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OVERACTIVE BOWEL (OAB) SYNDROME IN MIXED URINARY INCONTINENCE: 2ND) CAN IT BE TREATED DYNAMICALLY AND MECHANICALLY BY AN INTRAVAGINAL DEVICE?

Hypothesis / aims of study: The mechanical and dynamic pathophysiological hypotheses of OAB should provide the conceptual framework for devising an intravaginal device for mechanical treatment of mixed urinary incontinence. The aim of this study was to define the shape and elasticity criteria, as well as the theoretical behavior of such a device, so as to allow for its industrial production and its scientific evaluation according to the objective criteria of evidence-based medicine.

Study design, materials and methods: The application of pathophysiological mechanisms to the conception of an intravaginal device to treat mixed urinary incontinence was analyzed piece by piece, allowing the shape and elasticity requirements of each segment to be defined in the first instance. The theoretical behavior of the device as a whole was undertaken secondarily, while focusing specifically on the potential implications for OAB.

Results:

1st stage: Shape and elasticity criteria

1st criterion: The device must have two parts, a flexible one positioned under the bladder, and a rigid one positioned under the urethra. This difference in viscoelasticity must be ensured by the thickness, the firmness, and the difference in dimensions of the two parts. This difference in dimensions corresponds with the difference in the vertical and horizontal walls of the vagina (VVW-HVW). The rigid part under the urethra must be less than 2 to 2.5 cm in size, so as to only act on the mobile part of the urethra (the upper 2/3rds). The flexible part under the bladder should be larger in size.

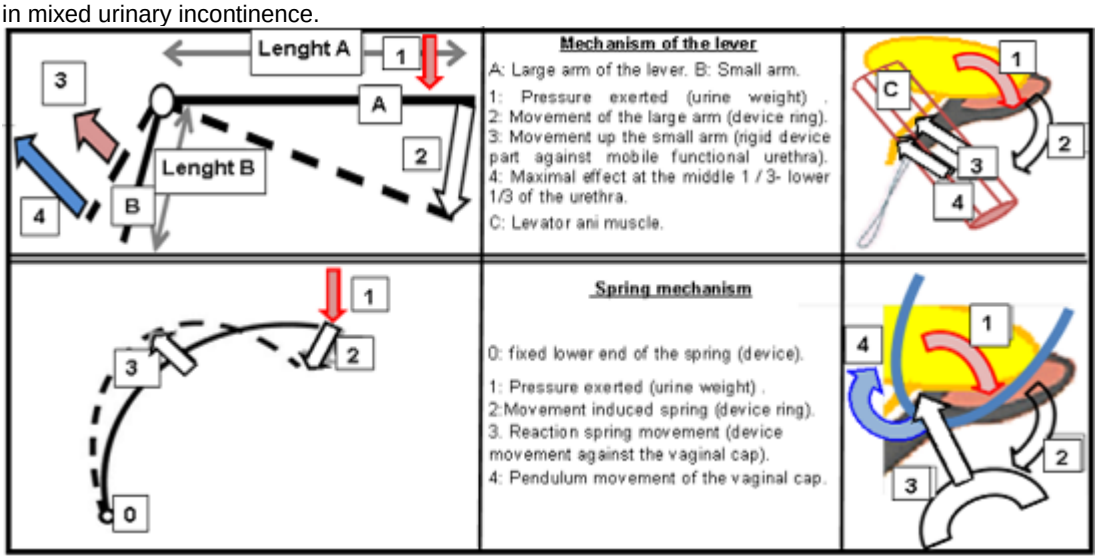
2nd criterion: To prevent the device from slipping out, the flexible part needs to be larger. The difference in width needs to be sufficiently large so that the flexible part is supported laterally by the pubovisceral bundles of the levator ani muscle, for which the upper side is situated at the level of the vaginal cap. The junction between the flexible and the rigid part of the device will hence naturally be situated against the vaginal cap (VC) and the bladder neck (BN).

3rd criterion: The flexible part should not have a solid shape, which promotes leakage of urine (1). An annular shape appears to be preferable in this regard.

The intravaginal device must hence comprise a rigid end of 2.5 cm and a larger-sized flexible annular component.

2nd stage: Analysis of the behavior and the deformation of the device

Upon straining, the weight of the urine moving to toward the HVW propels it downward and forward, which pushes the annular component in this direction. The first consequence of this movement on the annular component is a lever effect linked to the difference in the dimensions between the rigid and the flexible parts. Thus, the rigid part lifts and compresses the urethra along its entire functional length, with a maximal effect at its tip, recreating an angle at this level, in the same manner as the urethral support slings that are surgically inserted at this level. When the lever effect has blocked the lower end of the device, the difference in elasticity creates a spring-like effect that specifically supports the VC. The VC, attached laterally by a strong anatomical connection (SAC) (2), then undergoes a pendular motion that stretches and stiffens the upper part of the VVW and the BN, thereby avoiding vesicalization (funneling effect) of the urethra. This vesicalization then allows the urine to activate the receptors located at this level to initiate a contraction of the detrusor in a physiological manner at the onset of micturition, and in a pathological way in mixed urinary incontinence.



Interpretation of the results

It appears to be possible to create an intravaginal device for which the dynamic behavior should allow the pendular movement of the vaginal cap to be recreated, and to thereby treat the OAB component of mixed UI. Such a device had been industrially

manufactured. A phase III multicenter randomized controlled trial was conducted (3). Yet while the manufacturing laboratory is cognizant of the lever principle, the spring mechanism and the associated specific treatment of OAB has not been explained to them. Thus, the authors of the clinical study only considered evaluation of the efficacy, the tolerability, and the acceptability of an intravaginal device to treat incontinence. The possibility of a new hypothesis, encompassing physiological (the pendular movement of the vaginal cap) and pathophysiological (failure of this pendular movement underlying OAB) aspects is hence not known by the manufacturing laboratory and by the medical team in charge of the study. The aim of validating this was hence masked.

Method of the study: After an initial washout period with no treatment, allowing baseline evaluation, women with SUI were randomly assigned to a treatment or control group
(no treatment). The primary endpoint was the reduction of incontinence episode frequency (IEF), according to bladder diaries, as compared to the baseline. Secondary endpoints were
variation of the Urinary Symptom Profile (USP) score, of 24 h pad test, and CONTILIFE questionnaire scores, as compared to the baseline. Intent-to-treat and per-protocol analyses
were conducted.

Study Results: Fifty-five patients were enrolled and analyzed (26 controls and 29 treated). The mean relative variations of IEFs, SUI USP subscores, and overactive bladder (OAB) USP subscores were more significant in the treatment group than in the control group (−31.7 ± 65.1 % vs. −7.6 ± 24.5 %, p=0.002; −2.4 ± 2.6 vs. 0.2 ± 2.2, p=0.004; and −1.5 ± 2.8 vs. 0.2 ± 1.8, p=0.016, respectively).

Summary conclusion

OAB syndrome in mixed UI can hence be treated dynamically and mechanically by an intravaginal device. This treatment is effective, by recreating the pendular movement of the VC, which eliminates vesicalization (funneling effect). The efficacy of this treatment is a major argument for the validation of the physiological theory regarding the pendular movement of the VC.

References

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Disclosures

Funding: Filings of industrial patents and partnership with the B. Braun Medical SAS laboratory, 204 Avenue du Maréchal JUIN, BP 331, 92107 BOULOGNE CEDEX for the purpose of development of a preventive intravaginal device for female urinary incontinence. **Clinical Trial:** Yes **Registration Number:** Afssaps (FRANCE), N°2006/04/012 (www.afssaps.fr) **RCT:** Yes **Subjects:** HUMAN **Ethics Committee:** Comité de Protection des Personnes se prêtant à des recherches biomédicales; Hôpital Saint-Louis; Paris. France **Helsinki:** Yes **Informed Consent:** Yes