

# Letter to the Editor

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Dear Editor,

We have carefully read the work “Plantar fasciitis: analysis of therapeutic options” by Dr. Iglesias and collaborators recently published in the AAOT Journal.<sup>1</sup> We congratulate the authors for the interesting study on a condition with such a high incidence.

After more than 20 years of contributing to the development of shock waves in our country, we are gratified to see that the method is given recognition in a publication of these characteristics. As the authors point out, this therapeutic option is considered in the consensus treatment algorithm on plantar fasciopathy of the American College of Foot and Ankle Surgeons.<sup>2</sup> In said document, it is stated that extracorporeal shock wave therapy is safe and effective in the treatment of plantar fasciitis.<sup>2</sup> The same institution had already included shock waves as a treatment option 12 years before in another consensus.<sup>3</sup>

Given our experience in shock wave therapy, we would simply like to clarify some concepts about this technique expressed in the manuscript.

In the aforementioned publication, shock waves are mentioned as a treatment option, but the type of technology proposed is not detailed. The generic name of “shock waves” actually includes two types of mechanical waves: focal shockwaves, or shock waves per se, and radial pressure waves, which, from a strictly physical point of view, are not shock waves. These two technologies differ in their generation devices, physical characteristics, and mechanisms of action, but share several indications.<sup>4</sup> Their risk level is also different, which is why the International Society for Medical Shockwave Therapy and other institutions recommend the application of focal waves in the medical field.<sup>4</sup> In the case of plantar fasciopathy, both techniques can be effective.<sup>5</sup>

The article describes their mechanism of action mentioning that the shock waves create a “micro-tear (...), exacerbating an inflammatory reaction”. Actually, ‘micro-tear’ is a valid mechanical concept for the effect of shock waves on kidney stones, but not on living tissue. In lithotripsy, focal waves are applied to an inert mineral accumulation to fragment it so that it can be eliminated through the urinary tract.

Mechanical stimulation often brings to mind the outdated concept of *physical therapies*.<sup>6</sup> In musculoskeletal tissues, the effect of waves is, instead, biological. Mechanical waves act through a phenomenon called *mechanotransduction*, by which cells can recognize a mechanical stimulus and respond biologically.<sup>5,6</sup> This stimulus is detected by transmembrane receptors and communicated to the cell nucleus through protein channels, triggering a biological response.

The fascinating process triggered by shock waves includes changes in the permeability of cell membranes, the stimulation of mitochondria with the release of ATP, the dilution of substance P, the reduction of unmyelinated nerve fibers, the modulation of inflammatory processes, vasculogenesis (the process of blood vessel formation by *de novo* production of endothelial cells), angiogenesis (formation of new blood vessels from preexisting vessels), increased concentrations of nitric oxide and growth factors, and, finally, the mobilization, migration, and differentiation of pluripotent cells.<sup>5-8</sup> All this is demonstrated by abundant literature on basic sciences whose enumeration exceeds the scope of this letter. The result is the stimulation of cellular functions, the induction of biological regeneration, and the restoration of cellular homeostasis.

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**How to cite this article:** Moya D, Olivieri H, Crosa JI. Letter to the editor. *Rev Asoc Argent Ortop Traumatol* 2022;87(5):741-743. <https://doi.org/10.15417/issn.1852-7434.2022.87.5.1667>

If used properly and with reliable equipment, shock waves do not injure musculoskeletal tissues. Cyteval et al.<sup>9</sup> evaluated shoulders treated with focal waves with magnetic resonance imaging, immediately before applying the shock waves, 6 hours later, and 2 weeks later. They found no complications or significant impact on the anatomical structures in any of the cases.

The authors mentioned that the application “can be single or serial”, but, in reality, the vast majority of the protocols include 3 to 5 sessions,<sup>10</sup> as the same authors clarify later in the text.

Regarding the application itself, it is described that shock waves can be applied “with local anesthesia”, although this is a controversial issue.<sup>11</sup> Numerous studies have reported worse outcomes when using anesthesia specifically in plantar fasciopathy.<sup>12-14</sup> One of the reasons is that the presence of fluids in the area of application modifies the *acoustic impedance* of the area to be treated and alters the penetration of the waves.

Even general or regional anesthesia could modify the effect of the waves. Evidence points to an important role for the peripheral nervous system in mediating the cellular effects of shock waves applied to the musculoskeletal system.<sup>11,15-17</sup>

The perception of the waves stimulates nociceptors (C fibers), which, in addition to fulfilling their sensory function, release a variety of neuropeptides that induce protein extravasation, fibroblast stimulation, and cell activation.<sup>11,15</sup> Anesthesia would neutralize this effect.

In short, we have a tool that, unfortunately, has been underestimated because we are surgeons and it is a conservative, non-invasive procedure. This leads to ignorance, confusion, and, many times, to yield its use to other specialties and professions. However, we must bear in mind that, in essence, the specialist in orthopedics and traumatology is, or should be, an expert in the diagnosis of musculoskeletal pathology and its surgical and conservative treatment options. When properly used, focal and radial waves are a great non-invasive alternative in the treatment of this type of chronic and degenerative condition.

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Conflict of interest: The authors declare no conflicts of interest.

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