

Applicator Device for Topical Delivery of Drug Solution to Scalp

Client, William E. Fahl, PhD
Department of Oncology, UW Hospital and Clinics

Advisor, John Webster, PhD

Vanessa Grosskopf
Rachel O'Connell
Samantha Paulsen
Jeff Theisen



Overview

- Background
- Design Criteria
- Design Alternatives
- Preliminary Testing
- Design Matrix
- Final Design
- Future Work



Clinical Trials

- Drug developed by client's company, Procertus
 - Prevents alopecia (hair loss) in cancer patients
- Initial animal testing done in McArdle Laboratory
- Clinical trials proposed for human subjects at UW Hospital
 - 12 patients, daily trial for 25 to 35 days
- Get approval from FDA for human use



Mice pre- and post-radiation therapy. There is no hair loss in the area that was treated with the drug solution.

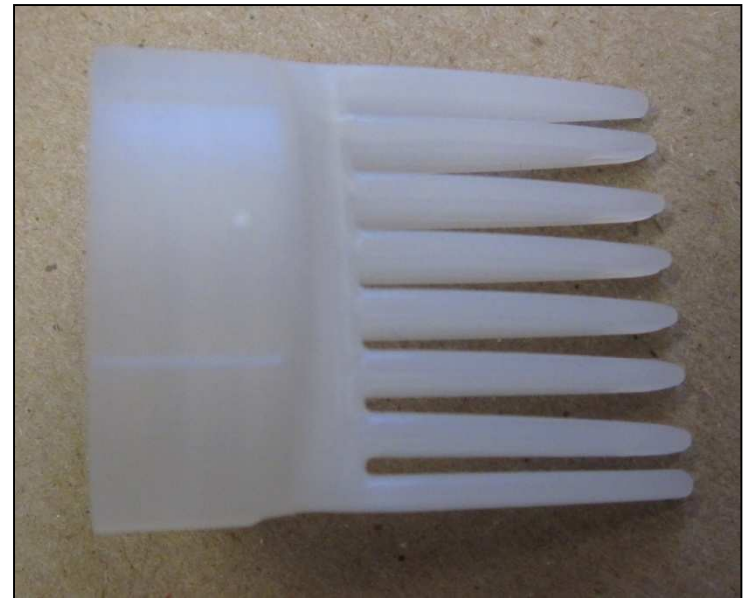


THE UNIVERSITY
of
WISCONSIN
MADISON

Current Device



Wolfe Tory Medical, Inc.
MADomizer with comb attached



L'Oreal comb from hair dye kit

Reasons for a New Device

- Current device is rudimentary example
- Appears unprofessional
- Excessive dead space
- Combs are expensive
 - Cannot be purchased individually



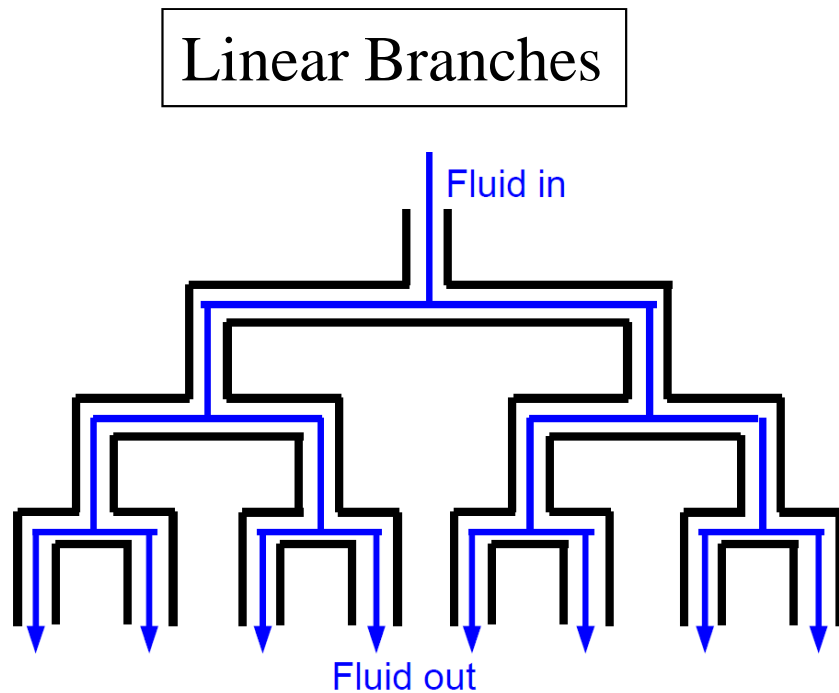
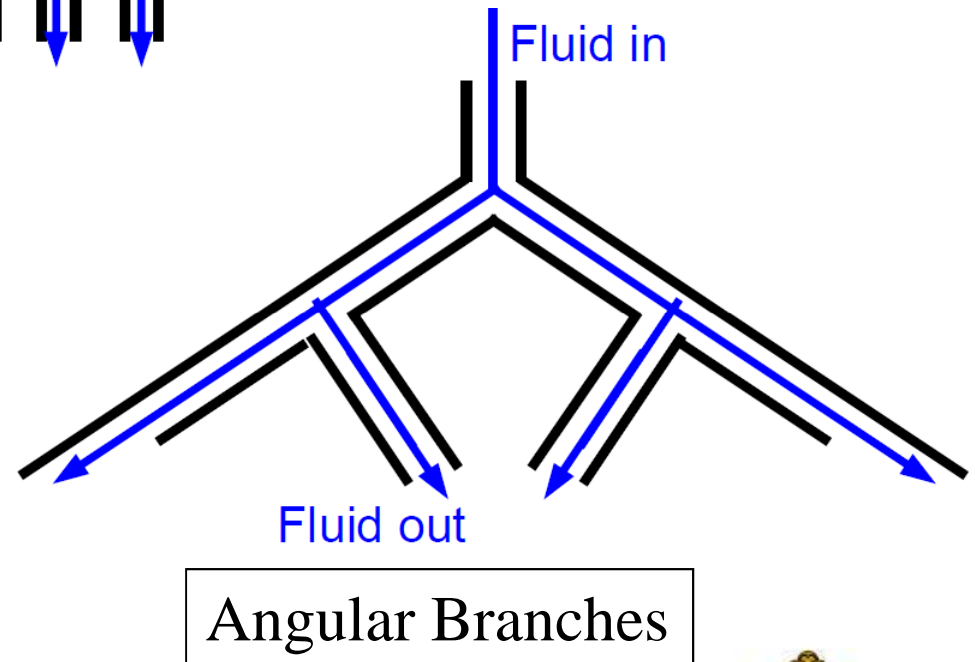
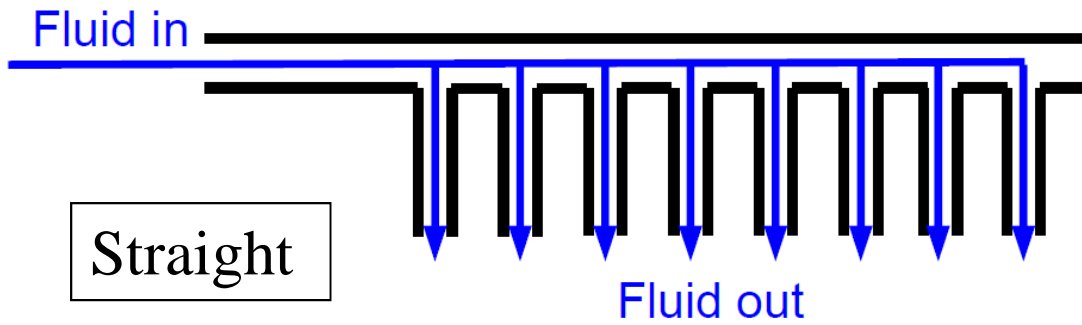
Rudimentary example of device

Design Criteria

- Deliver 2.0 mL \pm 5% to 50 cm² area on scalp
- Minimize amount of wasted drug
 - Minimize amount lost on hair
 - Minimize dead space to 1.0 mL
- One-time use/disposable
- Quick Application (60 to 90 seconds)
- Comfortable for patient and research assistant
- \$300 to \$400 budget



Comb Tip Design Alternatives



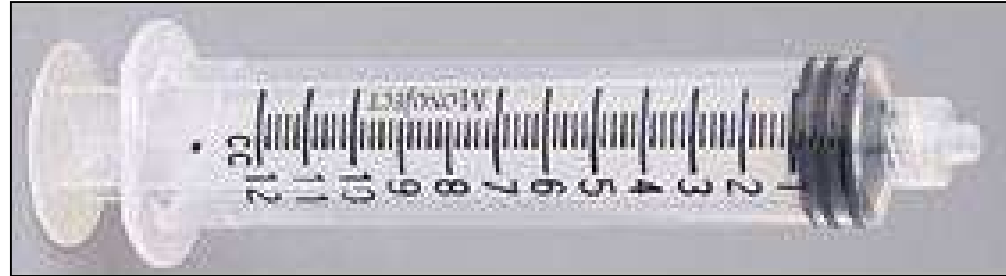
Design Matrix – Comb Tips

Criteria	Straight	Linear Branches	Angled Branches
Application Accuracy (Cleanliness and Even Distribution) (30)	19	28	23
Ease of Use Through Hair (20)	18	15	14
Patient Comfort (20)	17	16	16
Amount of Dead Space (15)	11	10	13
Feasibility (10)	9	7	6
Cost (5)	4	4	4
Total (100)	78	80	76

Reservoir Design Alternatives



Spray Bottle



Syringe

Hollow with Solution Ampoule



Design Matrix - Reservoir

Criteria	Spray Bottle	Hollow with Solution Ampoule	Syringe
Control over Liquid Flow (30)	27	20	26
Amount of Dead Space (20)	14	17	19
Preparation Time (15)	9	15	11
Liquid Storage (15)	12	15	9
Administrator Comfort (10)	7	9	6
Cost (5)	3	1	4
Test Results (5)	2	1	4
Total (100)	74	78	79

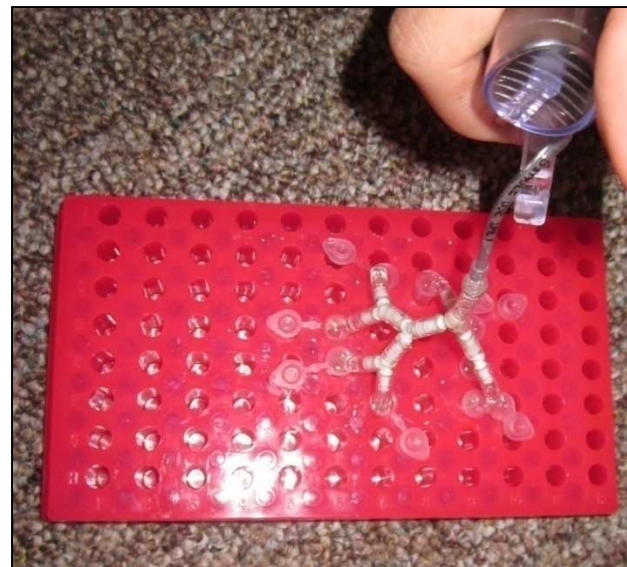
Testing Conclusions

- Syringe
 - Easiest to work with
 - Good control and comfort



Preliminary Testing - Reservoir

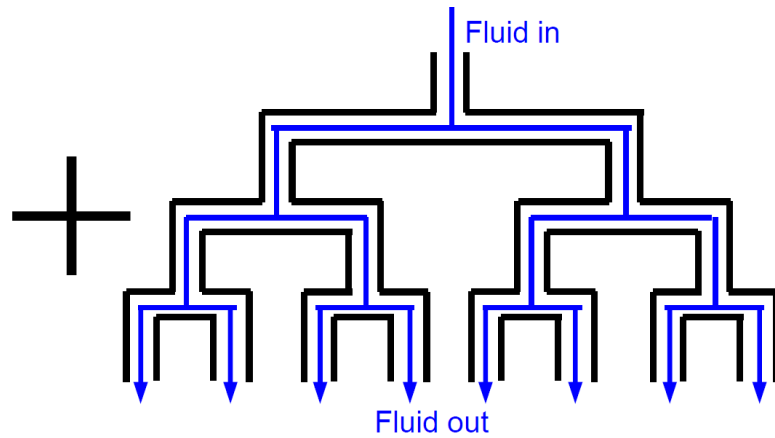
- Hollow with Solution Ampoule
 - Hard to control flow
- Syringe Handle
- Spray bottle
 - Less comfortable
 - Took time to fill dead space and fill vial



Final Design – Kit Contents



[1]



Contoured tip to fit scalp



[2]

Syringe
Handle

Potential Obstacles

- Fabrication of comb
- Selection of material
 - Firm enough to get through hair
 - Pliable enough to be comfortable and contour to scalp
- Fabrication/purchase of handle



Future Work

- Make SolidWorks design of comb tip
- Research materials for comb
- Fabricate comb tip compatible with existing syringes (Luer-Lock tip)
- Test final design
 - Accuracy (2 mL to 50 cm²)
 - Speed of application
 - Cleanliness



References

- [1] RachelsSupply.com. *Pipettes and Droppers*. Retrieved from <http://www.rachelssupply.com/pipette.htm>
- [2] The Mystic Corner. (2010). *Storage Jars & Vials*. Retrieved from <http://www.themysticcorner.com/Storagebtls.asp>



Acknowledgements

- Professor Naomi Chesler
- Dr. William B. Fahl
- Professor John Webster



Questions?

