The importance of extracorporeal shock wave therapy (ESWT) in the treatment of enthesiopathies

Introduction

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Extracorporeal shock wave therapy is becoming increasingly popular worldwide because it is easy to perform (almost no learning curve required) and has virtually no side effects (Fig.). A "PubMed" literature search lists 1.700 publications dealing with the use of shock waves outside the field of urology (lithotripsy). The number of publications concerned with the treatment of tendinopathy alone has increased to over 500. As a result, shock wave therapy has become a staple in the treatment of chronic enthesiopathies for patients and doctors alike.

Contrary to most technologies, shock waves were first used successfully in clinical settings before basic research was conducted in a second step. This is why during the last few years (experimental) research increasingly focused on elucidating the mechanism of action of shock waves in order to clear up the effects observed in clinical practice.

Literature

As early as in 2003, Wang[1] was able to demonstrate that ESWT improves blood circulation in the treated tendon portions. Also, shock waves were found to enhance the release of various growth factors, an effect that persists for 8 to 12 weeks and may be responsible for the healing of chronic inflammatory alterations. Zhang[2] was able to prove that ESWT promotes the release of lubricin and thus has a functional impact on the healing process. A study conducted in Turin[3], Italy, revealed that ESWT enhances the proliferation of fibroblasts and stimulates the production of TGF-beta and type I and III collagen. Han[4] and Davis[5] were both able to provide evidence of a strong anti-inflammatory effect produced by shock waves as a result of a significant reduction in pro-inflammatory cytokines and chemokines as well as matrix metalloproteinases (MMPs) and various interleukins.

The effect produced by shock waves on the migration and differentiation behaviour of stem cells, revealed by Aicher[6] and Wang[7] may play a crucial role in the healing of chronic tendinopathies.

Conclusion

These complex effects of shock waves in tissue are likely to be induced by mechanotransduction. The pressure, tensile and shear forces that act on the cells as a result of the application of shock waves lead to the activation of genes and gene groups in the cell nucleus, which then start to produce the aforementioned proteins to initiate the regeneration process.

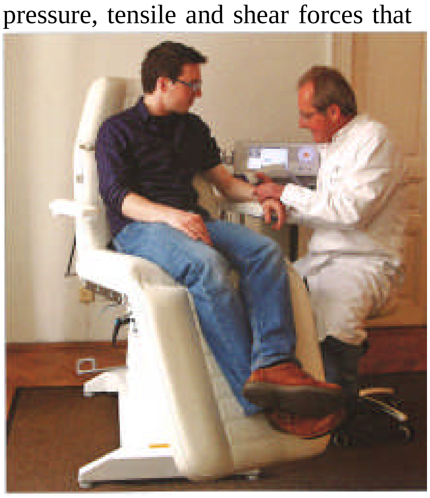

Fig.: Simple application of ESWT in the treatment of lateral epicondylitis (tennis elbow)

The knowledge derived from research during the last few years has greatly helped to better understand the mechanisms of action of ESWT in the treatment of enthesiopathies.

1 *Wang CJ et al: Shock wave induces neovascularization at the tendon-bone junction. A study in rabbits. J Orthop Res 2003; 21: 984-989*

2 *Zhang D et al: Extracorporeal shockwave-induced expression of lubricin in tendons and septa. Cell Tissue Res 2011; 346(2): 255-62*

3 *Berta A et al: Extracorporeal shock waves enhance normal fibroblast proliferation in vitro and activate mRNA expression for TGF-beta1 and for collagen types I and III. Acta Orthop 2009; 80(5): 612-7*

4 *Han SH et al: Effect of extracorporeal shock wave therapy on cultured tenocytes. Foot Ankle Int 2009; 30(2): 93-8*

5 *Davis TA et al: Extracorporeal shock wave therapy suppresses the early proinflammatory immune response to a severe cutaneous burn injury. Int Wound J 2009; 6 (1): 11-21*

6 *Aicher A et al: Low-energy shock wave for enhancing recruitment of endothelial progenitor cells: a new modality to increase efficacy of cell therapy in chronic hind limb ischemia. Circulation 2006; 114: 2823-30*

7 *Wang FS et al: Extracorporeal shock wave promotes growth and differentiation of bone-marrow stromal cells towards osteoprogenitors associated with induction of TGF-1. J Bone Joint Surg 2002; 84-B: 457-61*

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