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LONG CORONARY LESIONS TREATMENT THROUGH A PATIENT-SPECIFIC STENTING APPROACH.

F. Auricchio[1], M. Conti[1], C. Ferrazzano[2] and G.A. Sgueglia[3]

[1] Dipartimento di Ingegneria Civile e Architettura (DICAr), Università degli Studi di Pavia, via Ferrata 1, 27100 Pavia, Italy, +39-0382-985476

[2] IUSS - Istituto Universitario degli Studi Superiori di Pavia, Piazza della Vittoria 15, 27100 Pavia, Italy

[3] UOC Cardiologia, Ospedale Sant'Eugenio, Piazzale dell'Umanesimo 10, 00144 Rome, Italy

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Percutaneous Coronary Intervention (PCI) through the use of medical stent is a minimally-invasive therapeutic procedure for the treatment of coronary stenosis. Nowadays, several clinical studies have demonstrated the efficacy of PCI procedure in the therapy of focal and *simple* lesions. But, the treatment of diffuse coronary stenosis ($> 30mm$) is not yet standardized and clinically definite, constituting a challenging for interventional cardiologists [1].

The present study aims at investigating the performance of two different stenting strategies, i.e., the one long stent versus two overlapped short stents deployment, which are mainly used in the clinical practice for long coronary lesions treatment. Our study is based on a structural finite element analysis (FEA) [2, 3] and follows the trend to support the pre-operative planning in cardiology intervention by choosing the clinical procedure more suitable for the patient.

In this study, the numerical simulations of the coronary stenting emulate the clinical practice and embed both realistic models of stent Xience Prime/balloon (Abbott Vascular, Santa Clara, CA, USA) provided by the company and patient-specific coronary vessel generated by the elaboration of two X-Ray single-plane angiographic images. In particular, we consider post-stenting distribution of the maximum principal stress along vessel wall, vessel straightening and elastic recoil as measures of the stenting impact on vessel anatomy.

Results suggest that the two analyzed stenting strategies differ considerably. In particular, stress distribution along vessel wall appears to be more homogeneous in the case of long stent implant; in fact, the analysis shows that the two short stents implant induces a localized stress concentration in the overlapping region, having, thus, an higher potential risk of post-stenting neo-intimal hyperplasia (see Figure 1).

From a general point of view, present study confirms the utility of patient-specific sim-

ulations based on FEA, which allow on the one hand, to realistically replicate current complex endovascular procedures, on other hand, to virtually evaluate and optimize alternative interventional strategies.

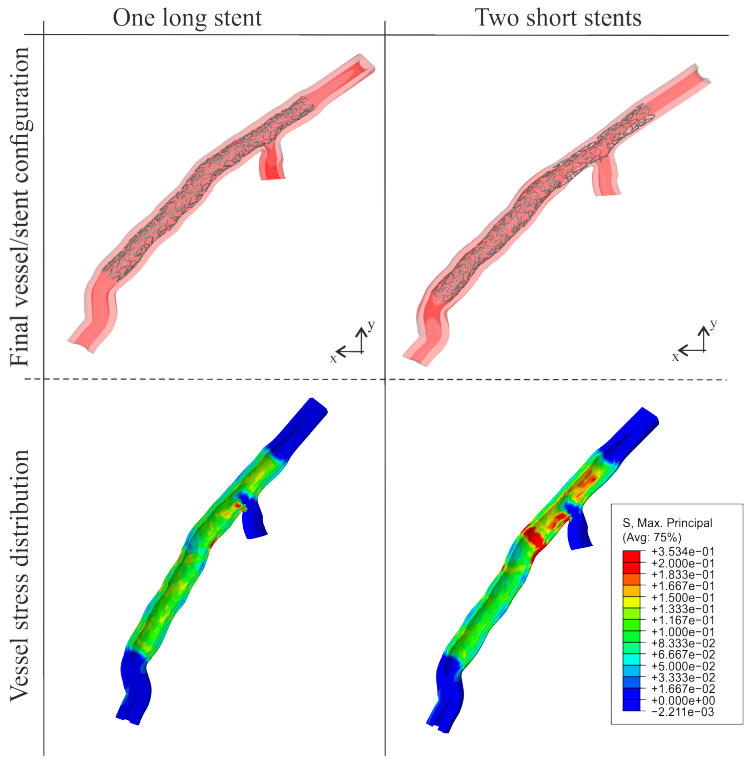

Figure 1: Comparison of the maximum stress distribution [MPa] along the arterial wall for both stenting options. The results corresponds at the end of the stenting procedure, i.e., at the end of balloon deflation.

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