The Microbial Barrier Effectiveness of LiquiBand® Exceed™

J Alarcon, BSc (Hons), CCRA
G Miller, BSc (Hons)

LIQUIBAND® Exceed™

Background:
Cyanoacrylate Topical Skin Adhesives (TSA) continue to gain acceptance as effective alternatives to conventional suture and staple closures in a wide variety of medical applications. LiquiBand® Exceed™, a new 2-octyl-cyanoacrylate adhesive device, has recently gained regulatory approval for topical wound closure. This device features a unique, winged applicator that along with a novel elliptical felt tip, provides broad and even application of adhesive to the wound site. The LiquiBand® Exceed™ Topical Skin Adhesive has been demonstrated to retain flexibility without cracking when subjected to standardized test methodology for determining adhesive film flexibility* on pig skin substrate ex vivo.[1] Along with strength and flexibility of closure and cosmetic outcome, effectiveness of microbial barrier is also an important clinical requirement requiring review. Microbial contamination of wound sites often results in surgical site infection (SSI) that are reported following 10-20% of all surgical procedures.[2] Approximately 157,500 cases of SSI were reported in US acute-care hospitals in 2011 resulting in an estimated cost of treatment for each case ranging between USD$10,000 - $25,000.[3,4] Preventive strategies, such as providing an effective barrier to infection, may help alleviate this considerable strain to healthcare resources. In this study, the barrier properties of LiquiBand® Exceed™ Topical Skin Adhesive are evaluated in vitro against various pathogenic gram positive, gram negative, yeast, and mold organisms commonly implicated in surgical site infections (SSI), including antibiotic resistant MRSA (S. aureus).

Objective:
To determine the effectiveness of an intact film of LiquiBand® Exceed™ Topical Skin Adhesive as a microbial barrier to in vitro challenge from a variety of pathogenic bacteria, yeast and mold species.

Methodology:
Testing was performed using industry standard methodology for determining barrier properties of cyanoacrylate films against microorganisms. A single layer of LiquiBand® Exceed™ Topical Skin Adhesive was applied, in accordance with manufacturer's instructions for use, to nutrient-rich agar plates, impregnated with a color indicator that respond to microbial colonization. Eight different pathogenic bacteria, yeast and mold species (1-2x10^6 CFU) were applied directly on top of the cyanoacrylate film, and then incubated for 7 days at 30-35°C. One hundred plates were tested per species for a total of 800 inoculations. Plates were visually inspected at day three and day seven, and the adhesive barrier was deemed to remain intact when the underlying agar media remained unchanged in color, as compared to a negative control.

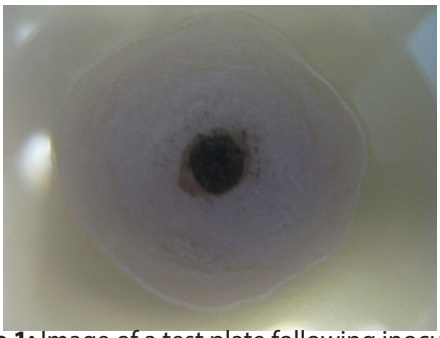

Figure 1: Image of a test plate following inoculation.

Results:
LiquiBand® Exceed™ Topical Skin Adhesive was found to maintain an effective barrier for three days, preventing contamination of underlying agar in 99.5% total plates assessed (Figure 1). Specifically, 100% of plates inoculated with E. coli, S. aureus spp. and Asp. brasiliensis remained uncontaminated, as did 99% of plates inoculated with the other four species tested. At seven days post-inoculation, the LiquiBand® Exceed™ Topcal Skin Adhesive film continued to provide an effective barrier in 100% of plates inoculated with both S. aureus species, including MSRA and was found to provide an effective barrier for seven days post bacterial challenge in 97.9% of all tests conducted (Table 1).

			% maintaining microbial barrier (n = 100 tests)	
Organism	**ATCC#**	**Challenge CFU**	**Day 3**	**Day 7**
C. albicans	10231	1.245 x 10^6	99	99
E. coli	8739	1.275 x 10^6	100	95
S. aureus (MRSA)	4330	1.095 x 10^6	100	100
S. aureus	6538	1.210 x 10^6	100	100
S. epidermidis	12228	1.250 x 10^6	99	95
Ps. aeruginosa	9027	1.975 x 10^6	99	97
E. cloacae	13407	1.450 x 10^6	99	98
Asp. brasiliensis	16404	1.250 x 10^6	100	99
% maintaining microbial barrier (n = 800 tests)			99.5	97.9

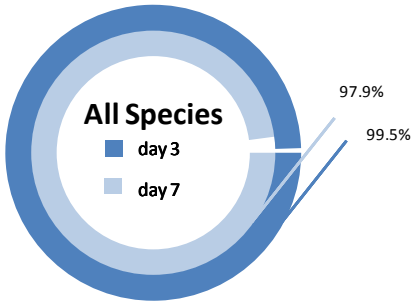

Table 1: Details of test methods and percentage of agar plates coated with cyanoacrylate film applied by LiquiBand® Exceed™ Topical Skin Adhesive maintaining barrier to various pathogenic microorganism species 3 to 7 days post challenge. The figure on the right of the table represents percent of barrier maintained against all species.

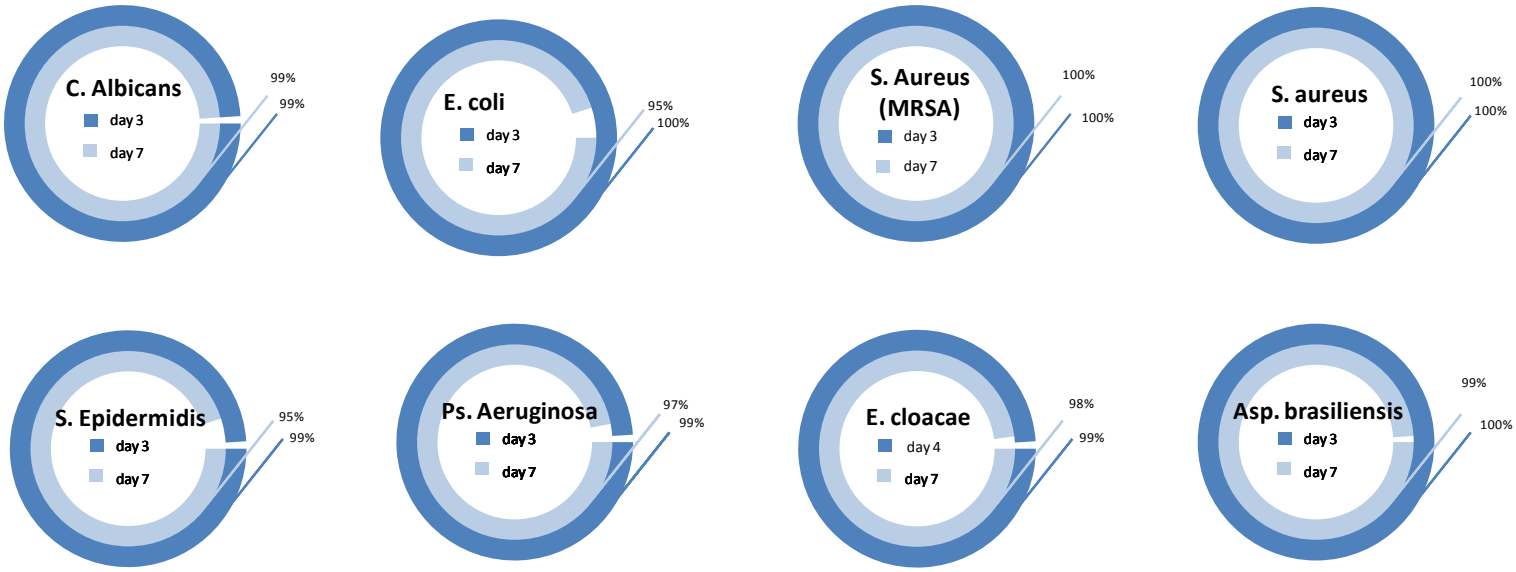

Figure 2: Percentage of agar plates coated with cyanoacrylate film applied by LiquiBand® Exceed™ Topical Skin Adhesive maintaining barrier to various pathogenic microorganism species 3 to 7 days post challenge.

Conclusions:

In this in vitro evaluation, LiquiBand® Exceed™ Topical Skin Adhesive provided an effective barrier to contamination, despite challenge from high concentrations of pathogenic bacteria, yeast and mold species. As previously mentioned, microbial contamination of the wound site can result in SSI.[2] The adhesive barrier was found to be robust, with 99.5% of the test plates uncontaminated three days post inoculation and 97.9% uncontaminated seven days post inoculation by eight different pathogenic microorganism species. Previous clinical studies have demonstrated that within 48-72 hours of wound closure, the natural wound healing cycle results in an effective microbial barrier[5,6]. A wound closure device that provides an effective barrier for up to 72 hours would provide sufficient time to allow for the natural wound healing process. Ideally, the wound closure device would resist cracking from wound site flexion, as previously demonstrated following ASTM testing of LiquiBand® Exceed™ Topical Skin Adhesive.[1] Overall, these results demonstrate the potential for LiquiBand® Exceed™ Topical Skin Adhesive to provide a flexible and robust wound closure, and an effective barrier to microorganism contamination.

References:

1. Data on File at Advanced Medical Solutions (Plymouth) Ltd.
2. Leaper D, Ousey K. Evidence update on prevention of surgical site infection. Curr Opin Infect Dis. 2015 Feb 17.
3. Magill SS, Edwards JR, Bamberg W, et al. Multistate Point-Prevalence Survey of Health Care–Associated Infections. N Engl J Med 2014;370:1198-208.
4. Scott RD II. The Direct Medical costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention. Centers for Disease Control and Prevention. March 2009.
5. Rosevear C, Dott J, Lazarus R. Reducing Risk Of Post-Operative Complications After Joint Replacement Surgery, Nurse Unit Manager Periopertive Services, Geelong Private Hospital, Geelong, Victoria 3220, Australia.
6. Nursing Times, Surgical wound care: current views on minimizing dressing-related pain, (September, 2004).

*ASTM D4338-97: Flexibility Determination of Supported Adhesive Films by Mandrel Bend (2011)

ADVANCED MEDICAL SOLUTIONS
Premier Park, 33 Road One, Winsford Industrial Estate, Winsford, Cheshire, CW7 3RT, UK
phone 1-855-Glues-77 (855-458-3777) email info@liquiband.com web us.liquiband.com

IRM 06 0223