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TRACHEOBRONCHIAL STENTS ACCOMMODATION ANALYSIS

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Summary: Medical interventions related with the implantation of tracheal and bronchial stents have become more common. However, tracheobronchial silicone prosthesis has some performance limitations related with implant migration, development of granulation tissue and accumulation of secretions. On the other hand, implant performance is strongly related with stent geometry and its accommodation with the patient. Additionally, this accommodation is also related with studs geometry, position and number. In fact, different studs are used by manufacturers, but stent performance limitations still persist.

In order to study studs geometry, position and number, a comparative finite element analysis was performed. Granulation tissue formation is related with contact stresses between stent and tissue, migration is related with interface movements, and secretion accumulation is due to regions of low velocity air movement. So, a coupling fluid-structure finite element analysis is essential in stent accommodation analysis. Airway cartilage and smooth muscle tissues were both considered in the analysis.

Results showed that granulation tissue formation and secretion accumulation could be minimized with less stiff stents. However, migration is minimized with more and bigger studs. So, the optimum performance is difficult to achieve, but a multi-criteria optimization procedure could be a good approach in order to develop new stud designs.