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MICRONEU: A NEW NOVEL DYNAMIC NON-LIVING MICROSURGERY MODEL

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Abstract

Microsurgery is a niche area of surgery in which training and manual dexterity are essential. With limitations in live animal use for training, numerous non-living and synthetic microsurgical models have been designed, tested and used in microsurgery training. The main problem in non-living animal models is absence of the dynamic circulation. MicroNEU has been designed to attempt to add a dynamic circulation to non-living animal models in order to overcome the greatest disadvantage of these models in an economical way.

Keywords

Microsurgery, Non-Living, Synthetic, Dynamic, Micro

1. Introduction

Microsurgery is a surgical subspecialty requiring great precision and manual dexterity (Dinghy, 1979). In microsurgical training, live animals have been used. However, the ethical considerations in use of live animals and the high running cost created limitations for training (Ad-El et al., 2000; Schnauzer, 2002). This situation directed microsurgery training to use cold or fresh non-living models.

Various models have been tried and used as non-living in the training such as porcine, chicken thigh, rat, human placenta and excised human tissue. All of the non-living models have individual limitations in use for training such as limited shelf life and disease transmission risk (Schnauzer, 2002; Succor et al., 1981; Steffens et al., 1992; Cohen, 1979; Ayoubi, 1992;

Waterhouse et al., 1985; Gavial and Sharma, 1990). However, all non-living training models have one major limitation in common: missing dynamic circulation.

With progression in technology, synthetic models have also been developed and used in microsurgery training. Numerous synthetic models have been created such as stretched latex gloves (Guler and Rao, 1990), gauze (Demirseren et al., 2003), cardboards (Crossby et al., 1995; Fanua et al., 2001), foliage leaf (Kaufman et al., 1984) and silicone tubes (Yen et al., 1995). Although the advancements in materials science and synthetic model design, no synthetic material is able to provide the handling experience of tissue and eventually, non-living model and living animal training would be required after training with synthetic models.

Adding a dynamic circulation to non-living tissues could decrease both the training time and cost; and, contribute to efficiency of the microsurgery training.

2. Model Design

Micro-NEU is an economical model that aims to add dynamic circulation to non-living animal tissue. Micro-NEU model comprises of three main parts: The first part is the non-living animal tissue such as cry preserved rat vessels or vessels from a cold chicken thigh. The second part is the fluid that would be used as a substitute for circulating blood. This fluid requires to be aqueous and it could be economically prepared by mixing 50% aqueous ultrasound gel with 50% water. Red dye could be added for creating a more realistic appearance. Finally, the third part is the dynamic circulation. This could be economically achieved by using an 12 Volt Direct Current water pump in the flask including aqueous fluid, connected to a 4 millimeters silicone tube followed by one way valve, divided into further two routes. In one of the routes, non-living vessel tissue would be attached to the model, where microsurgical training would be achieved. On the other route, the silicone tubing will continue. The aim of creation of these two routes is that, when the clamp is put on to the non-living vessel, the fluid flow would continue from the silicon tubing located parallel to the tissue. These two routes, then, will merge and lead back to the aqueous flask through one way valve. One way valves are placed to prevent the backflow and

assess the patency of microsurgical anastomosis. After the training, clamps could be removed from the non-living vessel to assess patency. MicroNEU microsurgical training model is demonstrated in Figure 1.

Micro NEU model is designed to address the missing dynamic circulation component of non-living microsurgical training models; however, there is still a limitation of Micro NEU compared to live animals: tissue response. Although coagulation and tissue response could not be performed, Micro NEU model achieves to provide an economical dynamic model for non-living animal models in microsurgery training.

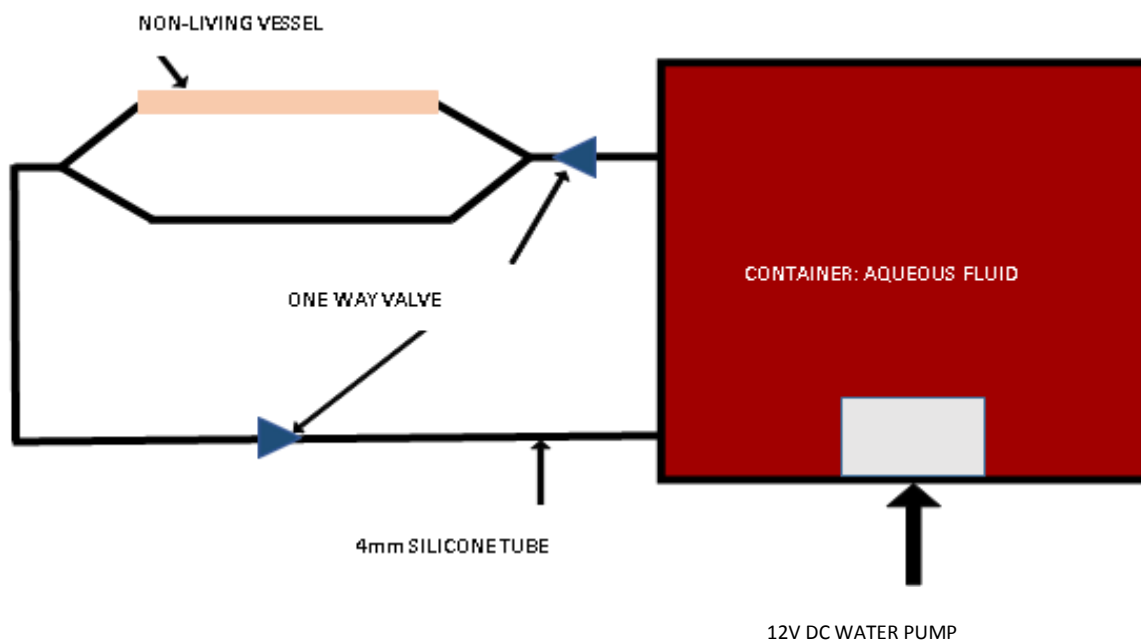


Figure 1: *Micro NEU Microsurgical Training Model*

3. Conclusion

Microsurgery training is greatly performed by using non-living tissue. However, these models do not imitate live conditions as they do not provide dynamic circulation. Live animal tissue is used for advanced training in numerous countries which brings a great ethical concern and financial expense to training. Micro NEU is a new novel dynamic non-living microsurgery model aiming to provide the dynamic circulation component for microsurgery training.

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