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A review of production technologies and materials for manufacturing of cardiovascular stents

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ABSTRACT

The purpose of this article is to give a general overview of the production technologies of stents with consideration of their design and materials. Since the beginning of the use of stents in medicine for atherosclerosis treatment, their development has changed rapidly. Various stents have also been developed with the development of materials science, treatment techniques and new manufacturing processes. In this way the development has shifted from the initial bare-metal stents (BMS), to drug-eluting stents (DES) and bio-resorbable stents (BRS), which are made of biodegradable polymers or metals. Various studies agree that it will be necessary to further review the experimentally obtained material properties with analytical and numerical studies. Here, the computational modelling (Finite element analysis – FEA and Computational fluid dynamics – CFD) was found as a valuable tool when evaluating stent mechanics and optimizing stent design. The development of the stent manufacturing technologies has also changed and been supplemented over the years. Nowadays, 3D printing could be an exciting manufacturing method to produce polymeric bio-materials, suitable for the latest generation of bio-degradable stents applications.

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Izvirni znanstveni članek

Pregled proizvodnih tehnologij in materialov za izdelavo žilnih opornic

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POVZETEK

Namen tega članka je podati splošen pregled tehnologij za izdelavo žilnih opornic z upoštevanjem njihove zasnove in materialov. Od začetka uporabe žilnih opornic v zdravstvu, ko so bile uporabljene za zdravljenje ateroskleroze, se je njihov razvoj hitro spremenil. Z razvojem različnih vej znanosti, kot sta znanost o materialih in znanost o obdelovalnih tehnikah in proizvodnih procesih, so se razvile tudi različne opornice. Na ta način se je razvoj premaknil od začetnih kovinskih opornic brez prevleke (BMS), do opornic, ki izločajo zdravila (DES) in biorazgradljivih opornic (BRS), ki so izdelane iz biološko razgradljivih polimerov ali kovin. Številne študije poudarjajo, da bo treba eksperimentalno pridobljene lastnosti materialov podpreti tudi z analitičnimi in numeričnimi študijami. Izkazalo se je, da je računalniško modeliranje (npr. analiza končnih elementov – FEA ter računalniška dinamika tekočin – CFD) dragoceno orodje pri ocenjevanju mehanike opornic in pri optimizaciji njihove zasnove. Z leti so se spreminjale in dopolnjevale tudi tehnologije izdelave opornic. 3D-tiskanje je danes najbolj obetavna metoda za proizvodnjo polimernih biomaterialov, primernih za najnovejšo generacijo biorazgradljivih opornic.

PODATKI O ČLANKU

Ključne besede:
Opornica;
Kovinska opornica brez prevleke;
Opornica, ki izloča zdravila;
Biorazgradljiva opornica;
Prevleke za opornice;
Dostava zdravil;
Izdelava opornic;
Material za opornice;
Lasersko rezanje;
Dodajalna izdelava (3D-tiskanje)

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