

# Modeling of the soft palate including polyethylene reinforcements

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## ABSTRACT

Obstructive sleep apnea (OSA) syndrome affects a large part of the population and may lead to many co-morbidities. The collapse of the soft palate is a main reason for OSA. One surgical procedure to remedy this (Fig. 1) is to implant polyethylene (PET) material into the soft palate [1], but its efficacy remains to be discussed [2]. In this study, we provide input to this topic based on numerical simulations. A 3D soft palate finite element model was created based on one specific patient's CT images. MIMICS and ABAQUS softwares were employed in transforming DICOM files into finite element models. A simplified material modelling approach with the Neo-Hookean material model was applied and nonlinear geometry was accounted for. The PET implant pillars were inserted in the 3D soft palate model. With the finite element model, we designed different surgery schemes and investigated their efficacy with respect to avoiding the soft palate to collapse into the pharynx wall and lead to OSA. Several models were tested, including different surgeries, anterior-posterior pillar positions, different settings for the radius and the array parameters of the implants pillars, and different Young's moduli for the pillars. Based on our simulation results, the longitudinal direction implant surgery improves the stiffness of the soft palate, but the strengthening efficacy is moderate. The transverse direction is evaluated to be a good choice to improve the existing surgery scheme. In addition, the Young's modulus of the polyethylene material implants has an influence on the reinforcement efficacy of the soft palate.

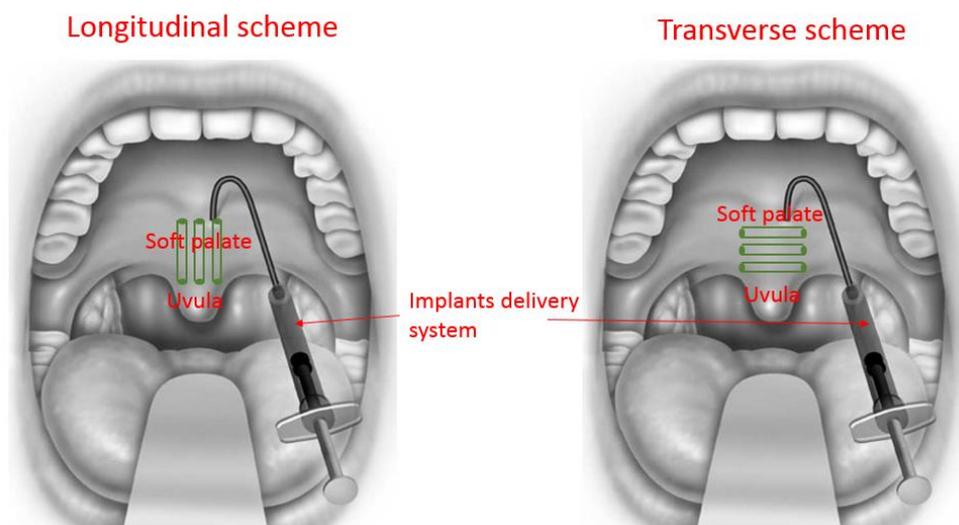


Fig.1 The schematics of the longitudinal pillar implant surgery and the transverse pillar implant surgery adapted from the reference paper [3].

## REFERENCES

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