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# Mechanical models for human tracheas based on uniaxial extension test

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## Summary

The constitutive model always plays a fundamental role in biomechanical researches on human trachea soft tissues. Due to the variety of constitutive theories, the selection of the appropriate one and the determination of its material parameters becomes a question. Based on longitudinal and circumferential extension tests on human tracheas, three constitutive models-the isotropic M-R model, the Holzapfel's anisotropic model and modified Hozapfel's model respectively, were utilized in this paper to fit the experimental data. A jointly fitting strategy was also proposed to obtain the anisotropic model parameters. For the isotropic M-R model, material parameters optimized from different directions are significantly different. The Holzapfel's model is prone to generate a linear stretch-stress curve in the non-essential direction especially in the situation of a histological large fiber angle, while testing results show obviously exponential-like curves in both directions. The modified Holzapfel's model could solve the above problem by introducing an exponential term in isotropic strain energy part, and could fit the test data successfully in both directions. It could be concluded that the modified model proposed is the most appropriate one for describing the isotropic property of human tracheas. Also, the jointly fitting strategy could directly obtain the fiber angle through optimizing process, which avoids a previously sophisticated but easily-inaccurate measurement of this histological parameter.