimally invasive, easily integrated treatment option for chronic scar pain after lumbar spine surgery. The method leads to objective improvements in tissue stiffness and a significant reduction in pain intensity. Objective changes in tissue stiffness and a significant reduction in pain support its use in a comprehensive approach to scar-related pain. Microneedling can be an effective addition to a multimodal therapeutic approach for painful scar tissue. Randomized, controlled studies with functional endpoints are needed to confirm its full clinical relevance.

The bibliography can be found in the article at www.sportaerztezeitung.com

Conflict of interest: There is no conflict of interest.

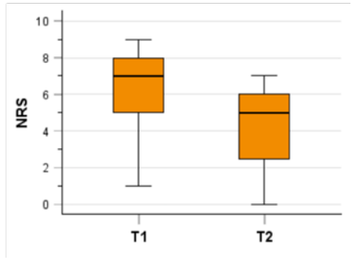


FIG. 4 Change in pain intensity (NRS) between T1 and T2. The median NRS was 5 points in T2, which was significantly lower than in T1 with 7 points (Wilcoxon test).

CUCUMBER WATER FOR MUSCLE CRAMPS

Pickle juice as a miracle cure?

KLAUS PÖTTGEN, MD /
BG PREVENT DARMSTADT

At the 2026 Australian Open, Carlos Alcaraz apparently drank cucumber water during his semifinal match against Alexander Zverev to relieve his muscle cramps. The limping tennis star won the match. For the same reason, ice hockey superstar Leon Draisaitl consumed mustard at the 2026 Olympics – because of the acetic acid it contains. Acetic acid is said to have a neural effect on cramps. In addition to acetic acid, pickle juice contains a relatively high amount of sodium (approx. 200 mg in 30 ml), but low amounts of magnesium and potassium.

Muscle cramps are a temporary but intense and painful involuntary contraction of the skeletal muscles that can occur in many different situations. There is evidence that some cases are related to water and salt imbalances, while others appear to be triggered by persistent abnormal spinal reflex activity as a result of fatigue in the affected muscles. This has led to alternative explanations, such as the theory of neuromuscular fatigue – i.e., impaired signal transmission between the brain and muscles after prolonged exertion.

Studies show that dehydration has no effect on the stimulation frequency required to trigger a cramp and confirm the involvement of spinal mechanisms. However, it is questionable to what extent these models are relevant to spontaneous cramps that occur during (exercise-associated muscle cramps (EAMC)) or after exercise. It has therefore been hypothesized that cramps are caused by persistent abnormal spinal reflex activity, which appears to be secondary to muscle fatigue. In particular, EAMC has been attributed to a disturbance in the sustained activity of alpha motor neurons, which is based on a dysregulation of alpha motor neurons at the spinal level. Muscle fatigue was considered to be a triggering factor, as it increases the afferent activity of the muscle spindles (type Ia and II) and simultaneously inhibits the afferent activity of the type Ib Golgi tendon organs. Indirect evidence supporting this theory comes from the observation that passive stretching of the affected muscle during a cramp can alleviate the symptoms – presumably through autogenic inhibition via the tendon organ reflex. Nevertheless, this does not explain why cramps are not an inevitable consequence of every strenuous activity, why they occur more frequently in environments with high heat stress, or why some people are affected while others are spared.

In the human model of electrically induced cramps, it has been reported that pickle juice effectively shortens the duration of cramps. Miller et al. found that the duration of cramps was reduced by an average of about 37 % when 1 mL of pickle juice was consumed two seconds after the onset of cramps, compared to an experiment in which water was drunk. This did not affect the intensity of the cramp. Ingesting small amounts of pickle juice had no measurable effect on plasma concentrations of sodium, potassium, magnesium, or calcium, nor on plasma osmolality or plasma volume. Since the pickle juice did not cause any changes in circulating electrolytes, the authors suggested that the shortened cramp is mediated by the activation of receptors in the oropharynx, leading to a reduced discharge rate of the alpha motor neurons that innervate the affected muscle. However, it is important to emphasize that this was not a study of EAMC, but rather cramps triggered by electrical stimulation during a maximal voluntary contraction of a small foot muscle. In a randomized study (2023) involving 82 patients with liver cirrhosis and a history of more than four muscle cramps in the previous month, 1 tablespoon of pickle juice taken at the onset of a cramp improved cramp intensity without causing any adverse side effects.

The bibliography can be found in the article at www.sportaerztezeitung.com

KLAUS PÖTTGEN, MD

» Specialist in general medicine and occupational medicine with additional qualifications in chiropractic therapy and sports medicine, among others
» Senior Physician at BG Prevent GmbH, Darmstadt
» 2011–2020 Team doctor at SV Darmstadt 98 (2015 – 2022 at the NLZ), 2022–2023 Additional member of the medical team at 1. FC Kaiserslautern (nutritional medicine, regeneration and performance medicine & team doctor), 2002 – 2014 Medical director at Ironman Germany

RADIOFREQUENCY ECHOGRAPHIC MULTI SPECTROMETRY (REMS)

Technology and real-world cases

CHRISTIAN SCHNEIDER, MD /
ORTHOPÄDIEZENTRUM THERESIE, MÜNCHEN

PD ANNA SCHREINER, MD / EBERHARD KARLS UNIVERSITÄT TÜBINGEN, MEDTEC MEDIZINTECHNIK GMBH, GIEßEN

REMS (Radiofrequency Echographic Multi Spectrometry) technology is an innovative, ultrasound-based method for assessing bone mineral density and bone structure that can be used to screen bone health and support the diagnosis and monitoring of osteopenia and osteoporosis [1].
Unlike conventional DXA measurement (dual energy X-ray absorptiometry), which has been considered the gold standard in osteoporosis diagnostics to date, REMS is based on the analysis of unfiltered ultrasound data, which is evaluated using special algorithms for spectral analysis, allowing not only bone mineral density (BMD) but also the structural quality of the bone to be assessed [1, 2].

FIG. 1 REMS device at Christian Schneider's Orthopedic Center Theresie, Munich

For each scan line, spectra are generated from these spectral signatures, which are then compared with reference data from healthy and osteoporotic bones [1]. The BMD values calculated from this (in g/cm2) are then converted into T and Z scores using linear transformations [1]. In comparison, conventional ultrasound methods are usually based solely on pure image information (B-mode) [1]. Devices based on this technology, such as the models developed by Echolight, enable precise, fast, and reproducible measurements directly on the lumbar spine (L1 – L4) and femoral neck – analogous to the DXA regions. A small ultrasound probe is placed on the skin, and the measurement takes about 10 minutes and is painless and radiation-free. In addition to the classic T- and Z-scores and BMD values, the system can also provide information on microstructural bone quality / integrity via the so-called fragility score – a parameter that is intended to better reflect the individual risk of osteoporotic fractures – as well as supplementary BIA-like body composition data [1 – 4].

These devices are now used in a variety of settings: in specialized medical practices (e.g., orthopedics, endocrinology, gynecology), clinics, health centers, and increasingly in pharmacies or as part of mobile screening services. Due to their mobility and ease of use, they are particularly well suited for prevention and early detection, for example in post-menopausal women or patients with risk factors for bone loss, but also in athletes, e.g. for training control in cases of overload damage despite (apparently) good bone density / health, or for the preventive detection of an osseous deficit requiring further clarification [5, 6]. REMS is also becoming increasingly important in research and for follow-up checks, for example in drug-based osteoporosis therapy.

ADVANTAGES

Compared to classic DXA, REMS offers the following advantages: The examination is radiation-free, mobile, and reusable, saves time, is also suitable for monitoring without any concerns, and provides additional information on bone architecture and fracture risk. REMS technology thus represents a promising alternative or supplement to established bone density measurement and significantly expands the possibilities in modern osteoporosis diagnostics [1, 7, 8].

Studies confirm a high degree of diagnostic agreement between the two methods and show that REMS can be a reliable alternative to DXA in osteoporosis diagnostics [1]. However, it has not yet been established as equivalent to the gold standard. Furthermore, its validity is limited in patients with endoprostheses, scoliosis, or severe obesity (BMI > 40), and its clinical application requires a certain amount of training.

In the UK, REMS technology is an integral part of the "Screen my Bones" initiative (www.screenmybones.com/). In Germany, Prof. Kurth, Frankfurt, is one of the leading scientific experts on the method [1, 8].

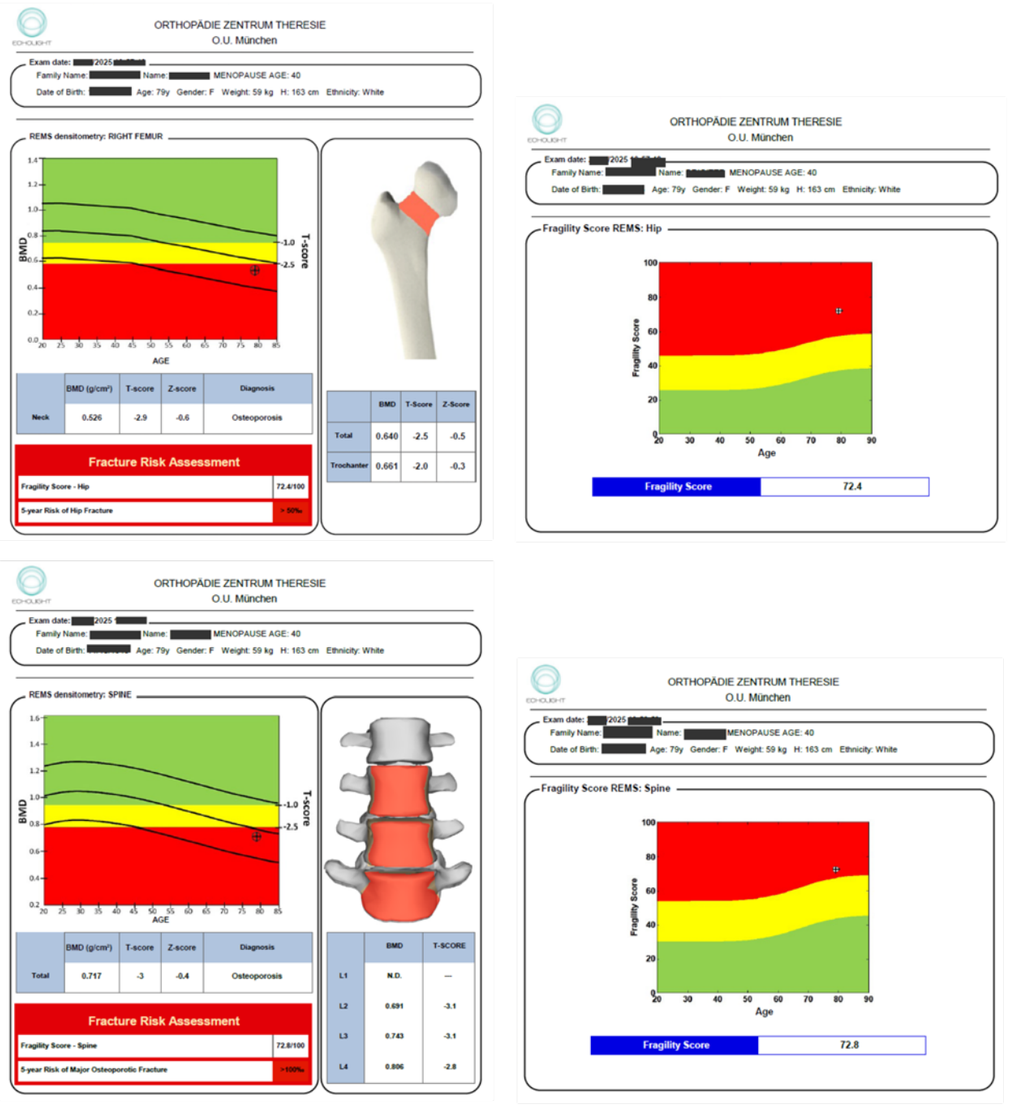


FIG. 2 Representation of BMD and T-score/Z-score in REMS measurement (femoral neck and lumbar spine) and fracture risk assessment (note: the fragility score is an indicator of bone structure quality, independent of bone mineral density (BMD)).

CHRISTIAN SCHNEIDER, MD

» Specialist in orthopedics with additional qualifications in sports medicine, physical therapy, chiropractic therapy, and naturopathic treatment.
» Theresie Orthopedic Center, Munich
» Among other things, chairman of the German Medical Association (Verband Ärzte Deutschland e.V.), board member of GOTS and the Bavarian Sports Medicine Association, member of the medical commission of the German Olympic Sports Confederation (DOSB), Olympic physician since 2006

PD ANNA SCHREINER, MD

» Specialist in orthopedics and trauma surgery
» Chief Medical Officer, MBST Global, MedTec Medizintechnik GmbH
» Eberhard Karls University of Tübingen + AKAD University

So far, the technology is only available in a few practices in Germany – e.g., at the Orthopedic Center Theresie in Munich (C. Schneider, MD) (Fig. 1), in Montabaur (Mr. M. Hötzel), and as a screening tool at some Biogena locations.

CASES FROM PRACTICE

45-year-old professional tennis player with activated OA of the knee including bone marrow edema of the medial femoral condyle. No trauma and no assessment of her bone health to date, as she has not yet reached menopause. No vitamin D supplementation has been given to date. In addition to knee therapy, a bone health screening using REMS was therefore carried out as a supplementary measure. This revealed osteopenia (T –1.3) measured in the femur with a T-score of –0.6 in the lumbar spine. In addition to adjusting her training regimen, vitamin D supplementation is now being administered in accordance with guidelines. Follow-up using REMS is planned in one year, with further diagnostics as needed.

22-year-old professional ice dancer with various recurrent musculoskeletal complaints; currently leading were lumbar spine complaints with bone marrow edema / stress fracture in the vertebral arch LWK 5 both sides incl. surrounding reaction. Part of the diagnostics also included ultrasound-based bone density measurement. This showed a normal lumbar spine but a T-score of –2.3 femoral with an increased 5-year hip fracture risk in the fracture risk assessment. The overall recommendation was core and stability training with partial lumbar orthotic support, kinesiotaping and heat / cold therapy, continuation of eccentric training (regarding knee complaints), as well as selective periradicular injection in the lumbar spine area, magnetic resonance therapy (MBST®) of the spine, and administration of 100.000 I.U. vitamin D3 intramuscularly (every three months). Follow-up using REMS planned after six months and, if necessary, extended diagnostics and training adjustments.

79-year-old female patient with tapping and pressure pain in the upper lumbar spine area without trauma or a history of osteoporosis. Imaging (pelvic and lumbar spine X-ray and lumbar spine MRI) revealed a symphysis-related pubic bone fracture, a degenerative, partially activated spine, and fresh upper plate fractures in L1+2. Osteodensitometry with REMS yielded a T-score of –3.0 (lumbar spine) and –2.9 (femur) with a significantly increased risk of fracture and normal body composition (Fig. 2). Denosumab was administered and a fixed vitamin D substitution was prescribed. The patient is undergoing regular physiotherapy, is mobile in everyday life, and has no complaints. A follow-up examination using REMS is planned in six months and, if necessary, DXA during the course of treatment.

The bibliography can be found in the article at www.sportaerztezeitung.com

PRECISION MEDICINE

Increase performance and reduce the risk of injury

THOMAS BLOBEL, MD[1], PROF. WINFRIED BANZER, MD[1,2], CHRISITAN HASER[1], PD FABIAN PLACHEL, MD[1, 3], PROF. FLORIAN PFAB, MD[4,5,6]

[1]EINTRACHT FRANKFURT,
[2]DEPARTMENT OF PREVENTIVE AND SPORTS MEDICINE, GOETHE UNIVERSITY FRANKFURT AM MAIN,
[3]HEALTHLAB SALZBURG, [4]BRIGHTON & HOVE ALBION,
[5]TECHNICAL UNIVERSITY OF MUNICH, [6]DNATHLETE AG

Professional sports are undergoing a profound transformation through the integration of precision medicine, also known as personalized medicine. By tailoring training, nutrition, recovery, and injury prevention strategies to the individual genetic, physiological, and subjective profiles of each athlete, precision medicine aims to enhance performance, reduce the risk of injury, and ultimately extend athletic careers. This article examines the current applications, benefits, and future directions of precision medicine in professional sports.

INDIVIDUALIZATION AS A NEW PARADIGM IN SPORTS MEDICINE

Precision medicine has established itself in many areas of medicine as an individualized approach to tailoring therapy and prevention strategies more specifically to the biological, genetic, and environmental characteristics of the athlete.

In sports medicine, this approach is still in its infancy – but the change is noticeable: with the use of high-resolution diagnostics and modern technologies, the need for tailor-made care for athletes is growing. These technologies support the necessary shift towards individualized, data-supported care concepts that is resulting from the development of professional sports.

The aim is to tailor training management, regenerative and preventive measures, and therapeutic interventions more closely to individual needs in order to specifically promote performance and identify injury risks at an early stage. Precision medicine provides the methodological basis for making data-driven and individually informed decisions – beyond blanket recommendations.

FIELDS OF APPLICATION AND CHALLENGES

The implementation of precision medicine in sports medicine requires a deep understanding of individual resilience and adaptability. A central aspect is the close integration with performance diagnostics, which makes relevant parameters measurable and interpretable. The focus is on the athlete as a complex system with numerous interconnected influencing factors.

Looking at the concepts of performance components in training science literature, the structural and functional complexity of athletic performance becomes clear – and with it the challenges associated with precision medicine [1]. Training and regeneration processes must be designed in such a way that they both promote performance development and improve stress tolerance. Precision medicine provides the framework for collecting and analyzing data in a targeted manner and translating it into concrete measures.

This results in key areas of application:

- **Prevention**
  Analysis and targeted reduction of injury risk
- **Rehabilitation**
  Optimizing and shortening return processes and preventing relapses
- **Regeneration**
  Individualizing and accelerating recovery processes to increase stress tolerance and training effectiveness
- **Injury cause analysis**
  Better understanding injury mechanisms and using this knowledge for prevention
- **Performance optimization**
  Achieving maximum performance in a sustainable manner
- **Increasing longevity**
  Reducing cell age and optimizing function ultimately lead to a higher life expectancy for athletes

The following section explains the key aspects of the aforementioned areas of application for personalized sports medicine in more detail.

GENETIC PROFILING AND PERSONALIZED APPROACHES

Advances in www.dnathlete.li have enabled the identification of specific markers related to muscle building, endurance, injury susceptibility, and recovery rates.

When coaches and medical teams know an athlete's genetic predisposition, they can design training and prevention programs that are tailored to the athlete's innate strengths and take potential weaknesses into account. For example, certain genetic profiles may indicate a predisposition to muscle, ligament, or tendon injuries, allowing targeted and additional preventive measures to be taken.

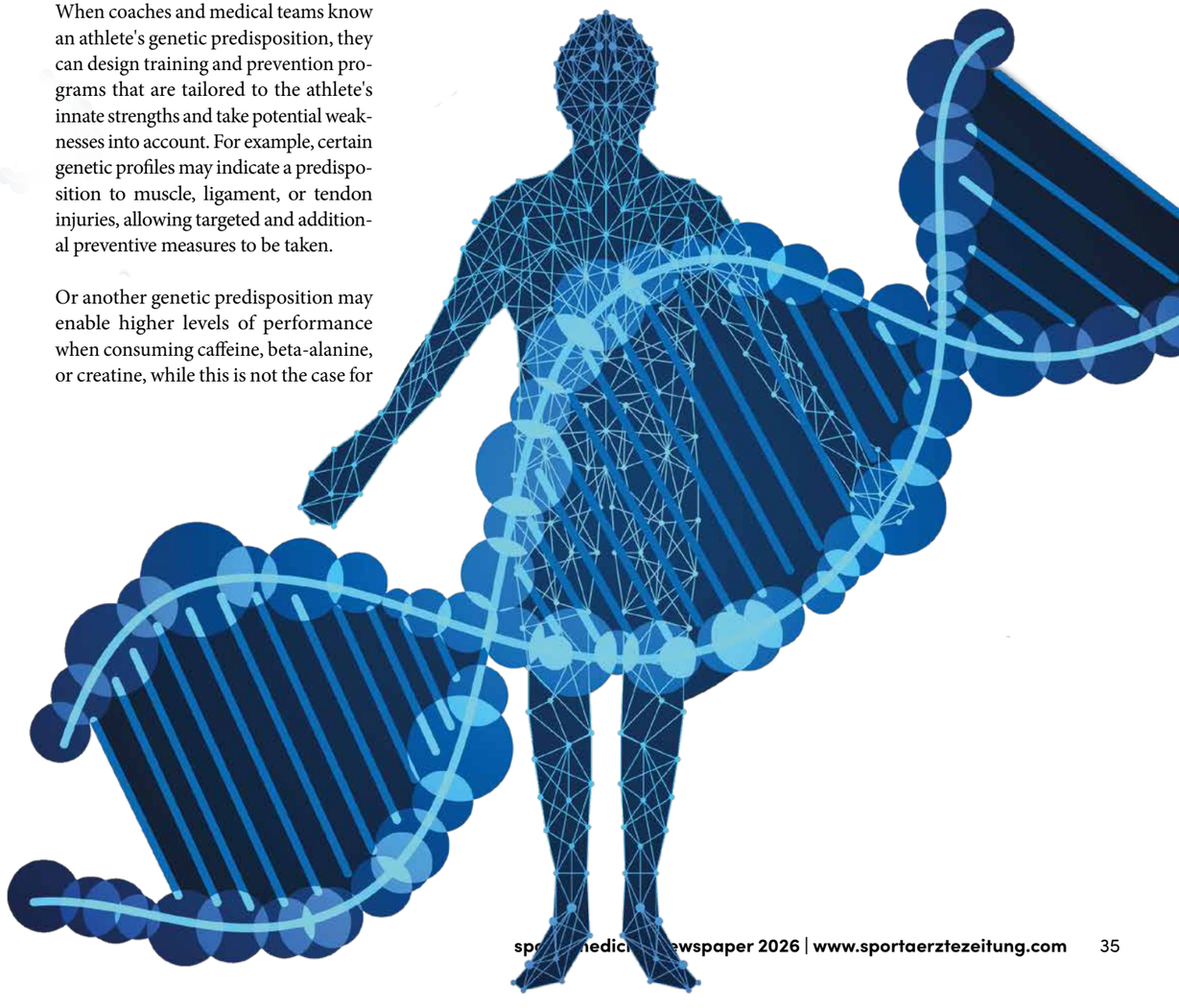
Or another genetic predisposition may enable higher levels of performance when consuming caffeine, beta-alanine, or creatine, while this is not the case for others [2]. A study published in the World Academy of Science Journal highlights the integration of genetic profiles with traditional biochemical and physiological assessments to optimize performance and ensure longevity in sports [3].

THE GREAT POTENTIAL OF EPIGENETICS – UNDERSTANDING AND UTILIZING MOLECULAR INDIVIDUALITY

Epigenetic processes add a dynamic component to this perspective: they control which genes are activated or deactivated under certain conditions – influenced by training, nutrition, stress, or environmental stimuli.

These adjustments are reversible and make it possible to achieve long-term positive changes at the cellular level through targeted stimuli. Epigenetic age clocks are complex biomarkers based on DNA methylation patterns that usually reflect biological age more accurately than chronological age, thus providing insights into an individual's health and aging process.

For athletes, these biomarkers have significant potential as they provide a personalized assessment of how training load, recovery, nutrition, and lifestyle affect long-term health and performance.



THOMAS BLOBEL, MD

was a research assistant at the Chair of Training Science and Sports Informatics at the Technical University of Munich, working in areas including medical data analysis and athlete management systems (AMS). Since 2021, he has been responsible for data and performance analysis in the medical department at Eintracht Frankfurt.

PROF. FLORIAN PFAB, MD

is a specialist in dermatology with additional qualifications in sports medicine, acupuncture, manual medicine/chiropractic therapy, and nutritional medicine. He has previously taught at the Technical University of Munich, the University of Regensburg, and Harvard Medical School. After serving as head of the medical department and senior team doctor at Eintracht Frankfurt, he took over medical responsibility at Premier League club Brighton & Hove Albion in 2024.

Monitoring biological age can help optimize training plans, avoid over- or under-training, and take measures to prolong peak performance and reduce the risk of injury. In addition, epigenetic insights can provide information about personalized recovery strategies and serve as a valuable tool for planning the longevity of athletes [4, 5].

BIOMARKERS AND THEIR POTENTIAL FOR PERFORMANCE OPTIMIZATION

Laboratory markers provide crucial insights into an athlete's physiological state and are therefore a cornerstone of precision medicine in sports. Biomarkers, such as creatine kinase (CK), help monitor muscle damage and recovery and enable individual training adjustments that optimize performance while minimizing the risk of overtraining and injury. Elevated CK levels, for example, may indicate excessive muscular stress or insufficient recovery, allowing timely measures such as modified training load, nutritional support, or rest periods to be initiated. Regular monitoring of such markers ensures a data-driven approach to athlete care and enables tailored strategies that increase resilience, improve performance, and support long-term athletic development. Regular communication with the athlete is crucial in interpreting these values in order to integrate subjective assessments into the decision-making process and avoid misinterpretations.

BIOMECHANICS – OBJECTIVELY ANALYZING AND INDIVIDUALLY ADAPTING MOVEMENT PATTERNS

Biomechanical analyses provide important insights for the individualized care of athletes. Every person moves differently, influenced by muscle control, joint structure, coordination, and movement experience. These individual movement patterns influence both the risk of injury and performance ability. Modern technologies such as motion capture systems, force plates, and electromyography (EMG) enable these patterns to be recorded as objectively as possible. Based on the data obtained, targeted analyses can be carried out and adjustments to technical training and load design can be derived with the aim of making movements more efficient, avoiding overload, and better meeting sport-specific requirements. EMG diagnostics provide valuable information on muscular control and enable early identification of neuromuscular deficits in prehabilitation and targeted correction using biofeedback-based activation. Biomechanical analyses thus make an important contribution to performance optimization and injury prevention and are an essential component of personalized sports medicine concepts.

WEARABLE TECHNOLOGY AND REAL-TIME MONITORING

The integration of wearable devices with built-in sensors enables the continuous recording of vital parameters, movement patterns, and stress data. These wearables provide real-time information on variables such as heart rate variability (HRV), oxygen saturation, and biomechanical efficiency. These insights enable immediate adjustment of training intensity and technique to optimize performance while minimizing the risk of injury. Recent developments include AI-driven smart sportswear that uses integrated sensors to monitor muscle activation and breathing patterns, for example, and provide real-time feedback on the quality of training execution [6].

PRECISION STRATEGIES FOR HYDRATION AND NUTRITION

Individualized hydration and nutrition plans are key components of precision medicine in sports. By analyzing individual sweat composition and metabolic responses, nutritionists can tailor electrolyte replacement and diet plans to the specific needs of each athlete.

This personalized approach ensures optimal energy availability, improves recovery, and supports overall health. Genetic testing also plays a role in determining nutritional needs, as certain gene variants can influence nutrient metabolism, leading to more effective nutritional strategies.

PHARMACOGENOMICS AND INJURY MANAGEMENT

Pharmacogenomics – the study of how genes affect an individual's response to medication – enables the customization of medication regimens for injury treatment and pain management. Understanding genetic variations in drug metabolism helps in selecting the most effective medications with minimal side effects, improving recovery outcomes and reducing downtime.

This approach ensures that medications and recovery programs are tailored to each athlete's genetic predisposition, improving performance and reducing the risk of injury [7].

NEUROCOGNITION

Improving neurocognition offers significant benefits to athletes by enhancing mental processing speed, attention, reaction time, and decision-making under pressure, which are key components of peak athletic performance.

As part of a precision medicine approach, these interventions are tailored to the cognitive profile of the individual athlete, enabling customized strategies that complement physical training. Cognitive improvements can help athletes better anticipate plays, adapt to changing environments, and focus in critical situations, which can lead to a competitive advantage in performance. This holistic strategy ensures that athletes are optimally prepared for success, not only physically but also mentally.

Numerous scientific studies have shown that any peripheral injury can be accompanied by changes in different parts of the brain. These findings also call for new, individualized prevention and rehabilitation strategies and allow for individualized preparation of athletes even before surgical interventions as prehabilitation. Tools such as SkillCourt are an example of the integration of neurocognitive training into precision sports medicine. SkillCourt uses interactive, data-driven technology to measure, analyze, and train visual perception, cognitive agility, and motor coordination in real time. By analyzing an athlete's performance on these tasks, coaches and physicians can identify cognitive strengths and deficits and take targeted measures to improve overall game performance. Integrating such tools into an athlete's training program supports injury prevention, rehabilitation, and sustained peak performance, bridging the gap between brain function and physical execution in sports [8 – 10].

ARTIFICIAL INTELLIGENCE AND PREDICTIVE ANALYTICS

The use of artificial intelligence (AI), especially machine learning techniques, enables sports medicine to precisely analyze large, complex data sets to predict injury risks and performance trends.

By processing data from various sources, such as wearables, training logs, and medical records, AI models can identify patterns and provide actionable insights that facilitate proactive interventions and strategic planning. Predictive analytics and machine learning are transforming injury prevention strategies in sports medicine by analyzing large amounts of data to identify patterns and trends that indicate an increased risk of injury. A well-thought-out data strategy is essential, because it is not the quantity, but the relevance, quality, and targeted use of data that determine the success of precision medicine applications.

CONCLUSION

The integration of precision medicine into professional sports represents a paradigm shift in athlete care and performance optimization. Through individualized approaches based on genetic insights, real-time monitoring, and personalized analysis, sports organizations can sustainably improve the longevity, performance, and overall well-being of athletes. All of the technologies mentioned are already available today and should be used in a targeted manner as part of a basic sports medical examination in order to comprehensively assess the initial situation and identify individual deficits at an early stage. On this basis, tailor-made intervention programs can be developed, which can be adapted through regular re-testing in order to respond dynamically to changes. With advancing technological development, the potential of precision medicine to revolutionize athletic performance and health management is becoming increasingly tangible.

The bibliography can be found in the article at www.sportaerztezeitung.com

KNEE OSTEOARTHRITIS

Protective effect of hyaluronic acid in steroid injections

LUKAS B. MOSER, MD[1,2,3], CHRISTOPH BAUER, PHD[1], PROF. STEFAN NEHRER, MD[1,2,3]

[1]CENTER FOR REGENERATIVE MEDICINE, DEPARTMENT OF HEALTH SCIENCES, MEDICINE, AND RESEARCH, KREMS

[2]DEPARTMENT OF ORTHOPEDICS AND TRAUMATOLOGY, UNIVERSITY HOSPITAL KREMS

[3]KARL LANDSTEINER UNIVERSITY OF HEALTH SCIENCES, KREMS

Gonarthrosis is one of the most common degenerative joint diseases. Intra-articular injections of corticosteroids offer effective and short-term symptom relief due to their potent anti-inflammatory effect. However, studies suggest that repeated steroid injections may be associated with an increased risk of cartilage damage and ultimately accelerated progression of osteoarthritis.

Parallel to steroid injections, hyaluronic acid injections have become established as a form of cartilage protection therapy due to their viscous supplementation effect. In recent years, the combined use of steroids and hyaluronic acid has become increasingly popular. The aim is to combine the rapid effect of steroids with the structural protective effect of hyaluronic acid.

THE DILEMMA IN PRACTICE: QUICK RELIEF – LONG-TERM DAMAGE?

The strong anti-inflammatory effect of cortisone is undisputed and often leads to rapid clinical improvement in osteoarthritis, but this short-term solution has a downside. Research has shown that corticosteroids trigger the programmed cell death of cartilage cells [1] and that repeated injections therefore carry the risk of cartilage damage and accelerated osteoarthritis progression [2].

This circumstance presents practitioners and patients with the challenge that symptomatic relief could mask progressive structural damage to the joint.

HYALURONIC ACID: MORE THAN JUST A LUBRICANT

This is where hyaluronic acid (HA) comes into play, whose effect goes far beyond that of a pure "lubricant" for viscosupplementation. HA is a biologically active molecule with multiple functions in the joint:

- Mechanical protection: HA improves the viscoelastic properties of the synovial fluid, thereby providing mechanical protection for the joint surfaces.
- Anti-inflammatory: HA modulates the inflammatory response, among other things by interacting with CD44 receptors on the cartilage cells, which inhibits the release of inflammatory mediators.
- Chondroprotection: HA directly protects the cartilage cells from the cell-damaging effects of steroids.

These properties make hyaluronic acid an ideal partner for counteracting the negative effects of corticosteroids.

PRECLINICAL AND CLINICAL EVIDENCE: WHAT DOES THE SCIENCE SAY?

Combination therapy is a promising approach, whose synergistic effects have already been proven in several studies. A randomized, double-blind, placebo-controlled multicenter study from 2018 involving 368 patients showed that the combined administration of cortisone and hyaluronic acid led to significantly faster and more pronounced pain relief than the respective single therapies [3]. While the cortisone effect dominated in the first few weeks, the hyaluronic acid component provided lasting improve-

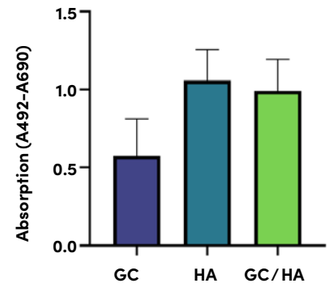


FIG. 1 Metabolic activity of cartilage cells after a single dose of glucocorticoid and hyaluronic acid, as well as a combination of both substances. Cartilage cells in which hyaluronic acid was present in the culture medium were more metabolically active.

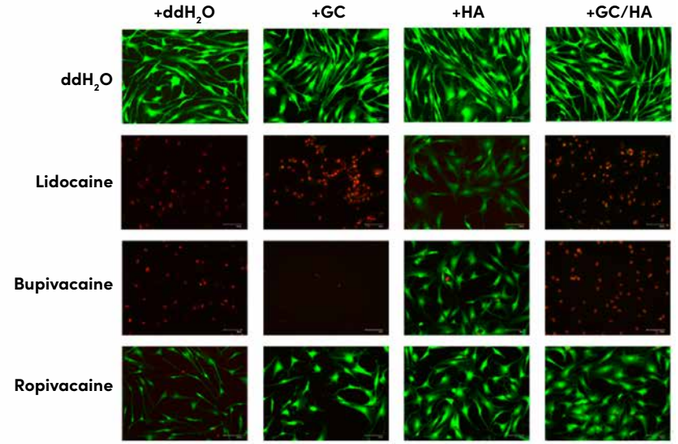


FIG. 2 These microscopic images from a live/dead stain impressively demonstrate the protective effect of hyaluronic acid (HA) on cartilage cells (green: living cells; red: dead cells). The results show that the local anesthetics lidocaine and bupivacaine are highly cytotoxic, while ropivacaine is significantly better tolerated. The key finding is that the addition of hyaluronic acid (+HA) alone almost completely counteracts the toxic effect of lidocaine and bupivacaine and ensures the survival of the cells. This protective effect is also visible in combination with a steroid (+GC/HA), albeit to a lesser extent than with pure HA administration.

LUKAS B. MOSER, MD

» Assistant Physician, Orthopedics and Traumatology
» Clinical Department of Orthopedics and Traumatology
» University Hospital Krems

DIPL.-ING. CHRISTOPH BAUER, PHD BSC BA

» Senior postdoctoral researcher – Master's degree in biotechnology & bioanalytics and PhD in regenerative medicine
» Postdoctoral researcher – Center for Regenerative Medicine
» University for Continuing Education Krems

PROF. STEFAN NEHRER, MD

» Specialist in orthopedics and orthopedic surgery
» Head of the Center for Regenerative Medicine and Department of Health Sciences, Medicine, Research at Danube University Krems, including professorship for tissue engineering + orthopedic department at Krems University Hospital
» A member of GOTS since 1992, he has served as its president and will be president of the 2025 GOTS Congress in Krems, as well as president of ÖGSMP (2022)

ment for up to 26 weeks. The well-tolerated combination thus appears not only to enable effective short-term symptom control, but also to cushion the potentially adverse effects of cortisone on cartilage through the protective effect of hyaluronic acid, offering longer-term benefits. These clinical results are supported by several preclinical studies. In an in vitro model, bovine osteochondral tissue cultures were treated with inflammatory mediators (interleukin-1β and interleukin-17) to simulate an osteoarthritis-like environment [4].

The combined use of hyaluronic acid and glucocorticoids showed a significantly stronger inhibition of cartilage-degrading enzymes such as matrix metalloproteinases and proinflammatory cytokines compared to single doses. At the same time, the vitality of the cartilage cells was better preserved and there was a reduction in structural cartilage degradation.

A similar study investigated the effects of combination therapy on arthritic human cartilage cells in a 2D cell culture [5]. Here, too, a significantly stronger chondroprotective effect was demonstrated, including reduced expression of cartilage-degrading genes and preservation of collagen type II synthesis and cell vitality. Another study also examined the effects of co-administration of hyaluronic acid with steroids and various local anesthetics in a human cell culture [6]. As can be seen in Figure 2, hyaluronic acid enhanced the positive effects of glucocorticoids while significantly reducing their cell-damaging effects, especially in combination with individual local anesthetics.

CONCLUSION

In summary, both clinical and preclinical studies suggest that the combination of hyaluronic acid with glucocorticoids represents a promising addition to conservative osteoarthritis therapy due to synergistic effects. The simultaneous use of both substances not only enables effective short-term symptom control, but also offers longer-term benefits by protecting the cartilage structure and cushioning the potentially adverse effects of steroids. For daily practice, this means that combined administration is a worthwhile, potentially safer, and more effective alternative to cortisone injections alone.

The bibliography can be found in the article at www.sportaerztezeitung.com

LATERAL LIGAMENT RUPTURE IN THE UPPER ANKLE JOINT

Diagnostics & Conservative Treatment

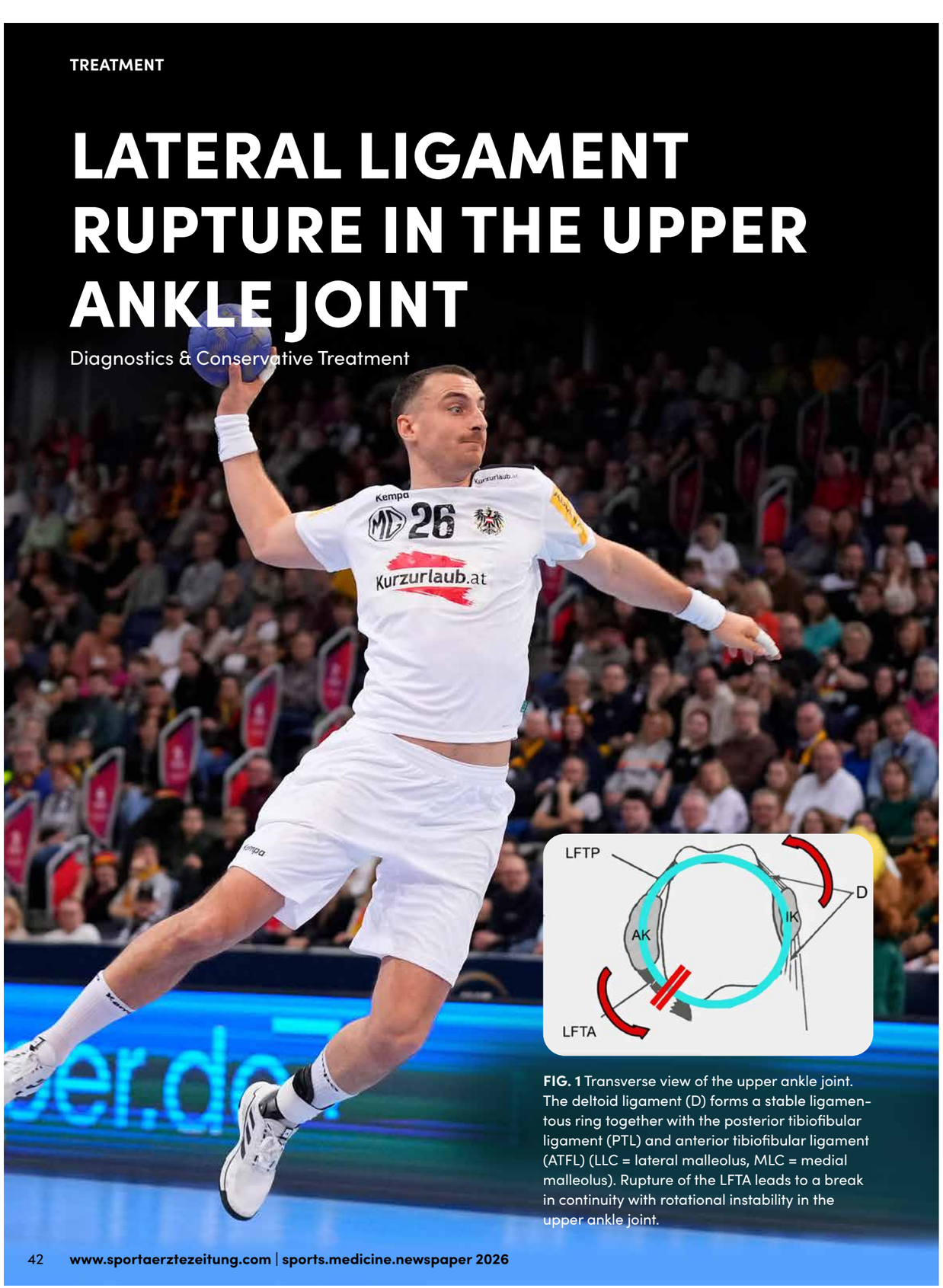


FIG. 1 Transverse view of the upper ankle joint. The deltoid ligament (D) forms a stable ligamentous ring together with the posterior tibiofibular ligament (PTL) and anterior tibiofibular ligament (ATFL) (LLC = lateral malleolus, MLC = medial malleolus). Rupture of the LFTA leads to a break in continuity with rotational instability in the upper ankle joint.

MELLANY GALLA, MD / FOOT SPECIALIST HANOVER, PRIVATE PRACTICE FOR FOOT AND ANKLE SURGERY

Lateral ligament injuries of the upper ankle joint (OSG) are one of the most common ligament injuries of the musculoskeletal system and particularly affect people who are active in sports. Although lateral ligament ruptures often lead to persistent instability, post-traumatic osteoarthritis, and significant impairment of athletic performance if treated inadequately, t his lesion is often considered a "minor injury" by both those affected and those treating them. Data show that only about half of all those affected undergo further diagnostic testing after an OSG sprain [1].

PREVALENCE, INJURY PATTERNS, AND CLINICAL RELEVANCE

The incidence of lateral ankle sprains in the general population is approximately one injury per 10,000 people per day, with the lateral ligament structure affected in 85 % of cases. Young adults aged 15 – 35 are particularly affected. This rate is significantly higher in physically active populations, particularly in sports with a high jumping and pivoting load profile, such as basketball, handball, volleyball, and soccer [2 – 4]. The classic injury pattern, consisting of a combination of supination / inversion trauma with combined plantar flexion, often leads to a tear of the lateral capsular ligament apparatus at the upper ankle joint (USG). The most common injury (approx. 85 %) is to the anterior talofibular ligament (ATFL), followed by the calcaneofibular ligament (CFL) (52 – 75%) and, less frequently (< 10 %), the posterior talofibular ligament (PTFL).

The lateral capsular ligament apparatus of the OSG not only serves as a stabilizer against anterior talar translation and inversion in the upper ankle joint. The anterior and posterior fibulotalar ligaments, together with the anterior and posterior portions of the deltoid ligament, form a firm ligamentous ring in the transverse plane of the malleolar fork (Fig. 1). Injury to the lateral structures thus leads to complex rotational instability. Epidemiological data show that 20 – 40 % of patients develop persistent symptoms such as pain, impingement syndromes, and functional and structural chronic instabilities after initial ankle sprain [5]. In athletes, a recurrence rate of up to 34 % has been reported if no targeted neuromuscular and proprioceptive rehabilitation is performed [6]. The risk of a repeat ankle injury is five times higher after a lateral ligament rupture [7]. Long-term clinical studies show that even seemingly "simple" lateral ligament ruptures significantly increase the risk of post-traumatic ankle osteoarthritis, especially in cases of residual instability or incomplete rehabilitation. Microinstabilities and repeated subtle sprains lead to chondral damage, which can result in degenerative joint destruction [5, 6].

DIAGNOSIS

Clinical examination forms the basis of the diagnosis. Targeted systematic palpation of the typical pain points (LFTA, LFC, anterior syndesmosis, peroneal tendons), the anterior drawer test, and the talar tilt test (inversion test) are used to test mechanical joint stability. Immediately after the acute event, swelling, pain, and muscle guarding significantly limit the informative value of these tests. A reevaluation after 3 – 4 days, as advocated by Niek van Dijk, enables a much more reliable assessment with improved diagnostic sensitivity and specificity [8].

Conventional X-ray diagnostics are not indicated if a fracture is not suspected. In particular, static images of the ankle joint do not provide reliable information in the acute injury situation. Ultrasound has proven to be a diagnostic tool for imaging ligament continuity, hematoma extent, and joint effusion volumes. Radiological studies have shown that the sensitivity of sonographic examination is significantly higher than that of MRI for imaging ruptured LFTA (94 – 100 vs. 67 – 87) and LFC (94 vs. 40 – 47) [9]. The specificity is approximately equivalent. Ultrasound thus enables rapid and cost-effective confirmation of the diagnosis and prompt initiation of treatment. Magnetic resonance imaging (MRI) remains indicated in cases of complex injury patterns, suspected concomitant pathologies such as osteochondral talus lesions, syndesmotic injuries, or in the absence of clinical improvement [10].

CONSERVATIVE THERAPY AND FUNCTIONAL TREATMENT CONCEPT

According to S2k guideline 187 – 025, conservative therapy is considered the gold standard for lateral ligament rupture without accompanying injury, provided that there are no complete ruptures of all three lateral ligaments with pronounced mechanical instability.

The main therapeutic goals are rapid pain reduction, edema reduction, restoration of physiological joint mobility, and regaining active-dynamic stability while minimizing the recurrence rate. Instead of complete immobilization and relief, early functional therapy with a semi-rigid ankle orthosis, which limits inversion and supination and reduces plantar flexion, is considered the standard. Several studies show that early functional treatment with early mobilization in the orthosis, full weight-bearing after pain and swelling have subsided, and accompanying physical therapy leads to a significantly faster return to sport, less muscle atrophy, and less joint stiffness than prolonged immobilization [11, 12]. Modular ankle orthoses have been available on the market for several years. The underlying

MELLANY GALLA, MD

» Specialist in orthopedics and trauma surgery and certified foot surgeon
» Head of the Foot Center at Helios Klinikum Hildesheim & foot specialist in Hanover, private practice for foot and ankle surgery
» Former president and honorary advisor to the Society for Foot and Ankle Surgery (GFFC)

concept of this treatment is the gradual reduction of the orthosis's stabilization from the acute stage to the rehabilitation phase, adapted to the ligament healing phases. Modular systems allow for initially higher lateral guidance in the acute phase with a gradual reduction in stability over time, which supports early functional mobilization while protecting against renewed inversion trauma. This is intended to support improved alignment of the collagen fibrils in the regenerated tissue as well as improved proprioceptive stimulation [13].

PROPRIOCEPTIVE AND NEUROMUSCULAR TRAINING – THE FOCUS OF RECURRENCE PREVENTION

Proprioceptive and neuromuscular training is the most essential component of rehabilitation, as functional instability is not exclusively structural, but is also caused by disturbed afferent feedback and delayed peripheral muscle response patterns. Randomized controlled trials (RCTs) [3, 12, 14, 15] show that 8-12-week progressive proprioceptive programs (wobble board, balance pad, standing on one leg on unstable surfaces) reduce the recurrence rate of sprains by 35 – 41 % and significantly improve functional stability scores. Meta-analyses [16, 17] of more than 30 RCTs combined show a significant reduction in the risk of re-rupture by 39 – 47 % through structured sensorimotor training (level 1a evidence). The S2k guideline 187 – 025 recommends starting proprioceptive training as early as week 2 – 3 after the trauma, i.e., already in the orthotic treatment phase, with a progressive increase until week 12. The focus is on balance exercises, agility skills, reactive changes of direction, and sport-specific jump-landing sequences for high-level athletes. Effective exercises include standing on one leg on an unstable surface, the Star Excursion Balance Test (Fig. 2), lateral hop tests, and multidirectional jumps with defined landing patterns [18].

FIG. 2 Star Excursion Balance Test (SEBT)

BIOLOGICAL REGENERATIVE ADJUVANTS: PRP, HYALURONIC ACID, AND ESWT

The use of platelet-rich plasma (PRP) in ligament ruptures aims to increase local growth factor concentrations to optimize ligament healing. Initial clinical studies report some positive effects on pain and subjective stability [19 – 21]. However, the current data are heterogeneous. Large-scale RCTs specifically on acute lateral OSG ligament ruptures are limited. The S2k guideline did not issue a strong recommendation for PRP in acute ligament injuries. Hyaluronic acid injections are mainly used to modulate intra-articular inflammatory processes in soft tissue after an outer ligament rupture. Individual studies report faster pain reduction and a quicker return to sports [21, 22]. There is currently no consistent evidence of a benefit in accelerating ligament healing or reducing recurrent instability. At most, a complementary role may be considered in cases of associated chondral lesions. Preclinical models have demonstrated improved ligament regeneration, angiogenesis, and matrix remodeling with extracorporeal shock wave therapy (ESWT). No clinical data are available for this therapeutic measure in acute lateral ligament rupture, so there is no evidence-based recommendation. ESWT can be used as a selective option for reducing pain and swelling.

CONCLUSION

Consistent early functional therapy with adequate 6-week orthotic treatment, structured physical therapy, and intensive proprioceptive training form the main pillars of treatment. Proprioceptive training in the early phase and after removal of the orthosis is an essential factor in preventing functional instability and re-rupture.

The bibliography can be found in the article at www.sportaerztezeitung.com

TRAINING

ISOLATED RESISTANCE TRAINING OF THE LUMBAR EXTENSORS

Multimodal or standalone approach – effectiveness in chronic, radiculopathic back pain

BRUNO DOMOKOS / POWERSPINE GMBH & INSTITUTE FOR SPORTS SCIENCE, UNIVERSITY OF WÜRZBURG

CHRISTOPH SPANG, PhD / PRIVATE SPINE CENTER DR. ALFEN WÜRZBURG

Chronic back pain continues to be a widespread clinical problem. Innovative therapeutic approaches that focus on strengthening the deep back muscles, especially the multifidus muscle (MF), are becoming increasingly important. Isolated lumbar extension resistance exercise (ILEX) enables targeted activation and strengthening of the lumbar spine muscles and is being used more and more frequently, especially in German-speaking countries.

Although the clinical success of ILEX therapy has been known for some time, the underlying changes in muscle morphology and function have not yet been sufficiently investigated. It is also unclear what role ILEX plays in multimodal therapy programs and to what extent the method can be used effectively and safely for specific spinal pathologies – as opposed to nonspecific back pain.

In a recent study published in October 2025 in the renowned journal Scientific Reports, 58 patients with chronic back pain were examined. All had specific spinal complaints, and the majority had radicular symptoms radiating to the lower extremities or relative indications for surgery. Participants could choose between a standalone ILEX program and a multimodal approach that also included manual therapy and general strengthening exercises (e. g., latissimus pull and abdominal crunch on equipment, as well as back and core training on the cable pulley). The program consisted of 25 sessions over a period of 16 weeks. The intensity and range of motion were individually adjusted to the symptoms and diagnosis, based on a systematic training protocol with gradual load increase. The primary outcome parameters were muscle thickness and cross-sectional area of the MF, as well as echogenicity, an indicator of muscle quality. In addition, pain intensity, disability, and health-related quality of life were regularly recorded, as was the maximum strength of the spinal extensors.

BRUNO DOMOKOS, PhD cand.

» Sports scientist (B.A., M.Ed.)
» Responsible for quality management and scientific development at Powerspine GmbH
» Scientist and expert in deep muscle diagnostics at the Institute for Sports Science, University of Würzburg

CHRISTOPH SPANG, PhD

» Neurobiologist (university degree) and sports scientist (university degree)
» Scientist in the field of chronic pain and tissue changes & senior training therapist at the Dr. Alfen Würzburg Private Spine Center
» Managing director of the Society for Medical Strengthening Therapy (GMKT-D)

RESULTS

The results showed clear therapeutic effects in both groups: pain and functional limitations decreased significantly, quality of life increased, and the maximum strength of the back muscles improved significantly.

Particularly noteworthy was the increase in the cross-sectional area of the MF, which was accompanied by a parallel increase lumbar strength. However, no changes in echogenicity could be detected. It is also interesting to note that changes in almost all parameters were already apparent in the early stages of therapy (after three weeks). A comparison between ILEX training alone and the multimodal approach showed no significant differences in terms of clinical improvements and the increase in maximum strength and cross-sectional area of the MF. Although the curves flattened towards the end of the intervention period, the data suggest that the development was not yet complete and that a longer duration of therapy could lead to further progress.

CONCLUSION

Targeted ILEX training is an effective measure for reducing pain, restoring function, and improving quality of life in chronic back pain and muscle size – both as a standalone program and as part of multimodal therapy approaches. The linear progress in muscle cross-sectional area and strength underscores the importance of continuous, individually tailored therapy for sustainable results. This study is the first to demonstrate the efficacy and safety of this specific method for specific spinal complaints with relative indications for surgery. Further studies on specific clinical pictures of the lumbar and cervical spine are currently underway or already in the planning stage.

Original paper: Isolated lumbar extension exercise alone or in a multimodal program for low back pain and radiculopathy: a non-randomized controlled trial

Bruno Domokos, Julia Domokos, Gustav Andersson, Stefan Mannel, Linda May Weigel, Horst Josef Koch, Birgit Wallmann-Sperlich, Christoph Raschka & Christoph Spang

ClinicalTrials.gov Identifier NCT06890052 (03/20/2025) https://clinicaltrials.gov/study/NCT06890052?cond=NCT06890052%20&rank=1

TYPE 2 DIABETES MELLITUS

Nutrition and exercise – the potential of targeted combinations

PROF. CHRISTIAN BRINKMANN, PhD /
IST UNIVERSITY OF APPLIED SCIENCES

Diabetes mellitus (DM) is an alarming global health problem [1]. The disease is often associated with various comorbidities and secondary complications, which, in addition to the suffering of patients, also leads to a considerable economic burden [2]. According to estimates, approximately 589 million people worldwide were affected in 2024, and this number is expected to rise dramatically in the coming years [3].

In Germany, at least 9 million people currently live with DM [4]. Over 90 % of these patients have type 2 DM. Lifestyle changes can have multiple positive effects for them, including improved glycemic control [5]. In some cases, especially when the disease is not yet advanced, these changes can even lead to remission of the disease [6]. Therefore, a healthy diet and regular exercise are highly recommended as effective treatment methods [7].

DIETS AND EXERCISE PROGRAMS

Various diets are being discussed for improving blood sugar control (HbA1c), insulin sensitivity, or beta cell function, including low-carbohydrate diets, low-fat diets, a Mediterranean diet, and various energy-restricted diets. There is still disagreement about which diet is most effective for managing type 2 DM [8]. In addition to changes in dietary habits, regular physical exercise is an established approach to improving the health of people with type 2 DM [9]. The question arises which diets and exercise programs can best be combined to maximize positive health effects in this patient group.

In a recently published systematic review, we included studies that combined different diets with the same exercise program in people with type 2 DM [10].

Energy-restricted low-carb diets with either high-fat or high-protein content showed superior effects in terms of some outcomes (medication dose, lipid profile, well-being) compared to diets with a higher carbohydrate content (in endurance or strength plus endurance training at moderate intensities). Other diets in direct comparison and in combination with exercise still need to be researched. In calorie-restricted diets, as well as in treatment with incretin mimetics for weight loss, targeted exercise interventions (especially strength training programs) can significantly reduce or even prevent the loss of muscle mass (which usually accompanies weight loss through calorie restriction) [11]. This is an important point, especially for people with type 2 DM, because a large proportion of the absorbed glucose is taken up by the muscles. In this case, more muscle mass means a higher likelihood for faster and more effective glucose clearance. Adequate protein intake is also crucial for optimizing the effects of strength training [12]. Another promising approach is the targeted combination of superfood consumption with exercise. For example, the consumption of certain foods, such as those with a high (poly)phenol content and correspondingly strong antioxidant effect (such as aronia berries), can have positive effects on chronic inflammation and glucose homeostasis in people with type 2 DM [13]. When it comes to exercise, timing is crucial.

Exercise-induced transient increases in oxidative stress are important for triggering training adaptations. Consuming foods with strong antioxidant properties too close to the time of exercise could therefore have a negative effect on long-term adaptations [14]. Exercise can also enhance the regeneration-promoting and anabolic effects of some superfoods. In a recent pilot study, we investigated the effects of daily consumption of a red berry juice with a high aronia content during a strength/endurance training intervention in individuals with prediabetes. After just two weeks, benefits for muscle mass were already evident compared to placebo [15].

CONCLUSION AND OUTLOOK

For people with type 2 DM, lifestyle interventions that integrate both diet and exercise hold significant potential. Low-carb diets combined with exercise currently promise the most positive effects in direct comparison with classic macronutrient distribution. However, it should be noted that there currently only few studies investigating the combined effects of other diets and exercise in this particular patient group (especially those providing direct comparisons of different diets alongside the same exercise intervention). When aiming for weight loss, dietary or pharmacological measures should be accompanied by strength training to reduce or even prevent the loss of muscle mass. An adequate intake of protein is important in this context. Consuming certain superfoods and exercising can also be particularly effective for some outcomes. Further studies are needed to investigate the combined effects of diet and exercise in people with type 2 DM.

The bibliography can be found in the article at www.sportaerztezeitung.com

PROF. (FH) PD CHRISTIAN BRINKMANN, PhD

» Sports scientist and biologist
» Professor of Fitness and Health at IST University of Applied Sciences Düsseldorf, Head of the Working Group "Integrative and Experimental Sports and Exercise Therapy in Diabetes Mellitus and Obesity" at the German Sport University Cologne
» Research on lifestyle interventions, metabolism, and wearable technologies

PHYTOSHAKE – ORIGINS AND PROSPECTS

Phytogenic nutrition, phytopharmaceuticals, phytochemicals

ROBERT ERBELDINGER

MATTHIAS ROßBERG, DMD

PD FELIX POST, MD

The Phytoshake product line represents a new class of functional foods that specifically target preventive and cellular protective mechanisms. It was initiated by Insumed GmbH as the result of several years of scientific research by Robert Erbeldinger and his team, who compiled key findings in nutritional medicine.

The currently available variants, Phytoshake Classic, Phytoshake Berry Deluxe, and Phytoshake Cardiobalance, have been an important part of modern nutritional medicine and integrative prevention since their introduction in 2022.

DEVELOPMENT AND EXPANSION OF THE CONCEPT

The development of the first Phytoshake Classic was largely inspired by findings from the research of Prof. Mehdi Shakibaei (LMU Munich; example references: DOI: 10.1016/j.aanat.2005.06.007; DOI: 10.3390/ijms23031695; DOI: 10.1186/ar2850; DOI: 10.3390/ijms 13044202; DOI: 10.1016/j.biotechadv.2018.03.014; DOI: 10.3390/ijms22147645; DOI: 10.1074/jbc.M111.256180; DOI: 10.1186/ar4393). For decades, his research group has been a global leader in basic research on the effects of phytogenic nutrients and phytopharmaceuticals, especially secondary plant compounds (phytochemicals), with a focus on inflammation modulation and its preventive benefits. The combination of these key scientific findings and Robert Erbeldinger's innovative spirit led to the development of Phytoshakes and thus also to the transfer of preclinical results into application-oriented sports medicine, which is referred to as a translational approach in the field of "targeted nutrition."

After the initial establishment of the Phytoshake concept and due to the growing importance of a natural, polyphenol-rich diet (example references: Epigenetic efficacy of curcumin; Resveratrol, sportärztezeitung 04 / 23), the second Phytoshake variant, Berry Deluxe, was developed. The extended application of Phytoshake Berry Deluxe in nutritional dentistry was scientifically supported by Dr. med. dent. Matthias Roßberg (nutritional dentistry & prophylaxis, sportärztezeitung 01 / 24; holistic oral health, sportärztezeitung online).

The product line was expanded in 2025 with Phytoshake Cardiobalance, which was developed under cardiological and medical consultation with PD Dr. med. Felix Post (example reference: Oats and heart health, sportärztezeitung 02 / 25). Insumed GmbH is currently developing a fourth Phytoshake product in collaboration with the sportärztezeitung (sports medicine journal). This product is intended to transfer nutritional medicine concepts to sports medicine and muscle regeneration, based on current research and the specific requirements of performance-oriented, preventive supplements.

MODERN PHYTOGENIC NUTRITION

The Phytoshake product line promotes a plant-based diet with a special focus on specific "soluble" fiber to support modern phytogenic nutrition with high-quality proteins in the medical context of "targeted nutrition & diet." This contributes to promoting the topics of "healthy aging" and "healthy diet/eating." Further information can be found at JAMA Network (example reference: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2834202) and PubMed (example reference: https://pubmed.ncbi.nlm.nih.gov/30638909/).

We are continuously developing our solutions in close collaboration with medical researchers and clinicians to ensure practical application in sports medicine and beyond. Further current work in the context of nutritional medicine and dietary supplements will be continuously integrated below: A recent paper by Dr. med. Christine Wild-Bode (LMU Munich): Collagen and enzymes (sportärztezeitung 02 / 25) as well as work that is now gaining relevance from the sportärztezeitung: Phytopharmaceuticals and phytogenic nutrition (01 / 23); Inflammation inhibition & regeneration optimization (01 / 20); Nutrition as therapy (02 / 17).

A study by Klümpen et al. 2026 points to the cholesterol-lowering effect of oats and metabolic syndrome. The study highlights the potential of high-dose oat diets as a sustainable and cost-effective therapeutic option for improving lipid profiles and treating metabolic disorders associated with overweight and obesity. This confirms the development and spread of the medical concept of targeted nutrition as a medical nutritional therapy.

In addition, please refer to the educational video by Dr. med. Klaus Pöttgen on anti-inflammatory nutrition and proteins in orthopedics and competitive sports:

EXPANSION MARCH 2026

"The precision of Phytoshake lies in the clarity of its indication – anti-inflammatory!" (Matthias Roßberg, DMD 2026).

Phytoshake is a co-therapeutic agent in a medical context and therefore not a convenience product for everyday use or a luxury food. It was developed in 2022 for curative, indication-specific use. The goal: cyclical intake for therapeutic and prophylactic purposes.

To clearly differentiate itself, Phytoshake consistently avoids any added sweeteners, sugar (see also: Schooling 2014 / Michaelsson et al. 2014), functional sugars, or flavor-modulating additives so as not to impair the natural effect of the ingredients. The product focuses exclusively on the medical effect within the framework of targeted nutrition.

"The strength of the Phytoshake concept is that each Phytoshake addresses a specific health target. This is targeted nutrition with precision, not a shotgun approach."(PD Felix Post, MD 2026).

USE OF ORTHOSES FOR KNEE OSTEOARTHRITIS

A multicenter, randomized controlled trial involving 466 adults aged 45 years or older with knee osteoarthritis examined whether a combination of counseling, written guidance, exercise instructions, and a custom-fitted knee brace with adherence support (AIE+B) yields better outcomes than counseling and exercise alone (AIE). The AIE+B group received orthoses that stabilized the affected knee compartment (patellofemoral, tibiofemoral, or neutral), as well as a follow-up appointment and brief motivational interviews. The primary outcome measure was the KOOS-5 score at 6 months. The AIE+B group showed a significant but moderate improvement in the KOOS-5 compared to the control group (adjusted mean difference 3.39 points; 95 % CI 0.96 to 5.82; effect size 0.24). Pain relief was particularly pronounced (KOOS Pain difference 6.13 points; 95 % CI 3.36 to 8.91; effect size 0.39). The benefits gradually declined over 12 months. Side effects were minor and expected. Thus, the use of a custom-made knee orthosis as a safe intervention offers an optional treatment option for improving quality of life in patients with knee osteoarthritis.

Holden MA, Nicholls E, Abdali Z, Birrell F, Borrelli B, Callaghan M, Dziedzic K, Felson D, Foster NE, Halliday N, Ingram C, Jinks C, Jowett S, Peat G; PROP OA trial team. Provision of knee bracing for knee osteoarthritis (PROP OA): multicentre, parallel group, superiority, statistician blinded, randomised controlled trial. BMJ. 2026 Jan 26;392:e086005. doi: 10.1136/bmj-2025-086005. PMID: 41587822; PMCID: PMC12829467.

BONE–BRAIN AXIS: THE CO-OCCURRENCE OF DEPRESSION AND OSTEOPOROSIS

Depression and osteoporosis frequently occur together, particularly in older adults, and represent a growing clinical challenge. This study summarizes the current state of knowledge regarding the bone–brain axis, a complex neuroendocrine and immunological communication pathway between the skeletal and central nervous systems. Mechanisms stemming from depression, such as chronic activation of the hypothalamic-pituitary-adrenal (HPA) axis, overactivity of the sympathetic nervous system, and persistent inflammation, lead to an imbalance in bone metabolism, exacerbated by behavioral factors and the side effects of certain antidepressants. At the same time, bone-specific signaling molecules such as osteocalcin, lipocalin-2, and extracellular vesicles cross the blood-brain barrier and modulate brain functions, such as hippocampal neurogenesis and serotonin signaling pathways, which are crucial for mood regulation. This communication is also influenced by circadian rhythms and genetic factors. Clinically, studies show that patients with depression often have reduced bone density and an increased risk of fracture, while patients with osteoporosis exhibit increased depressive symptoms. Therapeutically, these findings open up new avenues: neuromodulation using transcranial magnetic stimulation, individually tailored exercise therapy, and novel medications that specifically influence bone signaling could address both depression and osteoporosis simultaneously. The study advocates for an integrated systemic treatment approach that transcends traditional disciplinary boundaries and improves the health of vulnerable older adults.

Li P, Gao Y, Zhao X. The Bone-Brain Axis: Novel Insights into the Bidirectional Crosstalk in Depression and Osteoporosis. Biomolecules. 2026 Jan 31;16(2):213. doi: 10.3390/biom16020213. PMID: 41750283; PMCID: PMC12938012.

COMBINING SHOCKWAVE THERAPY AND DIETARY SUPPLEMENTS FOR TENDINOPATHIES

In a comparative study involving 90 patients, divided into three groups for shoulder tendinopathy, lateral epicondylitis, and Achilles tendinopathy, one group in each group was treated with extracorporeal shockwave therapy (ESWT) plus Tendisulfur Forte, while a control group received ESWT alone. Functional scores (UCLA Shoulder Score, Mayo Elbow Score, VISA-A for the Achilles tendon) as well as pain intensity (VAS) were assessed at multiple time points up to 60 days after the start of treatment. The group receiving the dietary supplement showed significantly greater functional improvements (e.g., $p = 0.0002$ for the UCLA score after 60 days), faster pain relief (significant starting on day 7 for epicondylitis, $p = 0.0024$), and a marked reduction in NSAID use (nearly 98 % NSAID-free after 60 days). Ingredients in the supplement, such as MSM, hydrolyzed collagen, vitamin C, Boswellia serrata, and curcumin, work synergistically to reduce inflammation and stimulate tendon healing. ESWT additionally enhances the bioavailability of the supplement through increased neovascularization. In addition to the good safety profile with no side effects, the study supports combination therapy as an efficient and well-tolerated approach for treating common tendinopathies with a significant reduction in pain medication.

Vitali M, Naim Rodriguez N, Pironti P, Drossinos A, Di Carlo G, Chawla A, Gianfranco F. ESWT and nutraceutical supplementation (Tendisulfur Forte) vs ESWT-only in the treatment of lateral epicondylitis, Achilles tendinopathy, and rotator cuff tendinopathy: a comparative study. J Drug Assess. 2019 May 3;8(1):77 – 86. doi: 10.1080/21556660.2019.1605370. PMID: 31105990; PMCID: PMC6508015.

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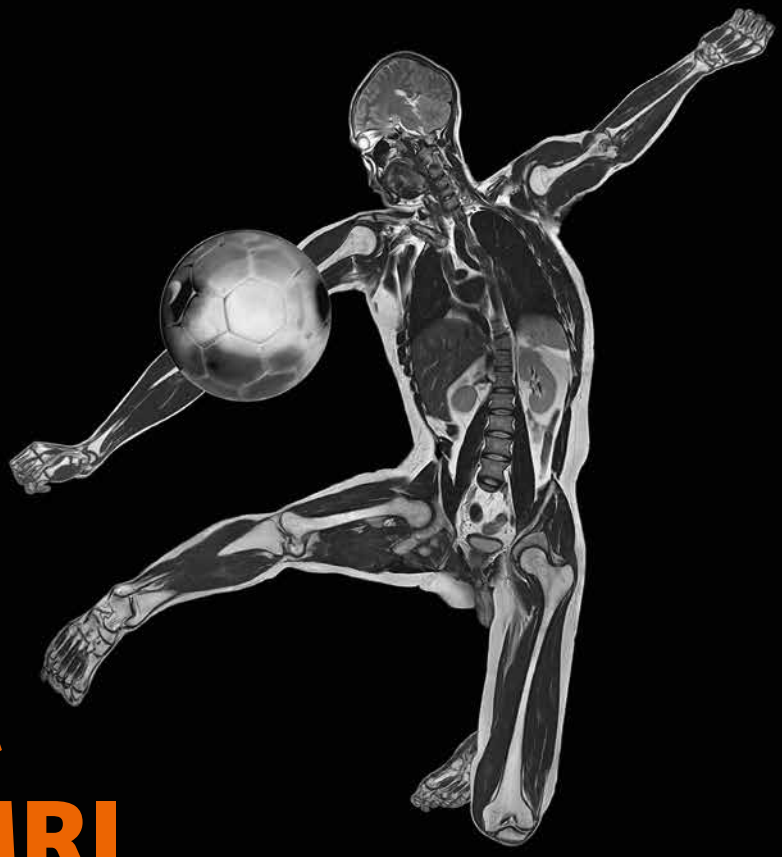

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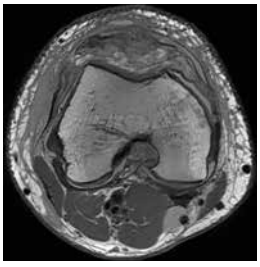

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