Abstract

The increasingly frequently diagnosed male urethral strictures are unfortunately becoming a disease of civilization, where the incidence increases with age. Consequently, this condition leads to a deterioration of quality of life. Etiology and epidemiology of urethral stenosis can be of various origins, affecting the elderly especially after 65 years of age, but also the young, whose diagnosis is the result of mechanical trauma, pelvic fractures or other as yet unknown factors. Treatment of urethral stenosis is still not consistent. Various treatment algorithms are in use, both those involving reconstruction and other solutions using the support of material and tissue engineering and tissue engineering, as well as new medical technologies.

Stenting, as an alternative to treating urethral stenosis is currently getting all the attention of researchers. This solution, is based on the use of biodegradable scaffolds. Their main task is to restore the normal function of the urethra, by promoting neovascularization and processes of new tissue formation. Materials used for stents dedicated to the treatment of urethral stenosis should be characterized by certain properties, which include biodegradability, non-toxicity and good mechanical strength. Due to the specific loading conditions in the urethra, special attention should also be paid to the design of the stent. As a result of urination and, in the case of men, also the phenomenon of erection and the action of the circular muscles surrounding the urethra, variable deformations and stresses occur in its tissues. Therefore, in addition to the proper selection of the material for the stent, it is important to develop a stent design that will work with the tissues at the site of implantation, which is only possible with a proper stent-tissue fit.

The purpose of the present study was to determine the loading conditions prevailing in the tissues of the urethra, to determine the strength characteristics of the urethra of the *New Zealand White* rabbit, to determine the material characteristics of the polymers sodium alginate and polydioxanone, taking into account different manufacturing technologies, to optimize the composition of the hydrogel material, to select the material for the stent, and to develop and optimize the stent design, along with performing a numerical analysis of the stent's behavior under the influence of the parameters determined *in vivo* and *in vitro*.

The results obtained in the dissertation, allowed the determination of important parameters characterizing the urethra, the knowledge of which was necessary to select the material and develop the stent design. The obtained results indicate, that the proposed material polydioxanone and the developed stent design can be an alternative solution in the treatment of urethral stenosis.