

EVALUATION OF THREE DIFFERENT ADHESIVE TAPES FOR THE COLLECTION OF EPITHELIAL CELLS AND THE SUBSEQUENT MICRO-ISOLATION FOR PCR ANALYSIS

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Adhesives are currently used widely for the collection of impression evidence and microscopic trace evidence; and, more recently recommended for biological evidence. However, the choice of adhesive can affect the success with which the evidence is obtained and subsequently analyzed. If the adhesive tape of choice contains too much adhesive, it will tend to remove more particulate than desired from the substrate, requiring the analyst to sort through more irrelevant particles and sometimes confusing the evidence with complicated mixtures. Whereas not enough adhesive will lead to inadequate material for analysis. Through a critical evaluation of various adhesives, the collection and subsequent analysis can be optimized.

Three adhesives were evaluated: (1) SPI Supplies carbon tape tabs, (2) Neschen Filmolux^{1,2} S23, and (3) Gel-Pak "0". The tapes were chosen because of their extreme differences in adhesiveness, thickness, and composition. The SPI supplies carbon tape tabs are currently used for gunshot residue analysis because of their suitability for scanning electron microscopy. Neschen Filmolux has been used by German forensic scientists for epithelial cell identification, and removal of trace evidence from cadavers³. Gel-Pak "0" has many materials science applications, but is not currently being used in biological or forensic analysis.

We evaluated these adhesives by seeding relevant forensic materials (i.e., pillowcase, shirt, direct skin contact) with epithelial cells and then removing the cells with each tape type. The tape was gently pressed on each substrate to remove the cells to ensure only the top layer of particulate was removed. Each tape was then viewed using a stereomicroscope (Olympus MVX10) to search for epithelial cells and estimate the number recovered on the lift. When possible epithelial cells were suspected on the Neschen Filmolux S23 and Gel-Pak "0", an amido black staining procedure was carried out to verify the presence or absence of epithelial cells. Due to the opaque nature of the SPI carbon tape, the amido black staining procedure could not be performed. Once the presence of epithelials was confirmed, the tapes were evaluated for ease of cell removal during micro-isolation.

Micro-extraction was accomplished by hand using sharpened tungsten needles while observing the suspected epithelial cells with a stereomicroscope. The recovered cells are then easily transferred to a micro-tube for PCR.

The SPI supplies carbon tape tab, with its thick layer of goeey adhesive, greatly complicates the micro-isolation and manipulation techniques. This tape also removes more than just the surface particulate and makes it difficult to determine which particles were loosely associated with the material or which were inherent. It also is an opaque tape, so it cannot transmit light, and therefore does not allow for any histo-chemical staining of suspected cells.

The Neschen Filmolux S23 adhesive is slightly less tacky than the carbon tape. It also removes more than just surface particulate, but not as much in comparison to the SPI carbon tape. The fact that it is colorless (transparent) is an advantage allowing the staining of suspect cells. The drawbacks are its thick adhesive layer which make isolation cumbersome, and its hydrophobic nature that may interfere with PCR analysis.

Gel-Pak "0" adhesive was so thin that it only removed the "newest" or "loosest" particulate that tends to be most relevant in forensic evidence. Typical results on the Gel-Pak "0" displayed mostly epithelial cells, and very little extraneous particulate. Like the Neschen Filmolux S23, the colorless and transparent adhesive allowed for easy staining and transmitted illumination. A further advantage over the Filmolux, however, is the adhesive backing that allows it to be mounted on many different collection surfaces (i.e., glass slides, plastic cartridges, etc.). Due to the fact that Gel-Pak is in reality a gel film instead of a true adhesive, removal of the cells is less inhibited than with the other two tapes. Also, because of the lack of adhesive, it does not interfere with PCR analysis.

Tape lift collection is commonly used for impressions and trace evidence; it can also be an efficient method for the collection and isolation of DNA evidence. When individual cells or a small aggregate of cells can be recovered and isolated for analysis, the DNA results can be more relevant and reliable.

References:

¹Neschen Filmolux S23, Neschen AG. Buckeburg, Germany: Neschen AG, 2006

²Schneider, Harald R., 31st ENFSI DNA Working Group Meeting, October 21, 2009

³Zamir A, Oz C, Wolf E, Vinokurov A, Glattstein B. J Forensic Sci, V 49: 68-70 (2004)