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Design and experimental verification of the stents for the treatment of urethral stenosis

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Urethral stenosis is a disease affecting mainly men. Treatment is based on restoring patency of the lower urinary tract [1]. Current treatment relies on the use of metal stents. This approach involves reoperation to remove the sent, which additionally causes discomfort and trauma. These problems prompt the require of material with specific mechanical, chemical, and biological properties characterized by auto-degradation. This process should a care out within the time frame necessary for the tissue remodelling of urethra. As a result, there has been a suggestion for treatment using hybrid stents with a rigid core and a surface layer based on sodium alginate. This seems natural because of the biological properties of alginate, i.e., biocompatibility, biodegradability, and tissue-forming ability, as well as because of the benefits of not needing to remove the stent from the tubular canal after treatment [2]. The purpose of this study was to analyse the effect of using a hybrid stent with a rigid core and hydrogel layer in removal of obstruction of the urethral canal in the treatment of urethral stricture. The experimental studies and numerical modelling were used during the analysis. In the first stage, numerical studies were performed to reproduce the conditions in the urethra with the inserted stent during urine flow. The results of this part provided information on the different variants of the designed stents. The study allowed identification of the most optimal stent. The in-vivo experiments on New Zealand White Rabbits were used for definition of boundary condition for numerical models. This study examined the possibility of developing stent designs in the restoration of urethral canal patency during the treatment of urethral stenosis.

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References

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