**An Adhesive Patch Device for Skin Microbiome Studies**

Timothy Yao*, Alex Dobak*, Talisha Allen, BS, Maesa Hanhan, MS, and Burkhard Jansen, MD, DermTech, La Jolla, CA, United States (*High School Summer Intern Students)

**Introduction**

Our understanding of the skin-residing microbiome on skin health has improved dramatically in recent years, and diagnostic or therapeutic applications based on the skin microbiome are starting to emerge. However, progress has been hampered by deficiencies in obtaining skin microbiome samples of sufficient quality and quantity, as the frequently used swab sampling methods generally capture only limited amounts of microbiome materials from the outermost layer of the epidermis. They are generally unable to collect species present in the deeper layers of the epidermis. This study investigated if a non-invasive adhesive patch device is capable of reliably capturing only limited amounts of microbiome materials from the outermost layer of the epidermis. They are generally unable to collect species present in the deeper layers of the epidermis. This study investigated if a non-invasive adhesive patch device is capable of reliably obtaining sufficient amounts of microbiome samples, from populations present in superficial and deeper layers of the epidermis. This may open opportunities to use this new tool in a variety of clinical applications.

**Materials and Methods**

The adhesive patch sample collection kit used for this study was manufactured by DermTech Inc. (La Jolla, CA, USA). Each kit contains 4 adhesive patches (19mm in diameter). By applying the adhesive patches to skin (Figure 1), layers of epidermal cells together with all microbiome residing on or between the skin cells are collected via the patches. Total DNA was isolated from the samples collected with each patch and subjected to 16s rRNA quantification with qPCR. Microbiome counts were assessed (one copy of 16s rRNA = 1 microbiome).

**Results**

Figure 2 shows transmission electron microscopy (TEM) pictures of skin stratum corneum cells (visible) and microbiome (not visible at the current magnifications) collected on an adhesive patch. Each patch harvested about 2-4 layers of epidermal cells.

Table 1 lays out the experimental design to investigate microbiome changes from different skin sites of 3 test subjects (with healthy, normal skin). Each site was sequentially collected with 4 adhesive patches. The microbiome from each patch was analyzed separately to detect changes in microbiome numbers as they correspond with deeper layers of the epidermis. Combined microbiome counts from the 4 patches from the same test site gave the total microbiome count on each test site. Figures 4 to 6 show the changes in microbiome counts on each patch or in each test site.

**Conclusion**

This study demonstrated the successful collection of skin microbiome samples from all skin sites of all test subjects. The outermost epidermal skin layers yielded the highest microbiome counts and numbers decreased with deeper layers of the epidermis. As each adhesive patch harvesting step removed about 2-4 layers of epidermal cells together with the microbiome residing in these cell layers, the adhesive patch tool allowed us to also collect and study microbiome samples from the deeper epidermal layers and not just those on the skin surface. This may help overcome the limitations encountered by the traditional swab method which collects the surface microbiome only. This unique feature and advantage may lead to numerous uses of this adhesive patch sampling tool in clinical applications that benefit from investigating and assessing skin microbiome compositions or populations from different epidermal layers without and with the ability to also assess and monitor skin cell gene expression signatures.

**References**


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