

# Laparoscopic Banding Device

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## Abstract

Our client, Dr. Julian, asked us to design a laparoscopic device for banding fallopian tubes that was less traumatic and more reliable than the one he currently uses. Last semester we constructed an enlarged prototype to test the design. This semester, we built another prototype and continued testing on the suction mechanism and band release.

## Background

Tubal ligation is a permanent form of birth control, commonly called getting one's "tubes tied". This technique works by mechanically blocking the ova from reaching the uterus. One million tubal ligations are performed each year. The banding procedure is done laparoscopically for minimal invasiveness. The procedure is reversible, but doing so is difficult.

## Current Products

There are many different methods of tubal ligation, such as Pomeroy, banding and clipping. Banding, the method Dr. Julian prefers, is a good option because it is non-electrical and easily reversible. The product he currently uses, however, fails up to 80% of the time (Julian, 2007).



Figure 1 (Left): The Fallope Ring Band® (produced by Gynac ACME (www.gynacme.com)).



Figure 2 (Right): The Fallope Ring Band® in action. The device grasps the fallopian tube, bands it and releases it (www.youtube.com).

## Design Criteria

The device must be:

- single use
- sterile and inert
- accurate with a failure rate of less than 20% (Julian, 2007)
- less than \$400 per device
- similar to current devices for surgeon's ease of use

## Design

Our design relies on two separate mechanisms. The suction mechanism secures the fallopian tube, and the band release mechanism releases a silicon elastomer band onto the fallopian tube, blocking passage of the ova.

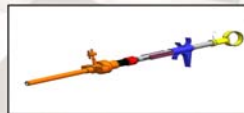


Figure 3: Three-dimensional CAD image of our laparoscopic banding device.

### Suction

The suction mechanism, which uses a small syringe, was shown to be gentler on the fallopian tube than the current product in the initial testing with sheep fallopian tubes last semester. The suction is capable of creating a secure hold on fallopian tubes while the band is released. A spring allows for controlled insertion and removal of the syringe.

### Band Release

Our current design incorporates a threaded knob to advance a pushrod that releases the bands individually. This mechanism should provide a surgeon with greater precision than current instrumentation allows. A resorbable separator will be placed between bands to ensure proper release.

## Testing and Validation

When testing the banding device this semester, we focused mainly on the two device mechanisms that we designed. It was important to determine the conditions that would result in approximately 95% success rate with the suction mechanisms, as well as a 95% success rate for releasing bands individually.

We tested on sheep fallopian tubes, which are histologically similar to human fallopian tubes. The fallopian tubes were placed in petri dishes with water and secured at both ends. The suction was tested at various contact angles to determine how the surgeon should approach the fallopian tube. It was determined through testing last semester that the suction must provide 0.25 N of force to secure the tissue more than 95% of the time.



Figure 4: Suction mechanism of banding device secures sheep fallopian tube during testing.

## Testing and Validation

As Figure 5 shows, the suction mechanism was successful 97% of the time and should be used at a contact angle of greater than 30 degrees from vertical and no more than 1mm from the tissue to ensure the fallopian is secured successfully.

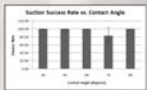


Figure 5: Success Rate of Suction mechanism vs. Contact Angle.

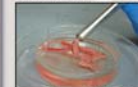


Figure 6: Sheep fallopian tube has been secured and the first band has successfully been released.

## Future Work

Our team has received a grant from the OB/GYN department of the UW Hospital so that we may receive funding to continue development of this design. Beginning in June, we will have the design manufactured professionally and begin testing on live sheep. We also plan to construct a band loader that will be used with device. The band loader, which will be a multiple-use device, will be tested this summer to determine whether it is easier to use than the current loading method. Additionally, we will research resorbable materials to be used as band separators to further ensure individual release of bands. Finally, we are pursuing a patent through the Wisconsin Alumni Research Foundation.

## Conclusion

We believe that this design will quickly become more popular among surgeons than its competitor due to its ease of use, gentleness on tissue, and reliability when releasing bands. We will continue to develop the design with the hope of seeing it implemented soon in laparoscopic banding procedures for tubal ligation.

## Acknowledgements

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