Radial Shock Wave Therapy - Where Do We Stand Today?

By Jan-Dirk Rompe

In the past 15 years the use of extracorporeal shock waves for the treatment of musculoskeletal disorders such as chronic therapy-recalcitrant tendinopathies has become a significant subject of research worldwide. While shock waves were initially categorized according to the way in which they are generated (electromagnetic, electrohydraulic, piezoelectric) or according to energy flow density (high-energy, low-energy), a distinction is also made today between focused, radial and planar applications.

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Shock wave technology continues to be plagued by persistent preconceived notions on the part of those who bear the costs of such treatment. The perspective of non-reimbursement has led to a change in orthopaedic shock wave application. Conventional, costly shock wave units - suitable for high-energy shock wave generation as well - are being increasingly replaced by radial shock wave units that are technically simpler, mobile, and economical - particularly for near-surface applications such as tendinopathies.

Radial Shock Waves

Radial shock wave therapy utilizes a ballistic technique. A projectile accelerated by compressed air and propelled at high kinetic energy hits an applicator placed on the skin. By using a coupling medium such as ultrasound gel, this impulse is delivered to the tissue in the form of a shock wave. From this point the shock wave continues to spread inside the body in the form of a spherical "radial" wave. In this generating principle, the applicator surface constitutes the geometric point with the highest pressure and the highest energy density. As opposed to other equipment, radial shock waves do not form an acoustic focus. Gerdesmeyer et al. (2004) pointed out that pressure and energy density of the radial shock wave steadily decrease after

leaving the applicator. Based on theoretical considerations, classic indications such as pseudarthrosis or tendinitis calcarea, which are located in the deeper tissue layers, appeared less appropriate for the treatment. However, radial shock wave treatment is to be considered as perfectly suitable for the treatment of indications near the surface.

Studies on Radial Shock Wave Therapy - An Overview

The suitability of radial shock wave therapy (rESWT) for the treatment of chronic plantar fasciitis was first demonstrated in 2004 in an FDA multicenter study by Gerdesmeyer and Weil in 242 patients. 3 months after three sessions of repetitive low-energy application of 2,000 impulses without local anesthesia (Swiss DolorClast®, EMS, Nyon/Switzerland) it showed a > 50% pain reduction in 57% of the verum group versus 40% of the placebo group. Pain perception as measured on the numeric analog scale (NRS) dropped from 7 to 4 points in the verum group, from 7 to 6 in the placebo group. The use of the Swiss DolorClast® (Fig. 1) was well-tolerated by patients even without local anesthesia. The pneumatically generated shock waves were applied to the painful area. An accompanying x-ray or ultrasound exam was not necessary. The applicator was positioned based on patient feedback in terms of pain perception and pain localization.

Figure 1: Swiss DolorClast®

In 2005 Spacca et al. conducted a single-blind randomized study on the effectiveness of rESWT in 62 patients suffering from tennis elbow. The verum group received four doses of 2,000 low-energy impulses of rESWT (Physio SWT, Elettronica Pagani Srl, Milan, Italy) at weekly intervals without local anesthesia, the control group four times 20 impulses. After 6 months the authors observed a pain reduction in the verum group from 5 points to 1 point on the NRS scale, and a pain increase from 5 to 6 points in the control group. The validated DASH score normalized from 38 to 10 points in the verum group while it remained stable in the control group (38 vs. 35 points).

In 2006 Cacchio et al. reported on a randomized-controlled study conducted on 90 patients suffering from chronic therapy-recalcitrant tendinosis calcarea of the supraspinatus tendon. 6 months following four sessions of repetitive rESWT of 2,500 low-energy impulses without local anesthesia (verum group) (Physio SWT, Elettronica Pagani Srl), the authors observed a reduction in pain on the NRS from 8 points to 1 point. After four repetitive applications of 25 low-energy impulses without local anaesthesia (control group), the score dropped from 8 to 6 points. 86% of the verum group saw a complete disintegration of the calcified deposit compared to 9% of the control group. Accordingly, 44/45 patients of the verum group obtained a score of excellent or good on the UCLA Shoulder Rating Scale compared to 0/45 patients of the control group. These results confirm the findings of an uncontrolled prospective study by Magosch et al. (2003) with three sessions of low-energy rESWT (Swiss DolorClast®, EMS) administered to 35 patients. After three sessions of low-energy rESWT the validated Constant Score rose from 69 to 81 points within 12 weeks. While the point value remained stable in subsequent studies, there were clear radiologic differences. The ratio of patients with complete disintegration of the treated calcified deposit rose from 18% after 4 weeks to 75% after 12 months.

rESWT applied to the Achilles tendon

Recently, a three-tailed, randomized, controlled study has been completed involving 75 patients with chronic recalcitrant Achilles tendinopathies assigned to different therapy methods. 4 months following inclusion in the study, the validated VISA-A-Score rose in all groups: from 51 to 76 points in Group 1 (eccentric loading exercises), from 50 to 70 points in Group 2 (repetitive low-energy rESWT (Swiss DolorClast®, EMS), and from 48 to 55 points in Group 3 (Wait-and-See). The indication of pain on the NRS went down in all groups, from 7 to 3 points in Group 1, from 7 to 4 points in Group 2, and from 8 to 6 points in Group 3. 60% of the patients in Group 1, 53% of the patients in Group 2, and 24% of the patients in Group 3 were "completey resolved" or "significantly improved" on the Likert scale. Eccentric loading exercises and radial shock wave therapy did not differ in terms of any of the criteria; both were significantly superior to "Wait-and-See". Whether a combination of eccentric extension and rESWT would deliver even better results is to be examined in a further study.

Based on the data obtained from the above studies and without precluding any comparative study, rESWT can deliver results that are similar to those of focused shock wave therapy for

the treatment of tendinopathies. In addition, due to the lower price of radial shock wave units, the cost of treatment has dropped significantly - by a factor of 5 in Germany today. The incidence of side effects was equally negligible in both methods. Of critical importance, however, are factors such as the selection of chronic therapy-recalcitrant patients and a repetitive application of 2,000 low-energy impulses at weekly intervals through so-called clinical focusing, the absence of local anesthesia as well as a the need to observe a minimum period of 12 weeks before the appearance of maximum impact.

Conclusion

In summary, radial shock wave therapy is a multi-validated effective treatment option for chronic tendinopathies of the foot, shoulder and elbow. Due to the non-existence of side effects and circumventing the need for immobilization and restricted weight bearing radial shock wave therapy can be recommended to patients as an alternative to surgery.

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