Titre	**Développement d'un outil d'évaluation de la rigidité pénienne chez les patients porteurs d'un implant gonflable**
Title	**Development of a tool to assess penile rigidity in patients with inflatable implants**
Location	LBMC (Laboratory of Biomechanics and Impact Mechanics) UMR_T9406 Univ. Lyon, Univ. Eiffel
Duration	To be defined from Sept 2023, minimum 4 months
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Context

Erectile dysfunction is a very common condition with an annual incidence of 19.2 to 26 cases/1000 men depending on the study (Salonia et al, 2022). It has a significant impact on quality of life and is recognized as a risk marker for cardiovascular disease. When less invasive therapeutic approaches to erectile dysfunction have proven ineffective (oral or injectable pharmacological treatments, vacuum), or in total penile reconstruction surgeries (phalloplasty), placement of an inflatable penile implant may be considered. Unfortunately, many patients with an implant, reportedly underuse their device due to difficulties in using the pump (difficult grip, lack of strength), resulting in an inability to achieve enough rigidity for optimal satisfaction (Habous et al., 2018).

Devices to measure erectile rigidity have been proposed (Rossello Barbara, 1996; Udelson et al, 1999) but currently no longer exist commercially.

Beyond an a posteriori evaluation of the effectiveness of the use of an inflatable penile implant in patients, numerical simulation tools could bring a lot to the understanding of the mechanical behavior of the implant in its environment and in the longer term, for the optimization of new implants. Currently, only very simplified 2D or 3D models of the penis have been proposed (Drlík et al., 2021; Gefen et al., 2000).

Objectives

The first objective of the internship is the mechanical design of a device able to measure the axial stiffness of an erected penis with an inflatable implant. The second objective is the creation of the finite element mesh of a penis with an inflatable implant, from MRI imaging.

Material and methods

The specifications of the device for measuring the axial stiffness of the erection will have to be established in consultation with the clinicians. Its design could be inspired from previously developed devices or manual dynamometer-type devices used in non-medical fields for mechanical characterization of flexible materials. The different prototypes of the device will have to be calibrated. They will be tested initially on a single-tube inflatable implant. The creation of the penis mesh with an inflatable implant will be done from MRI imaging. Open source imaging tools will be used.

Collaboration

This work is the subject of a collaboration between the Laboratory of Biomechanics and Impact Mechanics and the Urology and Andrology Department of the Lyon Sud hospital.

Expected profile

Initial training in mechanics. Send CV, cover letter, notes of higher education.

Keywords : penile implant, medical device, mechanical design, imaging, mesh

Références

Salonia et al. EAU - Guidelines on Sexual and Reproductive Health, 2022
Lledó-Garcíaet al., J Sex Med. juill 2015;12(7):1646-53.
Habous et al. Predictors of Satisfaction in Men After Penile Implant Surgery. J Sex Med. 1 août 2018;15(8):1180-6.
Rosselló Barbará M. Arch Esp Urol. 1996 Apr;49(3):221-7. Spanish. PMID: 8702341.
Udelson et al.. 1999. Int J Impot Res. 1999 Dec;11(6):327-37, doi: 10.1038/sj.ijir.3900443.