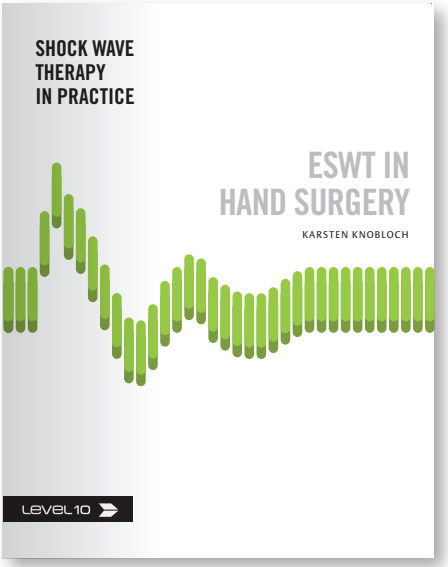
SHOCK WAVE
THERAPY
IN PRACTICE
ESWT IN
HAND SURGERY
KARSTEN KNOBLOCH
LEVEL10

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THE HISTORY OF SHOCK WAVES IN MEDICINE

/ Dr Ing. Pavel Novak

The first idea to use shock waves in medicine was probably submitted as a United States patent in 1947.[1] The patent, which was granted in 1951, described an electro-hydraulic shock wave source for the treatment of tumors in the brain.

This was still too early to become reality, but it predicted not only the first medically used shock wave source, which was also an electrohydraulic shock wave source used for the non-invasive disintegration of kidney stones, but also treatment with Transcranial Pulse Stimulation (TPS) on the central nervous system of patients with Alzheimer's disease (NEUROLITH®, STORZ MEDICAL).

The pioneer work started[2] when Dornier MedTech Systems GmbH engineers and physicists were tasked with finding out why cracks were observed in aircraft after they flew through rain at supersonic speed (Fig. 1).

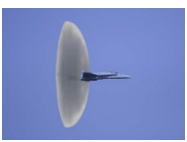


Fig. 1
Supersonic airplane passing the sound barrier.

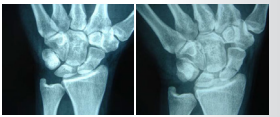
Germany is the birthplace of the first shockwaves applications in medicine.

These observations were investigated together with Eberhard Häusler from the Technical University of Saarbrücken in Germany. He is considered to have first proposed the use of shock waves for stone disintegration in the 1960s. The team that finally managed to make his idea reality consisted of leading scientists from Dornier MedTech Systems GmbH, Günter Hoff, Armin Behrendt, Wolfgang Hepp and Bernd Forssmann and physicians from the Institute of Surgical Research of the Ludwig Maximilians University in Klinikum Grosshadern, Munich, Prof. Christian Chaussey, Prof. Egbert Schmiedt, Ferdi-

COMPLICATIONS

Consolidation delay is defined as a fracture that does not consolidate within the first 6 months. When the fracture does not consolidate beyond 6 months from the initial trauma, it is called pseudarthrosis. In these cases, the bone fragments frequently undergo resorption at the level of the fracture and break down gradually.

Fig. 1
Pseudarthrosis located in the scaphoid waist.



Bone necrosis is the death of bone due to an insufficient supply of blood. The fracture in fact interrupts the vascular circulation in the proximal fragment with necrosis and subsequent collapse of the fragment.

Fig. 2
Pseudarthrosis of the proximal pole with evidence of necrosis of it.

The treatment of scaphoid pseudarthrosis has not yet been established and is still often controversial. In recent years, the use of shock waves has become the preferred treatment in the pseudarthrosis of the carpal scaphoid. This is also due to a series of studies that show a high efficacy of the treatment with overlapping or even superior results to the surgical ones.[3]

EXCLUSION CRITERIA

The presence of necrosis of the proximal pole does not represent an absolute contraindication.

MRI is key for vascular status of the scaphoid.

MRI allows a thorough evaluation of vascular damage. The presence of residual areas of still vascularized tissue may represent a positive prognostic index. The evaluation of the specialist will guide the indication to the treatment.

Shock wave treatment is contraindicated in all the cases in which the ratios of length are altered or there is presence of dislocation or inclination/declination of the fragments (deformity in V.I.S.I or in D.I.S.I.).

Even for the pseudarthrosis of the carpal scaphoid is valid the general rule that a too wide gap between the fracture segments represents a relative contraindication (atrophic form), very rare condition in this type of fracture.

The chronological age of the lesion should not be considered as a contraindication. We also had healing in lesions that were more than 8 years old. The presence of secondary arthrosis represents an absolute contraindication.

- Hand function or participant satisfaction were not reported.

Even combinations of the aforementioned therapeutic options are possible. As such, in December 2018 a randomized-controlled trial was published[20] comparing either:

- Percutaneous A1 pulley release vs.
- Percutaneous A1 pulley release followed by a steroid injection

The visual analogue scale score for pain, modified patient global impression of improvement and modified Quinnell grade were assessed at 3 weeks and 3 months after surgery. At 3 weeks, subjective improvement in the group with simultaneous steroid injection was significantly superior. At 3 months, pain score in the patients without a steroid injection was significantly better. No significant differences were found in the modified Quinnell grade. The authors conclude that the simultaneous steroid injection at the time of surgical release decreases pain and improves subjective outcomes during the early postoperative period after percutaneous trigger finger release.

On the other hand, detrimental effects of previous steroid injections and a following open trigger finger surgical release have been reported either. In a recent[21] retrospective analysis of 780 adults patients undergoing open trigger finger release in 999 digits by 6 fellowship-trained hand surgeons. Steroid injection timing relative to subsequent operative intervention correlated with postoperative surgical site infection in trigger finger release. Older age and decreasing days between steroid injection and surgery correlated with infection rates. Other factors found to be associated with infection rates included smoking, use of preoperative antibiotics, and use of lidocaine with epinephrine. The following recommendations were highlighted by the authors:

- We recommend careful preoperative counseling regarding higher wound healing risks for smokers, avoidance of steroid injections immediately prior to an operative date, and scheduling operative dates that tend to be greater than 80 days from the date of last steroid injection.
- We also recommend avoidance of epinephrine in the local anesthetic solution, as this may minimize surgical site infection risks.

Based on the aforementioned studies on steroid injections, percutaneous release and open release with the inheritant risk of adverse effects, ESWT as a completely non-invasive option should be considered first in my personal hand surgical view.

ESWT IN TRIGGER FINGER

As of now, two studies have been published of ESWT in trigger finger, which I will highlight in detail.

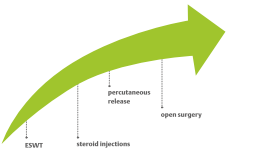


Fig. 9
Therapeutic cascade in trigger finger treatment proposed by Prof. Knobloch.

RCT COMPARING RADIAL ESWT AND STEROID INJECTIONS

The rationale to use radial and/or focused ESWT in trigger finger is to improve the affected superficial flexor tendon, which is inflamed and enlarged. ESWT can reduce tendon inflammation as has been reported on numerous studies on various locations like shoulder tendons, elbow tendons, patella tendons, Achilles tendons or the plantar fascia. As such, as soon as flexor tendon inflammation is reduced, tendon diameter and pain is reduced and tendon gliding is improved.