Assessment of AZ31 for Biodegradable Stent Applications

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Stents are used for a variety of purposes throughout the human body. This investigation focused on two types of stents: arterial stents – which are used to treat narrowed or weakened arteries – and tracheal stents – which are utilized to improve airway patency. Unfortunately, the currently utilized permanent stents have proven to be incompetent as they harbor an array of serious shortcomings. Thus, the purpose of the study was to focus on the use of a biodegradable magnesium alloy, AZ31, and assess its performance for various stent applications to determine whether this magnesium alloy can withstand the human body environment for the desired treatment time. It was hypothesized that the alloy could be engineered through manipulation of design in order to accommodate for time for healing. Through mathematical modeling of AZ31's degradation behavior for stent applications, the hypothesis was proven to be correct. AZ31 could be engineered as a candidate material for biodegradable stent applications through intelligent manipulation of design. The tracheal stent projected a long-term degradation behavior, comparatively lasting much longer than the arterial stent; however, an analysis of hoop stress still left promise for AZ31 in cardiovascular stent applications. A dual-material tracheal stent using AZ31 and AZ91 was also engineered and modeled in order to enhance longevity. It was found that the design could easily be manipulated to match the prescribed time for treatment. This investigation will allow for current stenting technologies to be improved upon and reduce the currently associated complications with permanent arterial and tracheal stents.

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