

Event: Medical Innovation (Secondary Division)

Team Members: Rakshaa Venkatraman, Cindy Ta, Alicia Roice, Ashley Chun

Chapter #: 32411 School: Mountain House High School, California Innovation: metriGo

POSTER (SolidWorks model made under mentorship of Ms. Erin Graf from LLNL)

Digital version of our printed poster for visibility

metriGo.

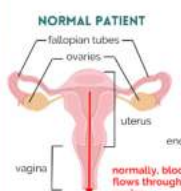
THE FALLOPIAN VALVE TO STOP ENDOMETRIOSIS

THE PROBLEM

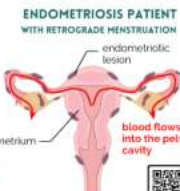
1 IN 10 U.S. WOMEN OF REPRODUCTIVE AGE HAVE ENDOMETRIOSIS.¹

A POSSIBLE CAUSE IS RETROGRADE MENSTRUATION.²

NORMAL PATIENT



ENDOMETRIOSIS PATIENT WITH RETROGRADE MENSTRUATION



SYMPTOMS debilitating pelvic pain, insomnia, infertility, limitations in daily & social activities, dysmenorrhea^{1,3,6,7}

YEARLY COST \$15,780 per patient, including healthcare and productivity losses³

RECURRENCE Recurrence rate is as high as 40% in 10 years after laparoscopic surgery⁴

SICK DAYS 50% of affected women 'stay in bed all day' with ~18 bed days per year related to endometriosis pain⁵

THERE IS NO CURRENT SOLUTION FOR ENDOMETRIOSIS.

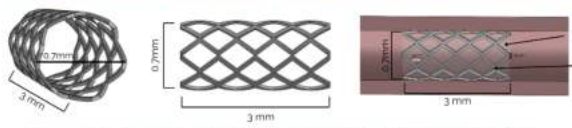
Current treatments (pain medication, laparoscopic surgery, etc.) only focus on **symptom management**, and are often ineffective.^{4,6}

THE NEED

A way to **stop the initial development and the recurrence** of endometriosis in high-risk (ex. family history, abnormal menstruation) and diagnosed patients by **targeting the source** of the disorder rather than simply managing the symptoms is **needed**.

THE INNOVATION

- metriGo: a package of two implants comprised of a **platinum-iridium frame** and a **semi-permeable membrane covering** that is inserted into the opening (**ostium**) of the **intramural segment** of each fallopian tube
 - Acts as a valve that blocks blood in the uterus from flowing out to the pelvic cavity, forcing it to flow through the vagina (**reversing retrograde menstruation**)
- The implants will be replaced **every two years** in order to ensure efficiency and proper functioning.




These models (above) were made using SolidWorks under the mentorship of Erin Teresa Graf, a medical materials engineer and specialist from Lawrence Livermore National Laboratory.

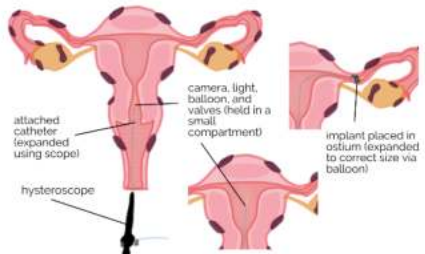
The metriGo implant is inserted using a **hysteroscope** with an embedded camera, light, and balloon delivery catheter. Implants for both fallopian tubes can be inserted in the same procedure! Scan QR code for more info.

A COMMENDABLE INNOVATION WITH A LOT OF SCOPE FOR APPLICATION AND USE.

- Pallavi Shikaripur Nadig, MD OBGYN



Spring-loaded frame allows for personalized adjustment and expansion once the implant is in the correct part of the fallopian tube. It is non-corrosive, **inert**, safe for use, and is designed with specific thickness, size, and elasticity as verified using the **lattice spring model (LSM)**



THE BENEFITS

- Prevents endometriosis and related pain at the source by **stopping retrograde menstruation**
- Doubles as a **contraceptive** that blocks sperm in order to prevent ectopic pregnancy while the implant is in place (procedure for planned pregnancy option possible)
- Minimally invasive, **incision-free** insertion procedure with minimal pain and short recovery
- Low cost and out-patient procedure makes metriGo very **accessible**
- Allows patients suffering from the condition to **live normal, productive lives**

THE COST

Comparing the average yearly costs per patient...

\$2000 VS \$15,780
with metriGo traditional³

- Two metriGo valves cost approx. \$200 total
- Implantation procedure every TWO years costs \$3600-\$3800

CUT THE COST OF ENDOMETRIOSIS BY 88%.

TRAINING & CAREER

Short training course for **gynecologists and primary care doctors**.

- Safe use of balloon-embedded hysteroscope in metriGo insertion procedure to place valves in fallopian ostia (similar to standard hysteroscopy procedures)
- Safe use of hysteroscope and hemostat forceps to extract valves after 2 years or when necessary

Provides a template for **biomedical engineers** to further develop devices targeting endometriotic lesions and bleeding.

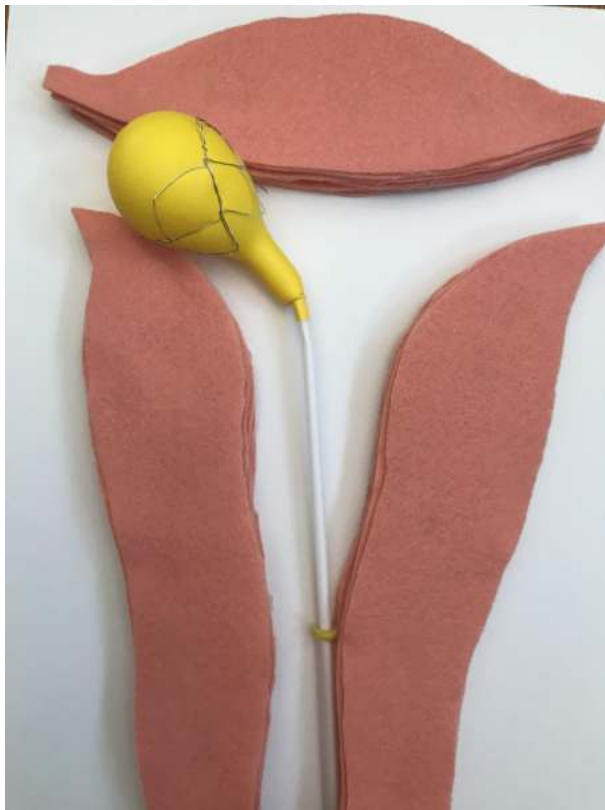
Acts as a pathway for further research in the future, shifting the focus in endometriosis care from **treating symptoms** to **finding cures**.

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INSERTION MODEL (UPSCALED)



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PROTOTYPE VALVES WITH MEMBRANE (UPSCALED)



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References

1. Missmer, S. A., Tu, F. F., Agarwal, S. K., Chapron, C., Soliman, A. M., Chiuve, S., ... As-Sanie, S. (2021). Impact of endometriosis on life-course potential: A narrative review. *International Journal of General Medicine*, 14, 9-25. doi:10.2147/IJGM.S261139
2. Alimi, Y., Iwanaga, J., Loukas, M., & Tubbs, R. S. (2018). The Clinical Anatomy of Endometriosis: A Review. *Cureus*, 10(9), e3361. doi: 10.7759/cureus.3361
3. Simoens, S., Hummelshoj, L., & D'Hooghe, T. (2007). Endometriosis: Cost estimates and methodological perspective. *Human Reproduction Update*, 13(4), 395-404. doi:10.1093/humupd/dmm010
4. Mettler, L., Ruprai, R., & Alkatout, I. (2014). Impact of medical and surgical treatment of endometriosis on the cure of endometriosis and pain. *BioMed Research International*, 2014, doi:10.1155/2014/264653
5. Barbara, G., Buggio, L., Facchin, F., & Vercellini, P. (1AD, January 1). Medical treatment for endometriosis: Tolerability, quality of life and adherence. *Frontiers*. Retrieved November 19, 2021, from www.frontiersin.org/articles/10.3389/fgwh.2021.729601/full.
6. Moradi, M., Parker, M., Sneddon, A., Lopez, V., & Ellwood, D. (2014). Impact of endometriosis on women's lives: a qualitative study. *BMC women's health*, 14, 123. doi:10.1186/1472-6874-14-123
7. Parasar, P., Ozcan, P., & Terry, K. L. (2017, March). Endometriosis: Epidemiology, diagnosis and clinical management. *Current obstetrics and gynecology reports*. Retrieved November 3, 2021, from www.ncbi.nlm.nih.gov/pmc/articles/PMC5737931/.
8. Abbott, J., Hawe, J., Clayton, R., Garry, R. (2003). The effects and effectiveness of laparoscopic excision of endometriosis: a prospective study with 2–5 year follow-up, *Human Reproduction*, 18(9), 1922–1927, doi: 10.1093/humrep/deg275
9. Edgardo Somigliana, Mirco Infantino, Massimo Candiani, Michele Vignali, Annalisa Chiodini, Mauro Busacca, Mario Vignali (2004). Association rate between deep peritoneal endometriosis and other forms of the disease: pathogenetic implications, *Human Reproduction*, Volume 19, Issue 1, January 2004, Pages 168–171, doi: 10.1093/humrep/deg513
10. Giudice, L. C., & Kao, L. C. (2004). Endometriosis. *The Lancet*, 364(9447), 1789-99. doi: 10.1016/S0140-6736(04)17403-5
11. Huntington, Annette, and Jean A. Gilmour. "A Life Shaped by Pain: Women and Endometriosis." *Journal of Clinical Nursing*, vol. 14, no. 9, 2005, pp. 1124–32. Wiley Online Library, doi: 10.1111/j.1365-2702.2005.01231.x.
12. Klemmt, P., & Starzinski-Powitz, A. (2018). Molecular and Cellular Pathogenesis of Endometriosis. *Current women's health reviews*, 14(2), 106–116. Doi: 10.2174/1573404813666170306163448
13. Lorraine Culley, Caroline Law, Nicky Hudson, Elaine Denny, Helene Mitchell, Miriam Baumgarten, Nick Raine-Fenning, The social and psychological impact of endometriosis on women's lives: a critical narrative review, *Human Reproduction Update*, Volume 19, Issue 6, November/December 2013, Pages 625–639, doi: 10.1093/humupd/dmt027
14. Malvezzi, H., Marengo, E.B., Podgaec, S. et al. Endometriosis: current challenges in modeling a multifactorial disease of unknown etiology. *J Transl Med*, 18, 311 (2020). doi: 10.1186/s12967-020-02471-0
15. Mohammed, A. M., Ariane, M., & Alexiadis, A. (2021). Fluid-Structure Interaction in Coronary Stents: A Discrete Multiphysics Approach. *ChemEngineering*, 5(3), 60. MDPI AG. Retrieved from <http://dx.doi.org/10.3390/chemengineering5030060>
16. Standring, S., Anand, N., Birch, R., Collins, P., Crossman, A. R., Gleeson, M., Jawaheer, G., Smith, A., Spratt, J. D., Stringer, M. D, Tubbs, R. S., Tunstall, R., Wein, A. J., & Wigley, C. B. (2016). *Gray's anatomy: The anatomical basis of clinical practice* (41st ed.). Elsevier Limited.
17. Taylor, H. S., Kotlyar, A. M., & Flores, V. A. (2021). Endometriosis is a chronic systemic disease: clinical challenges and novel innovations. *The Lancet*, doi:10.1016/S0140-6736(21)00389-5.
18. Young K, Fisher J, Kirkman M. Women's experiences of endometriosis: a systematic review and synthesis of qualitative research. *Journal of Family Planning and Reproductive Health Care*. 2015, doi: 41:225-234.