Chapter 12
Application of Aerodynamic Shock Wave in Medical Treatment

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ABSTRACT

Extracorporeal shock wave therapy in orthopaedics and traumatology is a relatively new treatment modality. The advancement of shock wave treatment has been quick in recent years. Shock waves have significantly altered therapy. Shock waves are now the treatment of choice for kidney and urethral stones. Urology has traditionally been the sole medical profession that uses shock waves. Meanwhile, shock waves have been utilised to treat insertion tendinitis, avascular necrosis of the head of the femur, and other necrotic bone changes in orthopaedics and traumatology. In veterinary medicine, another field of shock wave use is the therapy of tendons, ligaments, and bones. The basic theory and applications of shock waves, as well as their history in medicine, are discussed in this study. The goal of utilising shock wave treatment for orthopaedic disorders is to stimulate healing in the tendons, surrounding tissue, and bones. Shock waves have emerged as the preferred therapy for kidney and ureteral stones.

INTRODUCTION

When it comes to shock waves, several disciplines use them, including acoustics and the sciences of sound and matter. They also play an essential part in the domains of aerodynamics, chemistry, and physics, as well as materials science, space science, and biology (Honton, B. & Laperche, C., 2021; Shukla, P et al., 2021). The vast majority of shock wave literature is technical and intended for people with a thorough

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understanding of physics. Shock waves, on the other hand, are frequently associated with supersonic aircraft. Scientists in fields other than physics may be perplexed by this because the connection to clinically employed shock waves is obscure. Waves in front of a fast-moving item, such as an aeroplane or a bullet, can interfere constructively, creating what's known as a "bow wave." When an object accelerates, the pressure waves in front of it get closer together until they can no longer escape from the source (object) and pile up in front of it, generating the sonic boom that can be heard and felt after a supersonic aircraft has passed. Mach number is defined as the sound velocity divided by the object velocity. Shock waves in fluids, such as those employed in biomedical applications, have a low Mach number (close to one). The term "weak shock wave" refers to this phenomenon. Shock waves utilised in biomedical applications and those created by supersonic planes have certain similarities, but their genesis mechanisms differ (Jadhav, R.S. et al., 2020; Wang, M.-M.& Wu, Z.-N., 2021; Xiong, L et al., 2021).

Figure 1. Sketch of a pressure pulse waveform

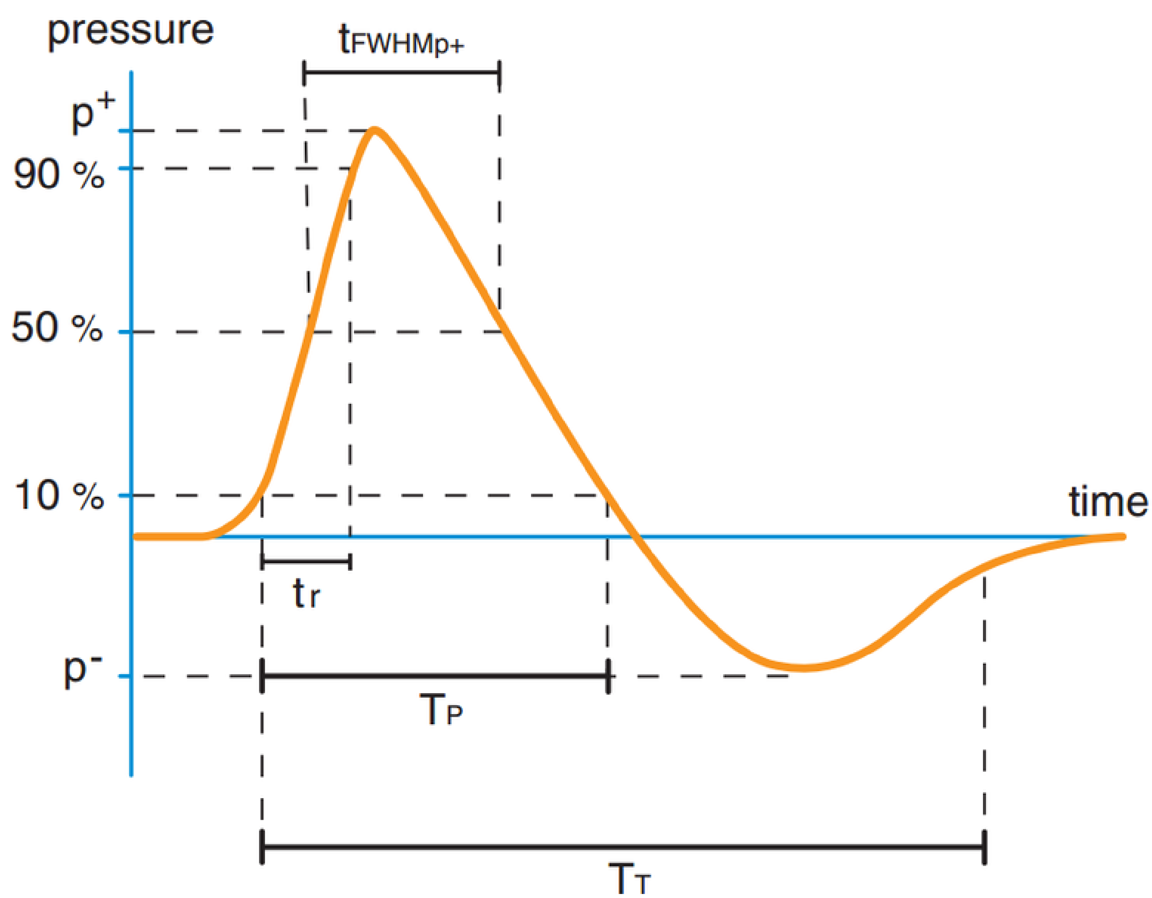

Figure 1 Sketch of a pressure pulse waveform showing the peak-positive pressure (p+), the peak-negative pressure (p−), the rise time (tr), the compressional pulse duration (t FWHMp+), the positive temporal integration limits (TP), and the total temporal integration limits (TT). In physics, the instan-