APPLICATION OF COG THREADS FOR VAGINAL WALL PROLAPSE REPAIR: EX-VIVO STUDY

Rita Rynkevic (1), Catarina Soares (2), Lucie Hympanova (3), Elisabete Silva (1), Teresa Mascarenhas (4), Pedro Martins (1, 5)

1. LAETA, INEGI, Faculty of Engineering, University of Porto, Portugal; 2. Faculty of Engineering, University of Porto, Portugal; 3. Institute for the Care of Mother and Child, Third Faculty of Medicine, Charles University, Czech Republic; 4. LAETA, Faculty of Medicine, University Hospital S. João, Portugal; 5. ARAID, i3A, University of Zaragoza, Zaragoza, Spain

Introduction

Pelvic organ prolapse (POP) is a pelvic floor dysfunction that dramatically influences women's quality of life. It is believed that the number of women suffering from POP increase more than 40% by 2050 [1]. Treatment by native tissue repairs have a relatively high failure rate (19%), presenting as recurrence or POP in other compartments. It can be addressed by a new operation, which may then use an implant for weakened or damaged tissue repair. The reason was that, the use of vaginal mesh have been associated with a high risk of graft-related complications (GRCs) due to insufficient biocompatibility and inappropriate mechanical properties of old-fashion materials [2]. Those inconvenient characteristics needs to be overcome by novel approaches. In 2019, the Food and Drug Administration ordered manufacturers of surgical mesh intended for transvaginal repair of anterior compartment prolapse to stop selling their products [3]. Therefore, this research aims to study an alternative surgical technique for POP correction. The reinforcement of vaginal wall provided by biodegradable cog threads. Technique is inspired by current use for face lifting procedures.

Materials and Methods

Commercially available 360°-4D cog threads (PCL-19G-100), made of polycaprolactone (PCL) (Yastrid, China) were used in this research. Sow' posterior vaginal walls (control n=5, cog n=5) were used to study threads reinforcement effect ex vivo by ball burst testing. Two threads were inserted into the tissue via cannula at 90° angle, creating a non-rigid reinforcement. Explant tensiometry was done using ball burst testing with an 11.5mm plunger at 10mm/min speed until the rupture.

Result

Thread reinforced vaginal tissue could withstand 68N of additional load than untreated tissue ($p<0.05$), showing its strengthening effect (Figure 1). Stiffness in a comfort and stress zone was significantly higher in the tissues reinforced with cog threads ($p<0.05$; $p<0.05$). The deformation was similar in both groups, and no significant differences in the comfort zone length were observed, indicating that threads do not affect tissue compliance.

Discussion

Injectable biodegradable cog threads were used for vaginal wall reinforcement, as a novel POP treatment concept. Results showed that cog threads provide immediate additional strength to the vaginal wall and don't interfere with physiological compliance. This technique has several advantages:1/treatment of early POP stages 2/ the transvaginal access (local anesthesia) 3/the possibility to have a vaginal delivery after threads insertion (not recommended with conventional meshes) 4/ no additional anchoring points and 5/ degradability reducing the material burden decrease chronic inflammatory reaction. The procedure could be personalized, by the injected threads number, material choice and thread type. We hypothesize this new technique will contribute in preventing prolapse progression, avoiding major surgeries and GRCs. Further research will follow to investigate short and long-term response of the vaginal wall in vivo.

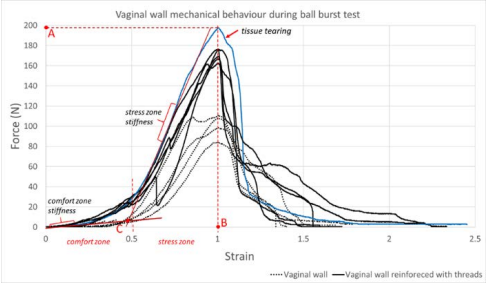

Figure 1: Mechanical behavior of the sow vaginal wall with and without cog threads. A blue colored curve - an example to highlight studied tissues characteristics: comfort and stress zone stiffness; A- ultimate load, B- the maximum change in length at ultimate force; C- comfort zone length.

References

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