

SURFACE MODIFICATION OF DACRON STENT GRAFT FOR ABDOMINAL AORTIC ANEURYSM REPAIR (AAA)

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INTRODUCTION

Endovascular stent repair is a minimal invasive procedure used for Abdominal Aorta Aneurysm (AAA) repair. Endovascular stent grafts are made of an inner tube material (woven Dacron or expanded PTFE) and outer mesh of nitinol or stainless steel. This procedure has been associated with long term complication's such as endoleak, late kinks and migration of the stent (1,2). Reports of migration and endoleak have been related to the lack of adhesion between the stent graft and the aortic wall (1). Poor tissue integration healing of woven Dacron and the aortic wall is a factor that has been found in migrated stent grafts (3).

Coating of the stent with poly(lactide-co-glycolide) (PLGA) was attempted to alleviate improper healing associated with Dacron Stent grafts. PLGA is a biodegradable polymer that promotes cellular reaction both in vitro and in vivo conditions. It was thought that slow acid release might stimulate fibrosis and better tissue integration. The release kinetics of PLGA from the coated stent was studied in Phosphate Buffer Saline (PBS) pH 7.4 solution at 37°C.

EXPERIMENTAL METHODS

Preparation of 50:50 PLGA solution

1 wt%, 5 wt% and 10 wt% of 50:50 PLGA (M_w75,400 Da) from Birmingham Polymers was dissolved in 10 ml of methylene chloride. The solution was stirred for 30 minutes to properly dissolve the amorphous PLGA.

Coating of Dacron stent grafts

Dacron Stent grafts were cut into cylindrical pieces with a height of 0.5 inches. The samples were then weighed to determine the initial weight before coating. Samples of the stent graft were then dip coated in 1wt% solution of PLGA, 5 and 10 times. The coated stent were air dried in a dust free environment for 24 hours and vacuum dried for 24 hours. After drying the samples were weighed to determine coating percentage. The morphology of the coated stent graft was obtained using Scanning Electron Microscope (SEM)

Coating of Dacron grafts

Dacron graft was cut into one millimeter by one millimeter square pieces. The initial weight of the samples was recorded. 3-samples of the square Dacron grafts were then 5, 8 or 10 dip coated in 5wt% and 10 wt%, PLGA solutions respectively. Coated samples were air dried in a dust free environment for 24 hours and vacuum dried for another 24 hours. Final weight of the coated samples were then obtained after the drying process. The samples were then suspended in a test tube filled with PBS solution and placed in 37°C incubator for 42 days

The pH and weight of the samples were observed on day 7, 28, and 42. The samples were removed from the solution, rinsed with distilled water and dried. The drying process took approximately 2 days, 1 day to air dry in dust free environment and vacuum dried for 24 hours. The pH was obtained after sample removal. After 2 days, the sample was weighed and placed in a fresh PBS solution. The pH and weight change of the samples recorded during the observation period were used to determine the release kinetics of the coated stents.

RESULTS AND DISCUSSION

Percentage coating of Dacron stent graft was obtained using the initial weight of the stent and the weight of the stent after coating. The stent was covered with 10% PLGA. Morphological features of the coated stent can be found in Figure 1.

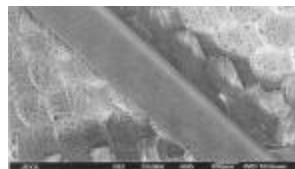


Figure 1: Coated Stent with 50/50 PLGA

The coating of PLGA was observed on Dacron fiber and not on the nitinol stent. Nevertheless, it can be concluded from this figure that coating of the stent with 50/50 PLGA will be difficult unless the stent is treated with a hydrophobic substance to ensure the attachment of the polymer. A decision was made to coat the Dacron fiber due to the results obtained for the coated stent graft.

Dacron grafts dip coated 5 times in 5 and 10 wt % 50/50 PLGA were flexible compared to grafts coated 8 and 10 times. Samples dip coated 5 times were more flexible than samples dip coated 10 and 8 times. The pH change of PBS during the study period can be found in figure 2. A dramatic change in pH was observed on day 21 and day 42.

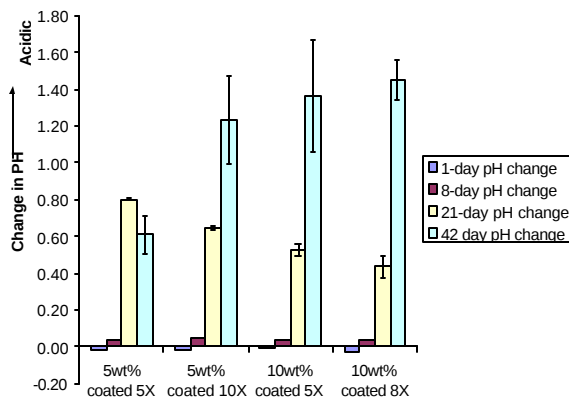
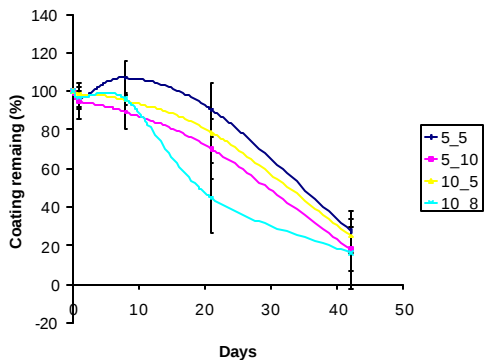


FIGURE 2: pH change with time

This pH change correlated with the decrease in weight observed in Figure 3. The degradation of the PLGA lead to an increase in the pH change. After 42 days, 27%, 18%, 25% and 16% of 50/50 PLGA remained for Dacron graft coated 5 times in 5wt% 50/50 PLGA, 10 times in 5wt% PLGA 5 times in 10wt% 50/50 PLGA and 8 times in 10 wt% PLGA, respectively.



5_5 – Dacron graft coated with 5wt% 50/50 PLGA dip coated 5 times; 5_10 Dacron graft coated with 5wt% 50/50 PLGA dip coated 10 times; 10_5 Dacron graft coated with 10wt% 50/50 PLGA dip coated 5 times; 10_8 Dacron graft coated with 10wt% 50/50 PLGA dip coated 8 times;

FIGURE 3: Percent Coating Remaining vs. Time

CONCLUSION

Successful coating of the Dacron stent graft was observed on the Dacron fibers. Coating of the nitinol mesh was not observed. Degradation of 50/50 PLGA was observed for the coated grafts until day 42. Further studies of the Dacron graft will be performed with 5 wt% 50/50 PLGA in cell and animal environments.

REFERENCES

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