

Scientific Evidence of Shock Waves in Orthopedics and Traumatology: It is Time to Set the Record Straight

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Stephen Burkhart, a pioneer in arthroscopic shoulder surgery, in his keynote address at the World Congress of Shoulder and Elbow Surgery held in Buenos Aires in 2019, asked himself whether this surgical technique could have been developed during the 21st century, the age of evidence-based medicine, and FDA restriction policies [1].

Shoulder arthroscopy is today an accepted and recognized practice by all health insurance companies in the world. However, it must be recognized that its development in shoulder pathology began in the mid-1980s, when the pressure of evidence was much less

pronounced. This allowed faster development and massive recognition from insurers.

The advent of shock waves in musculoskeletal pathology started in the late 90's. The publication of a special volume on this subject in 2001 in Clinical Orthopedics, under the coordination of Ogden [2], could be considered a milestone. From that moment, the technique was widely disseminated, but unlike arthroscopy, it has not achieved mass acceptance in the medical field or recognition by most health agencies and insurance companies [3, 4, 5, 6, 7, 8, 9,

10, 11, 12].

A few months ago, the National Evidence-based Health-care Collaborating Agency of Korea issued an extremely critical report about the scientific evidence that supports the indications for shock waves [12]. This is not an isolated case; there are numerous examples of health technology assessment agencies and health insurance companies that question the scientific evidence behind shock waves. This determines that reimbursements are not made to patients, but above all it questions not only the effectiveness of the method but also the

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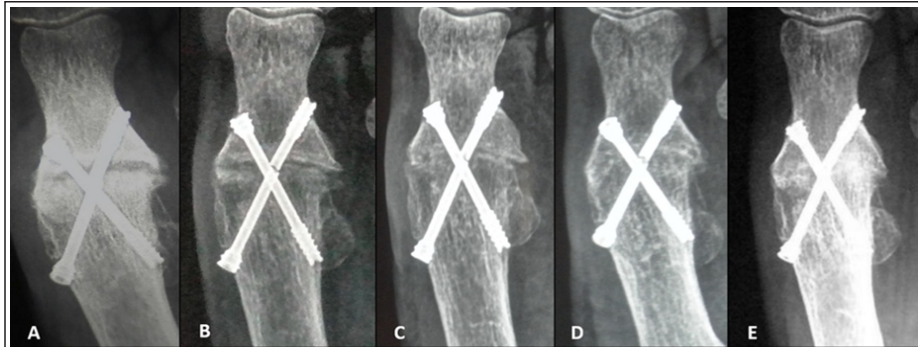


Figure 1: (a) A 70-year-old woman. Failed hallux arthrodesis 18 months after primary surgery. Pain and inability to walk. Lack of union is observed and the medial screw has suffered material fatigue. The option is surgical. (b) Two months after the application of three sessions of high energy focused shock waves. (c) Three months after shockwaves. (d) Four months after shockwaves. Arthrodesis has been completed and the patient is asymptomatic with no pain on gait. (e) Radiographic control at 2 years.

suitability of the professional who recommends it.

Clinical experts experience in many patients shows that shock waves can produce results that would not be possible to achieve with other non-invasive methods. Clinical data comparing previous and post-treatment studies shows an objective positive response that cannot be attributed to a placebo effect (Fig. 1).

So, why are there such conflicting criteria between practice, published evidence, and health agencies? Undoubtedly, the current situation is the consequence of the actions of many parties involved; including researchers, industry, state agencies, insurance companies, health professionals, and epidemiologists. It seems that each one approaches the subject from a biased position with a marked preconception about the effectiveness or uselessness of shock waves.

Are the Current Evidence-based Medicine Reports a Guarantee of Efficacy to Analyze the Indications of Shock Waves?

In 1991, Guyatt introduced the concept of “evidence-based medicine” [13]. It is defined as the use of the scientific method to organize and apply current data to improve health-care decisions [14]. This approach gained great popularity. Health Technology Assessment agencies provide information about medical, economic, social, and ethical issues related to the use of a health technology based on levels of evidence.

Reports about evidence from institutions such as the Cochrane Collaboration are highly valued.

However, with regard to shock waves, the quality of the reports is in many cases highly debatable. Frequently, emphasis is placed on methodological and statistical factors, which

of course is good, but not on the technical aspects of the method. An example is the study of Buchbinder et al. on the use of shock waves in chronic epicondylopathy [15]. The authors concluded that there was “Platinum” level evidence that shock wave therapy provides little or no benefit in terms of pain and function in lateral elbow pain. However, Rompe and Maffulli [16] revealed serious errors in this systematic review based on the inclusion of heterogeneous studies and errors in the shock wave application technique in several cases.

Surace et al. [17] discussed the results of “shock wave therapy” in “rotator cuff disease with or without calcification,” with a similar misleading approach.

First, they include two different clinical conditions, calcified and non-calcified tendinopathies of the rotator cuff, which have in common their anatomical location only. While a calcification settles by definition in a rotator cuff with regenerative capacities, non-calcified tendinopathy is a degenerative and progressive condition. This is like trying to compare the outcomes of treatments for pneumonia with lung cancer simply because both diseases are located in the lungs.

Second, the authors considered focused shock waves and radial pressure waves as the same treatment, when the physical parameters of these mechanical waves are absolutely different [18]. The modes of action and the effects of radial pressure waves on living tissue are different from those of focused shockwaves because bioeffects are related to the pressure waveform [19]. Hence, it is not a proper scientific approach to consider both of them as the same treatment just because the market named both methods similarly. Nowadays, numerous studies have shown that the best results in the treatment of rotator cuff

calcifications are generated from the application of high energy [20, 21, 22]; however, the systematic review, we discuss, also includes studies with radial pressure waves that do not reach those energy levels.

Although the values of evidence-based medicine are useful, its mode of implementation has been discussed in recent times [23, 24, 25, 26, 27]. Decreeing that a method is effective or not based on studies of poor clinical quality, beyond the fact that they may be correct from the statistical point of view, is like trying to end cannibalism by eating the last cannibal.

These errors could be avoided by incorporating experts in shock waves and orthopedic pathology into the studies, working jointly with epidemiologists.

What About the Quality of Scientific Literature?

Surgical techniques already installed in our daily practice are usually approved by insurance companies and health technology assessment agencies despite having debatable scientific evidence to support their use. Blom et al. [28] demonstrated that many of the 10 most indicated surgical procedures in orthopedics and traumatology are not supported by studies with a high level of evidence. This is not surprising, as it has been reported poor quality research methodology in the orthopedic literature [29]. Poolman et al. suggested that readers should not assume that studies labeled as “Level I” necessarily have high reporting quality [30]. Ionnadis stated that for many scientific fields, “claimed research findings may often be simply accurate measures of the prevailing bias [31].” Jager and Leek estimated that the proportion of false positive findings was between 14% and 29% in 100 published clinical studies that they attempted to replicate [32].

We have also witnessed a large number of surgical procedures that had an exponential growth after being approved by health systems, ended up falling into disuse after a few years because same outcomes with conservative treatment were demonstrated. Good examples of this are acromioplasty [33, 34] and the repair of injuries in the superior labrum of the shoulder [35, 36].

It is impossible to draw an accurate conclusion based on inadequate studies. Shock wave studies are not immune to this. In a study presented at the international shock wave



Figure 2: Logo of the International Federation of Shock Wave Treatment.

congress in San Sebastián, Spain in 2017, 37 clinical trials and a clinical protocol on the use of waves in shoulder pathology were evaluated by Moya et al. [37]. The authors concluded that in 70% of them, the inclusion and/or exclusion criteria were insufficient or inadequate. This included studies that favored the use of focused shock waves and radial pressure waves and those that reported poor results.

Besides this, industry influence on the results of clinical studies has also been demonstrated in other fields of orthopedics and trauma [38, 39, 40, 41, 42]. The contribution and role of the industry in the development of shock waves have been fundamental. Unfortunately, consciously, or unconsciously, this can generate a bias in the researchers. A paper presented at the same congress by Alfano et al. concluded that a tendency toward an increased frequency of favorable outcomes was found in shockwave papers supported by the industry [43].

What is the Role of Scientific Societies?

Given this enormous anarchy of concepts, methodologies, and criteria, the role of scientific societies is a key factor. Professional medical associations play a very important role in research, education, and dissemination of medical practices. Scientific societies and their members, who are ultimately responsible for therapeutic indications, must be considered as an essential participant in decision-making, which cannot remain solely in the hands of the market or on organizations to which the system assigns the role of judges.

Scientific societies must assume their role being aware of their great responsibility. Health professionals, medical institutions, and the general public trust medical societies

recommendations and guidelines. There are situations and risks of bias that should be avoided. The existence of scientific societies dedicated to the study of a specific therapeutic method implies the risk of significant bias. There is the possibility of plunging into a “collective psychosis” in which each one wants to demonstrate a greater ineffability of the method or

new indications.

In recent years, there has also been an increasing awareness about the extent of the financial links between medical device companies and medical institutions [44]. Institutional academic-industry relationships exist when academic institutions, or any of their senior officials, have a financial relationship with or financial interests in a public or private company [45]. It has been stated that to keep independence and integrity, “leaders of scientific associations must be free of all financial ties with the industry” [46, 47]. Although many institutions have issued conflict of interest guidelines, they are not always clear enough and their implementation is not easy. As Rothman has stated, “education must be carefully distinguished from marketing [44].” Grimshaw and Russell [48] concluded that the guidelines and recommendations of scientific societies do improve clinical practice but must be formulated based on credible evidence without conflicts of interest and on a crystal-clear methodology.

In the case of radial pressure waves and focused shock waves, for years, we have followed the recommendations of the International Society for Medical Shockwave Treatment [49]. The indications have been classified into: 1 – Approved standard indications, 2 – Common empirically-tested clinical uses, 3 – Exceptional indications-expert indications, and 4 – Experimental indications. In the era before evidence-based medicine, this classification may have been useful, but it is currently not enough. It is not clear which is the methodology or level of evidence considered to include each indication in the various categories; how these four categories are defined; what

conditions a professional must meet to be considered an expert; etc.

The insufficiency of this model is demonstrated by the fact that many health agencies and medical insurers do not accept it.

What is the Way we Choose?

Should a scientific society put aside what happens in the real world and continue to recycle information among a small group of members as if the method were unanimously accepted? We believe that it is important to start from a clear diagnosis of the situation. We must understand that better than looking for new indications or disseminating the use of the technique and promising information not yet published, scientific society’s members should contribute with high level of evidence studies demonstrating that radial pressure waves and focused shock waves are highly effective in specific medical indications.

The way for that is to define a clear and reproducible methodology and the development of consensus reports that represent the opinion of an expert workgroup. A first attempt was done few years ago. Indications in the field of orthopedics and traumatology were classified according to the recommendation scale proposed by the Journal of Bone and Joint Surgery [19]. This initiative has been taken as a basis for designing the recommendation guides by the International Federation of Shockwave Treatment. (Fig.2) An international initiative has been launched in this regard.

However, the contribution of shock wave experts and epidemiologists is not enough. Experts and institutions dedicated to the pathology of each of the anatomical regions of the musculoskeletal system must actively participate. The preparation of recommendations for the use of shock waves should not only be the result of specialists in the subject, other specialties that are not directly involved in the technique have much to contribute. It is time to put vertical thinking aside and to promote interdisciplinary proposals putting lateral thinking into practice [1].

Scientific and technological development, understood as a means for the well-being of patients, must be above any sectorial or

commercial interest. It is the responsibility of all stakeholders to consistently engage in demonstrating the usefulness of any method.

Seeking excellence is always a laudable goal, but it should never become an excuse to choose the easy path of lack of

action. We know that this Journal still has a lot to grow from a methodological point of view, but we believe that it is the first step in a dynamic process of growth. As the Chinese philosopher Lao-tse said: "A journey of a thousand miles begins with a first step." If we are capable of making that

long trip, we will make a great contribution to the treatment of many cases that are difficult to solve with other methods.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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References

- Burkhart SS. Shoulder arthroscopy: A bridge from the past to the future. *J Shoulder Elbow Surg* 2020;29:e287-96.
- Ogden JA, Alvarez RG, Levitt R, Marlow M. Shock wave therapy (Orthotripsy) in musculoskeletal disorders. *Clin Orthop Relat Res* 2001;387:22-40.
- Cigna. Medical Coverage Policy Extracorporeal Shock Wave Therapy (ESWT) for Musculoskeletal Conditions and Soft Tissue Wounds. Available from: https://static.cigna.com/assets/chcp/pdf/coveragePolicies/medical/mm_0004_coveragepositioncriteria_eswt_for_musculoskeletal_conditions.pdf
- Aetna. Extracorporeal Shock-Wave Therapy for Musculoskeletal Indications and Soft Tissue Injuries. Available from: https://www.aetna.com/cpb/medical/data/600_699/0649.html
- Blue Cross Blue Shield of North Dakota. Extracorporeal Shock Wave Therapy for Musculoskeletal Conditions and Soft Tissue Wounds. Available from: <https://www.bcbsnd.com/providers/policies-precertification/medical-policy/e/extracorporeal-shock-wave-therapy-eswt-for-musculoskeletal-conditions>
- Presbyterian: Extracorporeal Shock Wave Therapy for Musculoskeletal Disorders. Available from: <https://www.phs.org/providers/documents/extracorporeal-shock-wave-therapy-mpm-5-6.pdf>
- United Health Care. Extracorporeal Shock Wave Therapy (ESWT) for Musculoskeletal Conditions and Soft Tissue Wounds. Available from: <https://www.uhcprovider.com/content/dam/provider/docs/public/policies/comm-medical-drug/extracorporeal-shock-wave-therapy.pdf>
- Anthem Blue Cross. Extracorporeal Shock Wave Therapy. Available from: https://www.anthem.com/dam/medpolicies/abc/active/policies/mp_pw_a050255.html
- Moda Health. Extracorporeal Shock Wave Therapy. Available from: https://www.modahealth.com/pdfs/med_criteria/extracorporealshockwavetherapy_eswt.pdf
- National Institute for Health and Care Excellence (Nice). Extracorporeal Shockwave Therapy for Achilles Tendinopathy. Available from: <https://www.nice.org.uk/guidance/ipg571/chapter/1-Recommendations>
- Washington State Health Care Authority. Extracorporeal Shock Wave Therapy for Musculoskeletal Conditions. Final Evidence Report. Available from: <https://www.hca.wa.gov/assets/program/eswt-final-evidence-rpt-20170214.pdf>
- Korea National Evidence-Based Healthcare Collaborating Agency. Reevaluation Report on Extracorporeal Shockwave Therapy for Musculoskeletal Disorders. Available from: https://www.neca.re.kr/lay1/program/S1T11C216/tech_report/view.do?seq=143
- Guyatt GH. Evidence-based medicine. *ACP J Club* 1991;114:A-16.
- Tenny S, Varacallo M. Evidence based medicine. In: *StatPearls*. Treasure Island, FL: StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470182>
- Buchbinder R, Green SE, Youd JM, Assendelft WJ, Barnsley L, Smidt N. Shock wave therapy for lateral elbow pain. *Cochrane Database Syst Rev* 2005;2005:CD003524.
- Rompe JD, Maffulli N. Repetitive shock wave therapy for lateral elbow tendinopathy (tennis elbow): A systematic and qualitative analysis. *Br Med Bull* 2007;83:355-78.
- Surace SJ, Deitch J, Johnston RV, Buchbinder R. Shock wave therapy for rotator cuff disease with or without calcification. *Cochrane Database Syst Rev* 2020;3:CD008962.
- Loske AM, Moya D. Shock waves and radial pressure waves: Time to put a clear nomenclature into practice. *J Regen Sci* 2021;1:4-8.
- Moya D, Ramón S, Schaden W, Wang CJ, Guiloff L, Cheng JH. The role of extracorporeal shockwave treatment in musculoskeletal disorders. *J Bone Joint Surg Am* 2018;100:251-63.
- Verstraeten FU, In den Kleef NJ, Jansen L, Morrenhof

JW. High-energy versus low-energy extracorporeal shock wave therapy for calcifying tendinitis of the shoulder: Which is superior? A meta-analysis. *Clin Orthop Relat Res* 2014;472:2816-25.

21. Bannuru RR, Flavin NE, Vaysbrot E, Harvey W, McAlindon T. High-energy extracorporeal shock-wave therapy for treating chronic calcific tendinitis of the shoulder: A systematic review. *Ann Intern Med* 2014;160:542-9.

22. Huisstede BM, Gebremariam L, van der Sande R, Hay EM, Koes BW. Evidence for effectiveness of Extracorporeal Shock-Wave Therapy (ESWT) to treat calcific and non-calcific rotator cuff tendinosis--a systematic review. *Man Ther* 2011;16:419-33.

23. Harvey EJ, Martineau PA, Schemitsch E, Nowak LL, Agel J. Evidence-based medicine: Boom or bust in orthopaedic trauma? *J Bone Joint Surg Am* 2020;102:e6.

24. Ioannidis JP. Cochrane crisis: Secrecy, intolerance and evidence-based values. *Eur J Clin Invest* 2019;49:e13058.

25. Ioannidis JP. Evidence-based medicine has been hijacked: A report to David Sackett. *J Clin Epidemiol* 2016;73:82-6.

26. Accad M, Francis D. Does evidence based medicine adversely affect clinical judgment? *BMJ* 2018;362:k2799.

27. Tebala GD. The emperor's new clothes: A critical appraisal of evidence-based medicine. *Int J Med Sci* 2018;15:1397-405.

28. Blom AW, Donovan RL, Beswick AD, Whitehouse MR, Kunutsor SK. Common elective orthopaedic procedures and their clinical effectiveness: Umbrella review of level 1 evidence. *BMJ* 2021;374:n1511.

29. Bhandari M, Richards RR, Sprague S, Schemitsch EH. The quality of reporting of randomized trials in the Journal of Bone and Joint Surgery from 1988 through 2000. *J Bone Joint Surg Am* 2002;84:388-96.

30. Poolman RW, Struijs PA, Krips R, Sierevelt IN, Lutz KH, Bhandari M. Does a "Level I Evidence" rating imply high quality of reporting in orthopaedic randomised controlled trials? *BMC Med Res Methodol* 2006;6:44.

31. Ioannidis JP. Why most published research findings are false. *PLoS Med* 2005;2:e124. Erratum in: *PLoS Med* 2022;19:e1004085.

32. Jager LR, Leek JT. An estimate of the science-wise false discovery rate and application to the top medical literature. *Biostatistics* 2014;15:1-12.

33. Vitale MA, Arons RR, Hurwitz S, Ahmad CS, Levine WN. The rising incidence of acromioplasty. *J Bone Joint Surg Am* 2010;92:1842-50.

34. Nazari G, MacDermid JC, Bobos P. Conservative versus surgical interventions for shoulder impingement: An overview of systematic reviews of randomized controlled trials. *Physiother Can* 2020;72:282-97.

35. Onyekwelu I, Khatib O, Zuckerman JD, Rokito AS, Kwon YW. The rising incidence of arthroscopic superior labrum anterior and posterior (SLAP) repairs. *J Shoulder Elbow Surg* 2012;21:728-31.

36. Schröder CP, Skare Ø, Reikerås O, Mowinckel P, Brox JI. Sham surgery versus labral repair or biceps tenodesis for

Type II SLAP lesions of the shoulder: A three-armed randomised clinical trial. *Br J Sports Med* 2017;51:1759-66.

37. Moya D, Ramón S, Alfano F. Critical Appraisal of Clinical Trials on the Use of Shockwaves in Shoulder Pathology. In: *International Congress of Shockwave Treatment*. San Sebastián, Spain; 2017. Available from: https://www.shockwavetherapy.org/fileadmin/user_upload/dokumente/PDFs/Programme/2017_ismst-congress.pdf

38. Bhandari M, Busse JW, Jackowski D, Montori VM, Schünemann H, Sprague S, et al. Association between industry funding and statistically significant pro-industry findings in medical and surgical randomized trials. *CMAJ* 2004;170:477-80.

39. Okike K, Kocher MS, Mehlman CT, Bhandari M. Conflict of interest in orthopaedic research. An association between findings and funding in scientific presentations. *J Bone Joint Surg Am* 2007;89:608-13.

40. Gluud LL. Bias in clinical intervention research. *Am J Epidemiol* 2006;163:493-501.

41. Shah RV, Albert TJ, Bruegel-Sanchez V, Vaccaro AR, Hilibrand AS, Grauer JN. Industry support and correlation to study outcome for papers published in Spine. *Spine (Phila Pa 1976)* 2005;30:1099-104; discussion 1105.

42. Gelberman RH, Samson D, Mirza SK, Callaghan JJ, Pellegrini VD Jr. Orthopaedic surgeons and the medical device industry: The threat to scientific integrity and the public trust. *J Bone Joint Surg Am* 2010;92:765-77.

43. Alfano F, Moya D, Ramón S. Is industry Support Influencing Study Outcomes in Shockwave Literature? In: *International Congress of Shockwave Treatment*. San Sebastián, Spain; 2017. Available from: https://www.shockwavetherapy.org/fileadmin/user_upload/dokumente/PDFs/Programme/2017_ismst-congress.pdf

44. Rothman DJ, McDonald WJ, Berkowitz CD, Chimonas SC, De Angelis CD, Hale RW, et al. Professional medical associations and their relationships with industry: A proposal for controlling conflict of interest. *JAMA* 2009;301:1367-72.

45. Campbell EG, Weissman JS, Ehringhaus S, Rao SR, Moy B, Feibelman S, et al. Institutional academic-industry relationships. *JAMA* 2007;298:1779-86.

46. Rothman DJ. Professional medical associations and divestiture from industry: An ethical imperative for pain society leadership. *Pain Med* 2016;17:218-9.

47. Moynihan R, Albarqouni L, Nangla C, Dunn AG, Lexchin J, Bero L. Financial ties between leaders of influential US professional medical associations and industry: Cross sectional study. *BMJ* 2020;369:m1505.

48. Grimshaw JM, Russell IT. Effect of clinical guidelines on medical practice: A systematic review of rigorous evaluations. *Lancet* 1993;342:1317-22.

49. International Society for Medical Shockwaves Treatment. Indications. Available from: <https://www.shockwavetherapy.org/about-eswt/indications>.

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