

# Improved Endocervical Cell Yield With Cytobrush

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*A prospective study of 402 Papanicolaou smears was done comparing the effectiveness of three techniques in obtaining endocervical cells. The Zelsmyr Cytobrush cell collector yielded the greatest concentration of endocervical cells. More than one half (53.6 percent) of all cell samples obtained with the Zelsmyr Cytobrush produced "moderate" or "large" concentrations. The extended-tip spatula and cotton-tip swab techniques produced only 38.5 percent and 24.2 percent, respectively, in these categories. The Zelsmyr Cytobrush cell collector is an effective instrument, yielding increased numbers of endocervical cells on Papanicolaou smear.*

The Papanicolaou smear is an inexpensive, effective cancer-screening tool used by most clinicians to detect cervical cancer. There is some debate regarding the recommended frequency for Papanicolaou smear screening. At present the American Cancer Society recommends screening all sexually active women every three years, providing these women have had two negative Papanicolaou smears one year apart.<sup>1</sup> The American College of Obstetrics and Gynecology recommends annual Papanicolaou smear screening.<sup>2</sup> A recent review of adult health maintenance recommended that Papanicolaou smears be done every two years after two annual negative smears.<sup>3</sup> In practice, greater than 60 percent of physicians who care for women do a Papanicolaou smear on asymptomatic patients at least once a year.<sup>4</sup>

One reason for the difference of opinion regarding frequency of Papanicolaou smear screening is the variability in sensitivity of the test itself. The incidence of false-negative Papanicolaou smears is estimated to be as high as 50 percent.<sup>4</sup> Common variables affecting the false-negative rate include patient age, skill of the clinician, laboratory staining and slide interpretation, and sampling technique used.

A generally accepted criterion for adequacy of cervical sampling is the presence of endocervical cells. A previous study compared the effectiveness of the cotton swab, wooden spatula, and extended-tip plastic spatula with respect to endocervical cell yield.<sup>5</sup> Another study compared

the effectiveness of different fertility states on endocervical cell yield and subsequent sensitivity of Papanicolaou smear testing.<sup>6</sup> In both studies the extended-tip plastic spatula (Milex spatula\*) was more effective in obtaining endocervical cells than either the wooden spatula or the cotton swab applicator.

The Zelsmyr Cytobrush cell collector\*\* is a relatively new instrument for sampling of endocervical cells. A recent study suggested that the Cytobrush cell collector is more effective than the cotton swab both quantitatively and qualitatively in regard to the endocervical cell yield.<sup>7</sup> In addition, there is evidence that the Cytobrush cell collector can improve the endocervical cell yield beyond the transformation zone of the cervix, the area where the majority of cervical neoplasia is found.<sup>8</sup>

The purpose of this study was to compare the effectiveness of endocervical cell yield using three different sampling instruments: (1) traditional cotton swab, (2) extended-tip plastic spatula, and (3) Zelsmyr Cytobrush cell collector. The ultimate goal of this study was to determine which of these three instruments was most effective in obtaining endocervical cells. Improving endocervical cell yield should maximize detection of cervical neoplasia utilizing the Papanicolaou smear.

## METHODS

All Papanicolaou smears obtained from April 1, 1986, through September 30, 1986, in the Family Practice Cen-

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\* Milex spatula, Milex Products, Inc., Chicago.

\*\* Cytobrush cell collector, Medscand AB, Malmo, Sweden, distributed in the United States as Zelsmyr Cytobrush cell collector, International Cytobrush, Hollywood, FL. (Cost per 100: \$30.)

**TABLE 1. CONCENTRATION OF ENDOCERVICAL CELLS PRESENT BY TYPE OF METHOD USED TO COLLECT THE CYTOLOGIC SAMPLE**

Concentration of Endocervical Cells	Type of Method		
	Zelmsmyr Cell Collector No. (%)	Extended-Tip Spatula No. (%)	Cotton Swab Saline Solution No. (%)
None	22 (15.7)	33 (25.4)	41 (31.1)
Scant	18 (12.9)	22 (16.9)	26 (19.7)
Small	25 (17.9)	25 (19.2)	33 (25.0)
Moderate	48 (34.3)	31 (23.8)	26 (19.7)
Large	27 (19.3)	19 (14.6)	6 (4.5)
Total	140 (100)	130(100)	132 (100)

$\chi^2 = 28.46, df = 8, P = .0004$

**TABLE 2. CONCENTRATION OF ENDOCERVICAL CELLS BY PHYSICIAN TYPE**

Concentration of Endocervical Cells	Physician Type*	
	Faculty No. (%)	Residents No. (%)
None	38 (20.2)	57 (28.5)
Scant	35 (18.6)	28 (14.0)
Small	40 (21.3)	40 (20.0)
Moderate	56 (29.8)	45 (22.5)
Large	19 (10.1)	30 (15.0)
Total	188 (100)	200 (100)

$\chi^2 = 7.88, df = 4, P = .0960$   
 \* 14 patients excluded as a result of failure to identify physicians performing procedure

ter, St. John's Mercy Medical Center, St. Louis, Missouri, were studied prospectively. Smears were obtained by 29 physicians including 24 family practice residents and five faculty physicians. All women undergoing cervical screening during the study period were entered. Only pregnant patients and women with surgical absence of the cervix were excluded.

Data were collected from a total of 402 patients over the 27-week period. Three techniques were used for endocervical sampling: (1) saline-soaked cotton swab, (2) extended-tip plastic spatula, and (3) Zelmsmyr Cytobrush cell collector. Ectocervical sampling with a standard spatula was performed following each endocervical sampling. The three techniques were randomly assigned in one-week blocks. All resident and faculty physicians were notified and took part. Each week all clinicians agreed to obtain samples through the use of the technique assigned to that week.

Following the collection of the Papanicolaou smears, staff cytotechnologists were asked to evaluate the slides in the usual manner. In addition, the technologists were trained to estimate the numbers of endocervical cells present and categorize each sample. Categories of numbers of endocervical cells collected were (1) none, (2) scant, (3) small, (4) moderate, and (5) large. Staff cytotechnologists were unaware of the techniques used to collect the specimen.

Additional data noted for analysis were patient age and whether the physician collecting the sample was a resident or faculty physician.

Statistical tests used to analyze the data were the chi-square test for significant differences in proportions and one-way analysis of variance for significant differences in means.

**RESULTS**

During the six-month study period 402 Papanicolaou smears were obtained, and the yield of endocervical cells

using each technique was compared. More than one half (53.6 percent) of all endocervical samples obtained with the Zelmsmyr Cytobrush cell collector produced "moderate" or "large" concentrations of cells. The extended-tip plastic spatula produced fewer samples (38.5 percent) with "moderate" or "large" concentrations of cells. The cotton swab produced an even smaller proportion (24.2 percent) of samples in these two categories. These differences among the three techniques are statistically significant ( $\chi^2 = 28.46, P = .0004$ ). The proportion of samples falling into each of the five categories by technique used is shown (Table 1).

Additional analyses were done to give evidence that the observed differences among the three types of techniques used to collect samples were not caused by the patient, age differences, or physician type (faculty or resident) differences. There was no significant difference between faculty and resident physicians in the proportion of samples finally placed in the five categories of cell concentration ( $\chi^2 = 7.88, P = .0960$ ) (Table 2).

No difference in mean patient age existed among the three types of methods used to collect cell samples. Patient mean ages by group ranged between 38.8 and 41.4 years ( $P = .4175$ ). Similarly, patient age did not vary by level of concentration of endocervical cells reported. These means ranged between 36.5 and 44.3 ( $P = .1283$ ). Faculty, however, tended to see significantly older patients than residents (47.3 years vs 32.8 years,  $P = .0001$ ) (Table 3).

**DISCUSSION**

The results of this study confirmed the hypothesis that the Zelmsmyr Cytobrush cell collector was most effective in obtaining endocervical cells during Papanicolaou screening. The Cytobrush cell collector consistently yielded the greatest concentration of cells compared with extended-tip plastic spatula and the saline cotton swab. Residents and faculty both obtained results that were similar within the limits of statistical error. There was also

**TABLE 3. MEAN PATIENT AGE BY TYPE OF CYTOLOGIC SAMPLING METHOD, PHYSICIAN TYPE, AND CONCENTRATION OF ENDOCERVICAL CELLS PRESENT**

	Mean Age (years)	Standard Deviation	No.
Type of cytologic sampling			
Zelmsmyr Cytobrush cell collector	41.4	18.7	140
Extended-tip spatula	38.9	18.9	130
Cotton swab, saline solution	38.8	17.2	132
P = .4175			
Type of physician			
Faculty	47.3	18.4	188
Resident	32.8	15.6	200
P = .0001			
Concentration of endocervical cells			
None	36.5	17.0	96
Scant	44.3	20.5	66
Small	39.5	17.4	83
Moderate	40.0	18.0	105
Large	39.6	19.1	52
P = .1283			

no statistically significant difference in endocervical cell yield when comparing mean patient age and sampling technique used.

These results confirm that adequate randomization was accounted for during the study. Faculty staff physicians tended to do Papanicolaou smear testing on older patients when compared with resident physicians. Most likely this finding is common in family practice residency programs throughout the country.

This study was unique in comparison with other previously cited studies in that quantitative interpretations

of endocervical cell yield were obtained. It was particularly important to show prospectively that endocervical cell concentration significantly improved using the Cytobrush cell collector. Theoretically then, the greater the concentration of cells obtained, the more effective the test becomes as a screening tool for cervical cancer.

In summary, the study findings support the use of the Zelmsmyr Cytobrush cell collector for obtaining endocervical cells in Papanicolaou smear screening. The increased effectiveness of this instrument appears clinically important and should decrease the false-negative rate in the detection of cervical cancer.

## References

1. American Cancer Society: ACS report on the cancer related health check-up. CA 1980; 30:194-240
2. Morell ND, Taylor JR, Snyder RN, et al: False-negative cytology rates in patients in whom cervical cancer subsequently developed. Obstet Gynecol 1982; 60:41-45
3. Frame PS: A critical review of adult health maintenance, part 3: Prevention of cancer. J Fam Pract 1986; 22:511-519
4. American Cancer Society: Survey of physicians' attitudes and practices in early cancer detection. CA 1983; 35:197-213
5. Kivlahan C, Ingram E: Improved yield of endocervical cells in Papanicolaou smears in a residency setting. J Fam Pract 1985; 20: 381-385
6. Hamblin JE, Brock CD, Litchfield L, Dias J: Papanicolaou smear adequacy: Effect of different techniques in specific fertility states. J Fam Pract 1985; 20:257-260
7. Trimpos JB, Arentz NPW: The efficiency of the Cytobrush versus the cotton swab in the collection of endocervical cells in cervical smears. Acta Cytol 1986; 30:261-263
8. Boon ME, Alons-Van Kordelaar, Rietveld-Scheffers PEM: Consequences of the introduction of combined spatula and Cytobrush sampling for cervical cytology. Acta Cytol 1986; 30:264-270