Laser in Bone Surgery

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During the past half-century, laser osteotomy has been studied for a broad range of lasers, which almost covers the entire range of available laser systems in the market, from early unsuccessful experiments with CW lasers to newly developed ultrashort pulse lasers. Although a large variety of laser parameters including wavelength, pulse energy, pulse duration, and repetition rate have been investigated to find an optimum laser system as an alternative osteotomy tool, there is not a universal agreement on a specific type of laser to replace conventional mechanical saws. The only universal agreement is on the speed of cutting (ablation rate) which went to long-pulse Er:YAG and CO 2 lasers. Microsecond pulse Er:YAG and CO 2 lasers perform osteotomy by inducing efficient photothermal effect to the bone with the help of high absorption peak of water in the bone. However, having a speedy cut is not the only effective parameter to pave the way for transferring lasers to the operating room. Other parameters including cutting with the lowest thermal damage, ability for deep cutting, and compatibility with integrating sensors are among the other determinant parameters. Moreover, being able to be delivered through the fiber optic and as a consequence fit inside the endoscope channel could extend their application from the open surgery to minimally invasive ones. This chapter besides proving the necessary information on the physics behind the laser-bone interaction provides a short review on the history of bone surgery with laser and state-of-the-art studies in this field.
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