



A Comparative Analysis of the Efficacy of Alcohol-based Deodorant and BIOFIX spray as Fixatives for Cytological Smears.

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KEYWORDS

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ABSTRACT:

Introduction Fixation is a key step in cytological preparation that preserves cellular details essential for accurate diagnosis. Commercial fixatives like BIOFIX are commonly used, but can be costly, less accessible and require careful handling. In search of an affordable and practical alternative, this study evaluates the efficacy of an alcohol-based deodorant as a fixative in oral cytology.

Objectives: To compare the efficacy of BIOFIX spray and alcohol-based deodorant as fixatives in exfoliative cytology using Rapid PAP staining.

Methods: Smears were collected from the dorsal tongue of 45 healthy adult volunteers. Each subject provided two slides/smears one fixed with BIOFIX spray and the other with alcohol-based deodorant. Both were stained using the Rapid PAP method and blindly evaluated by two oral pathologists under light microscopy. Six cytological parameters were assessed: staining uniformity, cell and nuclear morphology, cytoplasmic and nuclear staining, and presence of impurities.

Results: All deodorant-fixed smears were acceptable, while 7 BIOFIX-fixed smears were excluded due to poor quality. Deodorant-fixed smears showed better staining uniformity (86.8% vs. 50%) and significantly fewer impurities (26.3% vs. 73.7%) than BIOFIX-fixed smears. Other parameters like cell morphology, nuclear morphology, and cytoplasmic staining showed comparable results between the two groups ($p > 0.05$).

Conclusions: Alcohol-based deodorant proved to be a reliable, cost-effective, and accessible fixative, offering better staining quality and cleaner smears than BIOFIX. It holds promise for routine use in cytology, especially in large-scale screenings and low-resource settings.

1. Introduction

Cytological smears are a crucial diagnostic tool in pathology, allowing for the examination of cells to detect abnormalities and diseases^[1]. Several processes, including collection, appropriate fixation, staining and quality control are necessary for a cytopathological diagnosis to be accurate. Fixation is a crucial step in repairing the cells, allowing for assessment and the development of a suitable diagnosis^[2]. Rapid turnover rate of oral mucosal cells, the exfoliated cells have a valuable role in diagnosis. Exfoliative cytology is based on the monitoring the mucosal exfoliated cells through natural or artificial means. It is a minimal technique for obtaining cells to rule out the diagnosis^[3,4].

BIOFIX spray is commercially available biological fixative designed to preserve tissues and cells. It is often used in medical and laboratory settings for its ability to

stabilize cellular structures without causing significant distortion^[5].

Alternative fixative methanol is known to have toxic potential, So in recent years, there has been a need of alternative fixatives that can provide similar results. This might include the use of household products, which are known to be less toxic, more accessible and cost-effective. Among these alternatives, deodorant have been considered as fixatives in cytological preparations^[6]

The alcohol content helps in coagulating proteins and preserving the morphology of cells, similar to traditional alcohol-based fixatives.^[7] Deodorant, primarily composed of alcohol and other volatile compounds,^[8] So use of deodorant as a fixative and could offer advantages such as reduced toxicity, ease of availability, low cost and rapid action.



A thorough and detailed literature search showed no study was done on deodorant as alternative to conventional fixatives in cytology.

2. Aim and Objectives

1. To analyze the efficacy of deodorant as fixatives in cytological smears.
2. To compare the efficacies of BIOFIX spray and deodorant as fixatives in Rapid PAP staining.

3. Methods

The study comprised 45 healthy adult volunteers aged between 18–60 years, with no history of oral lesions, systemic diseases, smoking habits or use of topical oral medications. After obtaining informed consent, two smears were collected from the dorsal surface of the tongue and buccal mucosal surface of each participant using a sterile wooden spatula, following rinsing of the oral cavity with water. Each smear was evenly spread on a pre-labeled glass slide and allowed to air-dry for 10-15 seconds.

One slide from each participant was fixed using a BIOFIX spray by spraying from a distance of 20 cm for 2 seconds, while the second slide was fixed using an alcohol-based deodorant containing ethanol, propylene glycol by spraying from a distance same as that for BIOFIX spray for 2 seconds. All slides were air-dried horizontally for 15 minutes at room temperature (25°C).

Both sets of smears were subjected to Rapid PAP staining.

The slides were grouped in BIOFIX and deodorant groups and all stained slides were randomized. Blindly examined under light microscopy at 40× magnification by two independent oral pathologists. The cytological quality was assessed using the following six parameters^[9] Table: 1

All data were analyzed using the SPSS software version 28.0. Descriptive statistics, including means and percentages, were computed. The Chi-square test was used to assess differences in fixation quality between the two groups. A p-value less than 0.05 was considered statistically significant.

Table 1

Parameter	Acceptable (1)	Unacceptable (0)
Staining Uniformity	Even, consistent stain	Uneven or patchy stain
Cell Morphology	Clear cell borders, proper N:C ratio, no folds/overlaps	Overlapping, folded, or damaged cells
Nuclear Morphology	Clear, distinct nuclear border	Indistinct or folded nucleus
Cell Staining	Intact membrane, no granular cytoplasm	Disrupted membrane, granular or patchy stain
Nuclear Staining	Smooth, clear nuclear membrane	Blurred or damaged nucleus
Impurities	None	Present

4. Results

Out of the 45 smears in each group, 7 BIOFIX-fixed smears were found to be unacceptable, and 42 deodorant-fixed smears were acceptable. Thus, 38 smears from each group were evaluated for cytological quality.

Table: 2 Descriptive analysis of the parameters in deodorant and BIOFIX fixed smears. (n=38)

Parameter	Deodorant-Fixed (n, %)	BIOFIX-Fixed (n, %)
Uniform Staining	33 (86.8%)	19 (50%)
Cell Morphology	27 (71.0%)	28 (73.7%)
Nuclear Morphology	36 (94.7%)	35 (92.1%)
Cytoplasmic Staining	30 (78.9%)	29 (76.3%)
Nuclear Staining	38 (100%)	36 (94.7%)
Impurities Present	10 (26.3%)	28 (73.7%)



Nuclear staining was acceptable in all 38 deodorant-fixed smears (100%) and 36 BIOFIX-fixed smears (94.7%), with no statistically significant difference observed ($p > 0.05$). Uniform cell distribution was more frequently observed in deodorant-fixed smears ($n = 33$; 86.8%) than in BIOFIX-fixed smears ($n = 19$; 50%). Impurities, such as mucous debris, dye precipitates, and fixative residue, were present in only 10 deodorant-fixed smears (26.3%) compared to their presence evident in 28 BIOFIX-fixed smears (73.7%), showing a statistically significant reduction in impurities with deodorant fixation ($p < 0.05$).

Other parameters, including cell morphology, nuclear morphology and cytoplasmic staining showed no statistically significant difference between the two groups ($p > 0.05$), though a slightly better trend in overall clarity and uniformity was observed in deodorant-fixed smears (Table:2)

5. Discussion

Fixatives are an important part of cytology because they help preserve the cells so they can be studied under a microscope^[7]. Traditionally, alcohol-based fixatives like ethanol or commercial sprays like BIOFIX are used. However, these can have some issues—they may be difficult to store, require licenses, toxic and are sometimes not easily available^[11,12]. In this study, we tested whether an alcohol-based deodorant could work as a reliable and easy-to-access alternative to the commonly used BIOFIX spray.

The results showed that the deodorant performed better than the BIOFIX spray. 42 deodorant-fixed smears were acceptable out of 45, while 7 out of 45 smears fixed with BIOFIX were found to be of poor quality and had to be excluded. This suggests that the deodorant was more reliable in fixing the smears properly. Although nuclear staining was acceptable in both groups and not significantly different, uniform staining was clearly better in the deodorant group (86.8%) compared to the BIOFIX group (50%). This means that the cells in the deodorant-fixed smears were more evenly stained, making them easier to be observed under the microscope. Another finding was the presence of impurities. Only 26.3% of deodorant-fixed smears showed impurities, compared to 73.7% in the BIOFIX group. This difference was statistically significant and suggests that deodorant fixative helps produce cleaner smears reducing contamination during fixation.

Other features, such as cell morphology, nuclear morphology and cytoplasmic staining, were similar in

both groups, with no significant differences. However, deodorant-fixed smears still showed a slightly better overall appearance in terms of clarity and preservation.

These findings indicate that an alcohol-based deodorant can serve as an effective, affordable, non-toxic and readily available alternative to commercial fixatives like BIOFIX spray. This aligns with the results of Priyadarshi et al. who demonstrated that natural substances such as honey, when properly standardized, could produce cytological outcomes comparable to or even better than conventional ethanol fixatives.^[10]

The PAP staining method remains an essential technique in exfoliative cytology. Over time, it has been optimized to improve staining consistency, reduce processing time, and minimize reagent use, particularly through the Rapid PAP modifications^[13] so PAP stained used in this study. Accurate staining of nuclear and cytoplasmic elements is central to cytological interpretation, and any shortcomings in smear preparation, fixation, or staining can significantly affect diagnostic reliability^[14].

Studies, like the one by Hulimane and Shaila, found that wet fixation was better than spray fixation because it caused fewer impurities and gave a better spread of cells on the slide^[9]. However, our study shows that when applied properly, an alcohol-based deodorant can give even better results than commercial spray fixatives. It helps preserve the cells well and reduces unwanted marks or dirt on the slides. Also, deodorant is affordable, easy to find, and simple to use, which makes it a great option for large-scale screenings or places with limited resources.

The study by Pandiar et al. reported better nuclear and cytoplasmic staining clarity with honey as a fixative compared to ethanol and jaggery. Although honey showed slightly superior staining characteristics, no statistically significant difference was observed among the three fixatives overall^[4]. Similarly, a study conducted by Sona et al. on buccal smears also demonstrated no significant differences ($p > 0.05$) between the natural and alcohol-based fixatives in terms of cytological parameters such as staining quality and cellular preservation^[15].

Although honey is a natural fixative, it has some drawbacks. It has a short shelf life, can develop mold and needs refrigeration and frequent replacement. Slides fixed with honey may also fade faster^[7,16-18]. In comparison, alcohol-based deodorant is easy to store, does not spoil or grow mold and provides clearer smears with fewer impurities. It is cheap,



easily available and does not require special handling, making it a better and more practical fixative for regular use.

Fixatives are an important part of cytology because they help preserve the cells so they can be studied under a microscope^[7]. Traditionally, alcohol-based fixatives like ethanol or commercial sprays like BIOFIX are used. However, these can have some issues—they may be difficult to store, require licenses and are sometimes not easily available^[11,12]. In this study, we tested whether an alcohol-based deodorant could work as a reliable and easy-to-access alternative to the commonly used BIOFIX spray.

The results showed that the deodorant performed better overall than the BIOFIX spray. All 45 deodorant-fixed smears were acceptable, while 7 out of 45 smears fixed with BIOFIX were found to be of poor quality and had to be excluded. This suggests that the deodorant was more reliable in fixing the smears properly. Although nuclear staining was acceptable in both groups and not significantly different, uniform staining was clearly better in the deodorant group (86.8%) compared to the BIOFIX group (50%). This means that the cells in the deodorant-fixed smears were more evenly stained, making them easier to observe under the microscope. Another finding was the presence of impurities. Only 26.3% of deodorant-fixed smears showed impurities, compared to 73.7% in the BIOFIX group. This difference was statistically significant and suggests that deodorant fixative helps produce cleaner smears. This could be because deodorant was applied with better control, reducing contamination during fixation.

Other features, such as cell morphology, nuclear morphology and cytoplasmic staining, were similar in both groups, with no significant differences. However, deodorant-fixed smears still showed a slightly better overall appearance in terms of clarity and preservation.

These findings indicate that an alcohol-based deodorant can serve as an effective, affordable, and readily available alternative to commercial fixatives like BIOFIX. This aligns with the results of Priyadarshi et al. who demonstrated that natural substances such as honey, when properly standardized, could produce cytological outcomes comparable to or even better than conventional ethanol fixatives.^[10]

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In contrast to our findings, a study by Pandiar et al. reported better nuclear and cytoplasmic staining clarity with honey as a fixative compared to ethanol and jaggery. Although honey showed slightly superior staining characteristics, no statistically significant difference was observed among the three fixatives overall^[4]. Similarly, a study conducted by Sona et al. on buccal smears also demonstrated no significant differences ($p > 0.05$) between the natural and alcohol-based fixatives in terms of cytological parameters such as staining quality and cellular preservation^[15].

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Conclusion

Alcohol-based deodorant can be a good alternative to BIOFIX spray for fixing cytological smears. Deodorant-fixed smears showed better staining, fewer impurities and more uniform cell distribution. While both fixatives preserved the cell structures well, deodorant had the added benefits of being affordable, non-toxic, easy to use and widely available. Unlike natural fixatives like honey, it does not spoil quickly or need refrigeration. These findings suggest that deodorant can be used effectively in routine cytology, especially in mass screening programs or low-resource settings, where cost and availability are important.



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