IMPROVEMENT TO THE *IN VITRO* ADHESION TEST FOR CHITOSAN BANDAGES

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Statement of Purpose: A new adhesion test was developed to evaluate bioadhesive chitosan bandages, currently used as external wound dressings for severely bleeding injuries. The old test (1) was highly variable because of a combination of cohesive and adhesive failure mechanisms as seen with previous bioadhesive studies (2). The new test includes a nylon mesh that eliminates cohesive failure and thus reduces variability.

Methods: The improved *in vitro* adhesion test for chitosan bandages was based on a standard tissue adhesion test (3) and then modified with a screen (4). The chitosan bandages were tested on a MTS 858 Mini Bionix system. Two types of bandages, B1 and B2, were used in this experiment. Twelve, 2.54 cm diameter disk specimens were cut from two bandages of each type. Clamps were used to mount a specimen and a 2.54 cm square nylon mesh layer with a 49% open area between the cover plate and the loading platform (Figure 1). A 0.25 ml drop of bovine blood was placed on the mesh surface and allowed to wick into the bandage. The bandage sample was compressed at a rate of 50 kPa/s to a stress of 60 kPa with a 200 mm^2 contacting probe and held for a three-minute dwell time. The probe was withdrawn from the bandage at a rate of 1 mm/s. The adhesion strength (kPa) was determined by the peak force (N) divided by the contact surface area (mm^2). The probe surface was cleaned with 5% acetic acid and water to eliminate any chitosan residue between tests. Student's t-test was used to determine statistical significant differences ($p < 0.05$).

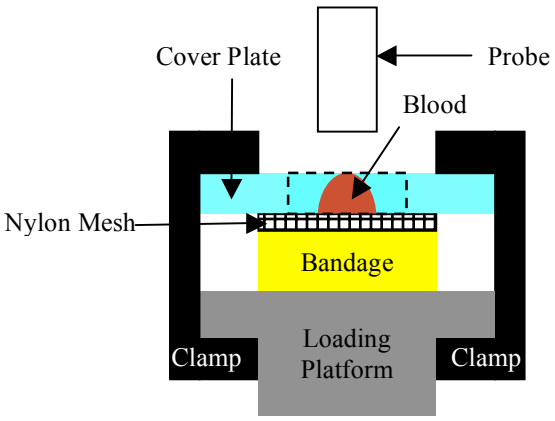

Figure 1: Schematic of the *in vitro* adhesion test setup with an 80-µm thick nylon mesh and a 1 mm thick cover plate with the center removed to allow exposure of the test surface to the specimen.

Results/Discussion: The adhesion strength for B1 bandages tested with and without mesh was 42±4 and 35±8, respectively. The adhesion strength for B2 bandages tested with and without mesh was 52±6 and 46±9, respectively. The addition of the mesh to the test resulted in no significant differences in both the B1 and B2 groups. There was no significant difference between B1 and B2 bandages tested without mesh. The only significant difference ($p = 0.007$) was found between B1 and B2 bandages tested with mesh (Figure 2).

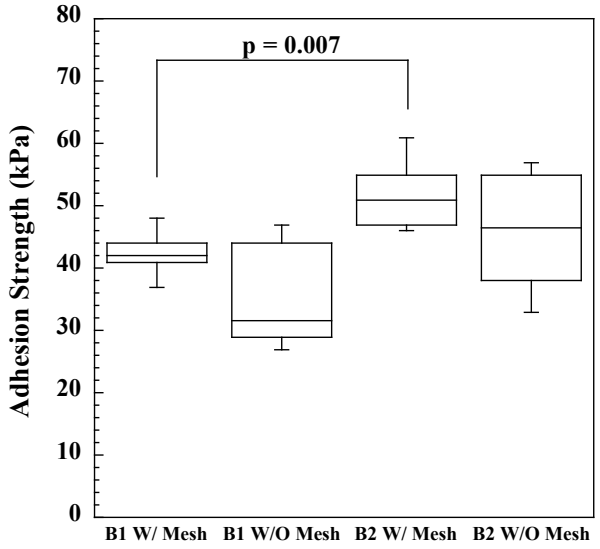

Figure 2: Box plots of B1 and B2 bandage types' adhesion strength tested with and without nylon mesh.

Conclusions: We were able to eliminate cohesive failure, reduce variability and distinguish between two types of chitosan bandages with minimal number of samples.

References:

(1) Wu, P., et al. "Development of in vitro adhesion test for chitosan bandages." Abstract presented at Society for Biomaterials Conference, 2001.
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(3) ASTM F2258-03 Standard Test Method for Strength Properties of Tissue Adhesives in Tension.
(4) Chen, W.Z., Hoseny, R.C. "Development of an objective method for dough stickiness." Lebensm.-Wiss. U.-Technology. 28, 467-473, 1995.

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