



Latest report: “Healing explosions: Revolution in shock wave therapy”

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Discoveries in neurology, cardiology and oncology reveal the transformative potential of shockwaves

Since the early 1980s, the use of shockwaves in medicine, first known through lithotripsy in urology and later in orthopaedics, has become well established. Traditionally associated with these disciplines, however, advancing research is now opening up a far wider range of applications – particularly in neurology, cardiology and, remarkably, oncology. These developments reveal the extraordinary **high regenerative potential of shockwave therapy**, which goes far beyond previous areas of application and is changing the landscape of medical treatment methods forever.

In a detailed documentary, which was broadcast on Wednesday, February 7, 2024, by **ORF III** under the title “**Healing Explosions – Revolution in Shockwave Therapy**”, the Austrian broadcaster provided a comprehensive insight into the evolution, therapeutic benefits, underlying mechanisms of action and innovative fields of application of shockwave therapy. It also shows how the close and constructive collaboration between physics and medicine can lead to effective and ground-breaking therapeutic methods.

Main topic: The amazing regenerative power of shock waves

The core of the findings: It is above all the **regenerative capacity of shock waves** that pushes the boundaries of what is medically feasible and therefore has the potential to fundamentally revolutionize medicine.

In the following review of the documentary, we focus primarily on the medical aspects, the latest scientific findings and the evident proof of the effectiveness of shockwave therapies due to the wealth of information on history and technical development.

From military technology to the art of healing: the pioneering work of shockwave therapy

The discovery of shock waves and their utilization in medicine is a fascinating story that has its origins in a military context. Originally researched for its destructive power, the shockwave found a pioneering application in healthcare: lithotripsy. This procedure, introduced in the 1980s, revolutionized the treatment of kidney stones by providing a non-invasive method of fragmenting the stones using focused shock waves. This transformed what was once a destructive force into a healing tool.

Shockwaves in orthopaedics: the rise of extracorporeal shockwave therapy

In orthopaedics, extracorporeal shock wave therapy (ESWT) is at the forefront of non-invasive treatment methods using shock waves. Since the late 1990s, ESWT has used high-energy shock waves to provide effective pain relief and promote the healing of tendon and muscle injuries. As a leading technique, ESWT has proven effective in treating conditions such as tennis elbow, heel spurs and in aiding bone regeneration by stimulating the body's own tissue repair mechanisms. This form of therapy is characterized by its ability to activate the body's natural healing power, making it a key option among the various shock wave treatments in orthopaedics

While extracorporeal shockwave therapy is already established in orthopaedics, spectacular new horizons are now opening up in cardiology, neurology and possibly also oncology.

Enormously effective: shock waves have recently also been applied to the open heart



Priv.-Doz. Dr. med. Johannes Holfeld, Medical University of Innsbruck – Image source: ORF.at

“The mechanism of action that we have discovered in the laboratory does not only apply to the heart, but is the same in all tissues and all organs,” explains Priv.-Doz. Dr. Johannes

Holfeld from the Medical University of Innsbruck, who habilitated on cardiac shock waves, explains in the documentation: "At the end of an operation, when the patient is still connected to the heart-lung machine – that's the safety net – the small transducer is moved around the heart and the previously defined, diseased areas are treated."

Breakthrough in research: premature end to a study reveals extraordinary effectiveness of shockwave therapy

In the associated study, the Innsbruck researchers achieved a "truly spectacular result", according to Johannes Holfeld – a result that could not previously be achieved with any other method. The study was even terminated prematurely with the approval of the ethics committee. However, this was not due to a lack of effectiveness of the therapy – quite the opposite:

The shockwave works so extraordinarily well on the heart that patients who had only received sham treatment as part of this placebo-controlled, blinded study should no longer be deprived of the real treatment! The patients included in the study were all completely untreated with medication.

This is a rare occurrence in medical research, which implies the potential that the shock wave will have for cardiology in the near future: "We are literally waking up the heart muscle as if from hibernation," summarizes study leader Holfeld, "by ingrowing new blood vessels thanks to the shock wave. This allows us to actually regain relevant areas of the heart muscle."

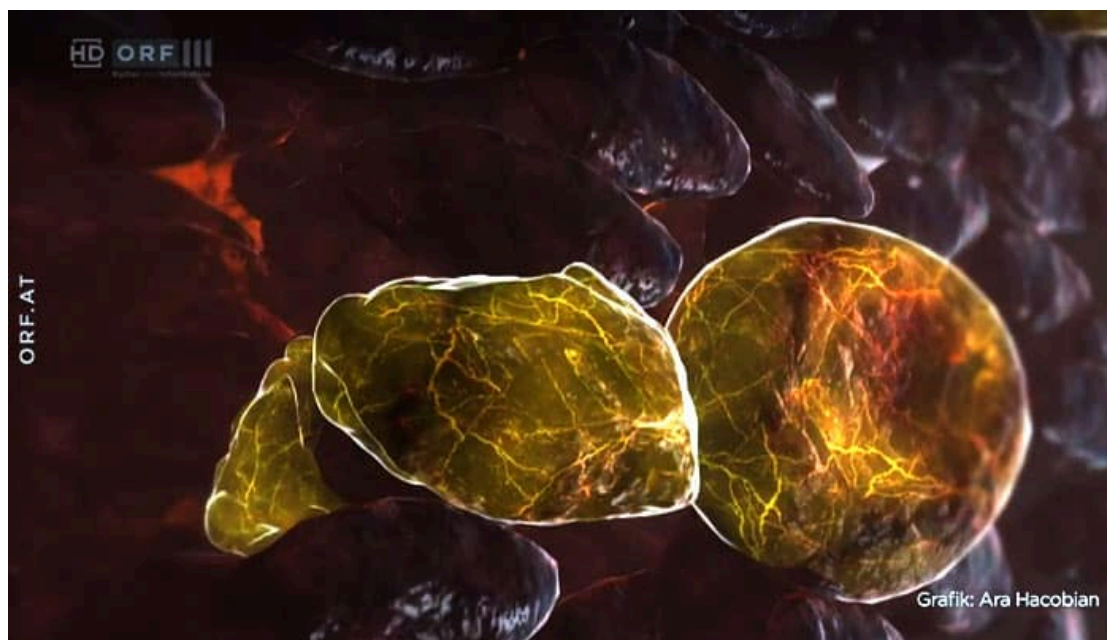
Shock wave mechanisms of action: mechanotransduction processes largely decoded

Shock waves are a physical phenomenon that has slowly found its way into medicine and into influencing processes in the body via many detours. Because the shock wave had its origins in the crushing of stones, it was long thought that the increasingly evident regenerative effects of this technology had to do with a kind of micro-trauma. This was a false assumption, as it has since turned out.

"The shock wave was in the voodoo corner for a very long time," explains Dr. Wolfgang Schaden, a doyen of shock wave research and application in the documentary. This had to do with the fact that the mechanisms of action of shock waves were not fully understood in the past. As a result, shock wave therapy was met with a great deal of skepticism for a long time. Only in recent years has science begun to understand the mechanism of action behind it, reports the ORF documentary.

In what is known as mechanotransduction, mechanical stimuli in the body are converted into cell activity and the shock wave impulse can develop a healing effect: Nerve regeneration and wound healing, for example, can be extremely accelerated. Today, the understanding of mechanotransduction forms the basis of further scientific research (more information on shock waves and mechanotransduction: [Transcranial Pulse Stimulation \(TPS\) – What are shock waves?](#)).

The research group led by Johannes Holfeld at the University of Innsbruck has also begun to investigate the effects of shock waves at cellular level. In Innsbruck, it has now been discovered that the mechanical impulse of the shock wave shears off small bubbles from the cell surfaces. Since a cell is not hard and rigid, but has a liquid membrane, the bubbles detach without damaging the cell.

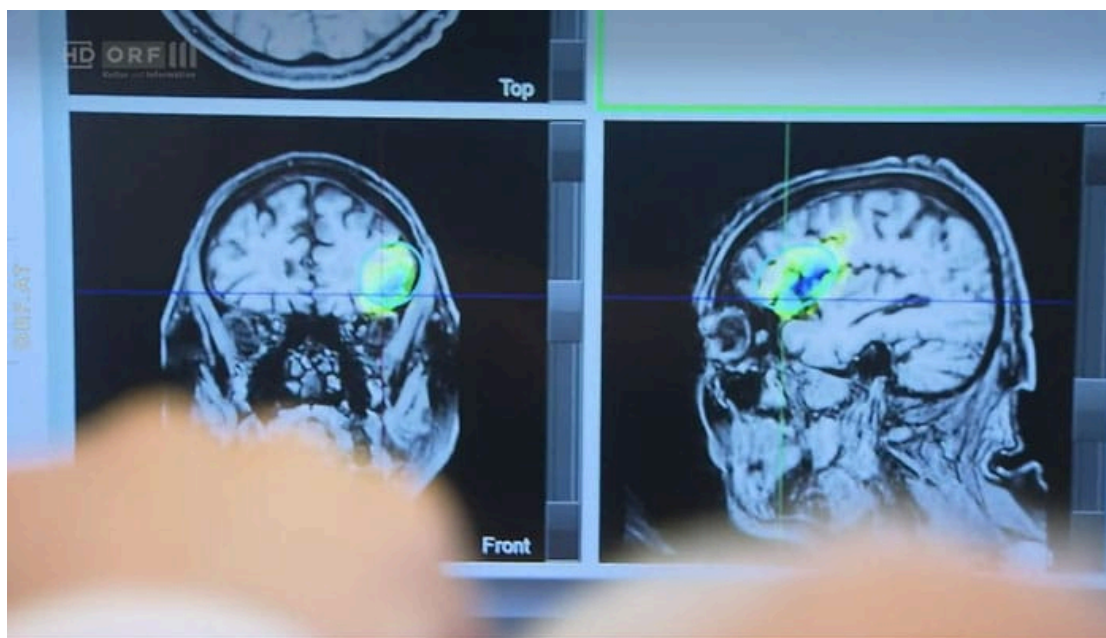


Shock wave detaches vesicles from the cell surface – Activation of the immune system – Image source: ORF.at

These vesicles in turn transmit the neighboring cell to a receptor of the innate immune system, namely the toll-like receptor 3, which is required to initiate all the regenerative effects in the body. In addition, the results of basic research are providing increasing evidence that the shock wave triggers the body's own stem cell therapy.

Where is shockwave therapy heading? Use in neurology and oncology

The positive effects of shockwaves on the nervous tissue in the brain have now also been researched and are known to be used successfully with transcranial pulse stimulation (TPS) for Alzheimer's dementia, other forms of dementia, Parkinson's disease and also for depression, autism and attention deficit hyperactivity disorder (ADHD). Numerous clinical studies and investigations that have already been published or are in progress are increasingly underpinning the effect of TPS that clinics and doctors are experiencing with their patients in their practices.



Transcranial Pulse Stimulation (TPS) – Live treatment on the head – Image source: ORF.at

However, research is not only being carried out into the effects of shock waves on the brain, but also on the nerve tissue in the spinal cord. Shockwave technology should help to alleviate or even prevent paraplegia after spinal cord injuries.

Possible hope against cancer: shockwave therapy in the sights of Charité research

But can this technology perhaps also be used to influence the second most common cause of death worldwide, namely cancer, asks the ORF documentary. Initial research work, including at the Charité in Berlin, points to this: The idea of cancer treatment using shock waves is aimed here less at destroying cancer foci than at unmasking metastases. Shockwave treatments are also intended to selectively destroy cancer cells, but the main aim is for the immune system to fight tumors more effectively together with modern cancer drugs, according to the hope of the doctors at Charité, who have started an initial study at the end of 2023.

A number of patients have already been treated with astonishing success. The documentary reports on a particularly spectacular case of a patient who was diagnosed with malignant melanoma 12 years ago. The melanoma was removed, but the patient already had lung metastases and an abundance of superficial skin metastases. All attempts at chemotherapy, radiotherapy and surgery failed. The patient then underwent immunotherapy with checkpoint inhibitors and shockwave therapy was also applied to one of the surface metastases.

The result: the metastasis treated with the shockwave disappeared after four therapy sessions. But that was not all: the doctors were astonished to discover that the other skin metastases and the metastases in the liver also disappeared by themselves over time. The result was an abscopal effect with a systemic effect, i.e. only one area was treated, but the effect was felt throughout the entire organism.

Future-oriented and safe: shockwave therapy sets new standards in medicine

The research and application of shockwave therapy is at an exciting turning point. While the impressive possibilities of this technology continue to be intensively investigated in specialist areas such as urology, orthopaedics, neurology, cardiology and possibly soon also oncology, new horizons of healing are opening up for more and more patients. A decisive advantage of shockwave therapy is its safety: many years of experience, including six million lithotripsies performed in the USA, show that even the high-energy applications of shockwave therapy do not cause any significant side effects. This reinforces the hope that shockwave technology has the potential to permanently change the medical landscape – by providing effective, low side-effect treatment options for a wide range of conditions. The future of shockwave therapy is bright, and ongoing research will undoubtedly continue to reveal ways in which this revolutionary method can improve the lives of patients worldwide.

The ORF III documentary can be viewed here:

[Click here](#)
