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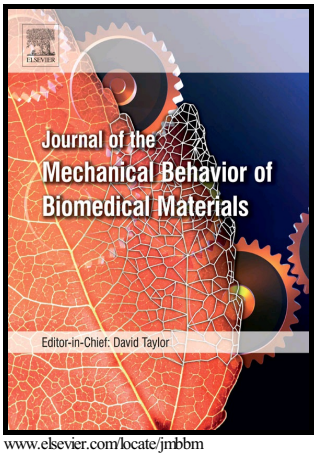


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# Optimizing the deformation behavior of stent with nonuniform Poisson's ratio distribution for curved artery

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**Abstract**

Stent implantation at a highly curved artery has always been a challenge, considering the relatively high chance of in-stent restenosis (ISR) caused by severe straightening effect and high strain energy over the vessel wall. In this paper, a novel optimization based design method was proposed to manipulate the deformation behavior of the common ring-and-link stent. By changing the location of the connection point between rings and links, traditional ring-and-link structure was modified to achiever tunable Poisson's ratio (PR). With the nonuniform cellular structure design method proposed in a previous study, PR distribution of the stent structure was optimized to achieve the desired curvature. As a result, the obtained stent structure with nonuniform PR could perfectly fit into the curved artery after expansion, without causing any obvious vessel straightening. To validate the proposed method, two different vessel models were introduced. Firstly, a short vessel with a constant curvature was set as the design objective, and both numerical and experimental tests were conducted. Further, a patient-specific vessel was applied. Both test results showed that optimized stents would cause much smaller vessel straightening. Moreover, vessels stented by the optimized structures had much lower stress concentration and strain energy. All those properties will decrease the possibility of ISR significantly.

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