A Comparison of Self-Collected Nasal Flocked Swabs with Staff-collected Nasopharyngeal or Nasal swabs for Respiratory Tract Sampling in Volunteers

Poster Nr. P1372

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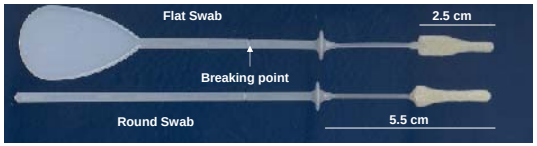
Abstract

Objectives: Nasal swabs (NS) for diagnosis of respiratory viruses are less invasive than nasopharyngeal swabs (NPS), and may enable self-collection. Previously, we studied 2 NS prototypes, and found them equivalent to NPS in sampling epithelial cells, but self-collection was inferior to staff collection. In this study we modified one of the nasal flocked swab (NFS) to optimize sampling and comfort, and to validate that 2 sequential NS will optimize respiratory cell sampling. Our objective was to examine if the new Copan NFS is equivalent to NPS in sampling the respiratory tract, and if self-sampling is equivalent to staff sampling.
Methods: 55 volunteers had 2 self-administered NFS, followed by 2 staff-administered NS using NFS or rayon swabs in random order. Pictorial instructions were provided. Discomfort, ease of administration, and preferences were assessed. The 2nd self-collected swab was compared with the staff-collected swab. 20 subjects had 2 NPS with pernasal FS or rayon swab. Swabs were placed in a one mL tube of UTM; 500 ul was used for nucleic acid extraction and 500 ul to prepare cell smears. Epithelial cells were counted under an UV microscope; Averaging 4 fields or 10 fields when less than 10 cells per high-powered field (hpf) were present. DNA was quantitated using a beta-Actin real time PCR.
Results: In the 55 volunteers, the 2nd self-collected NS was superior to the initial swab, with a mean (SD) of 117 (65) vs. 67 (43) cells/hpf. The 2nd self-collected NS was superior to staff-collected rayon NS {38 (25) cells/hpf}, and comparable to staff-collected flocked NS {132 (56) cells/hpf}. In the 20 subjects with NPS, the mean NPS (SD) cell yields were 145 (43) and 55 (30) for the flocked and rayon, respectively; and 136 (53) and 32 (22) for flocked or rayon staff-administered NS. A high correlation was found between the cell count and log DNA copies/ml (R=0.9, P<0.001). No difference was found between self and staff administered flocked NS or NPS. Flocked NS performed better than rayon with significant higher mean log DNA count. Mild discomfort or ease in self-swabbing was reported. Self-swabbing was preferred to staff collection.
Conclusions: The new Copan nasal flocked swab design is superior to rayon NPS or NS, and equivalent to flocked NPS, for sampling respiratory epithelial cells or DNA. Self nasal sampling is feasible and easy to perform, and equivalent to staff sampling. 2 sequential swabs are required for optimal cell yield.

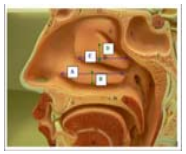
Objective

Nasal swabs (NS) for diagnosis of respiratory viruses are less invasive than nasopharyngeal swabs (NPS) and may enable self-collection. Previously, we studied 2 nasal swabs, prototypes a round and a flat swab design , and found them equivalent to NPS in sampling epithelial cells, but self-collection was inferior to staff collection. In this study we modified the round nasal flocked swab to optimize sampling and comfort, and to validate the hypothesis that 2 sequential nasal swabs will optimize respiratory cell sampling. Our objective was to examine if the new Copan nasal flocked swab is equivalent to nasopharyngeal swab in sampling the respiratory tract, and if self-sampling is equivalent to staff sampling.

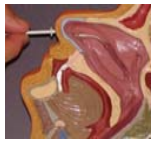
Materials



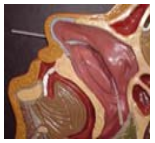
Original Flat and Round nasal flocked swabs design



Path of Nasal swab



Nasal swab collection

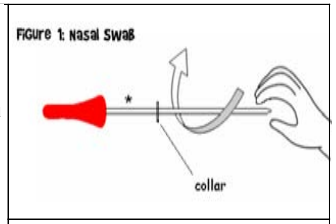


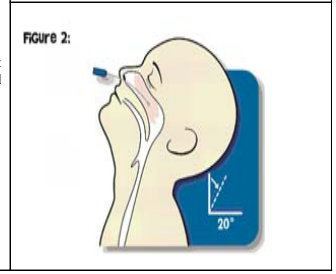
Nasopharyngeal swab collection

Final design of the Round nasal swabs for self collection

The ABCs for nasal Swabbing (Instructions)

1. Open package without touching swab tip
2. Take swab out of package and hold by handle
3. Tilt head back approximately 20 degrees (Figure 2)
4. Insert nasal swab into nostril following a horizontal pathway (Figure 1). Insert as far as it is comfortable (try a minimum of 3 cm as depicted by an asterisk*, but not further than 5.5 cm as depicted by the collar in (Figure 1). DO NOT insert nasal swab up toward eyes
5. Rotate (spin) swab gently within nose (Figure 1) before slowly exiting.
6. Do not touch tip of swab after removal





Instructions for Nasal self collection

Methods

- 55 volunteers had 2 self-administered nasal swabs with the new nasal flocked swabs, followed by 2 staff-administered NS using the new nasal flocked swabs or rayon swabs in random order.
- Written and Pictorial instructions were provided.
- Discomfort, ease of administration, and preferences were assessed using a Likert scale.
- The 2nd self-collected swab was compared with the staff-collected swab.

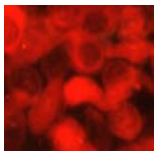
- 20 subjects had 2 nasopharyngeal swabs with pernasal flocked swab or rayon swab.
- Swabs were placed in a one mL tube of Copan UTM; 500 ul of the sample was used for nucleic acid extraction and the other 500 ul to prepare cell smears.
- Epithelial cells were counted under an UV microscope
- Averaging 4 fields or 10 fields when less than 10 cells per high-powered field (hpf) were present.
- DNA was quantitated using a beta-Actin real time PCR on the Light Cycler.

Results

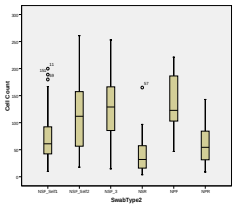
Questionnaire results

Self collection report	
Discomfort	Mild 58%
	82% no or little difficulty
Preference	40% prefer or strongly prefer
	36% neutral
	24% prefer staff

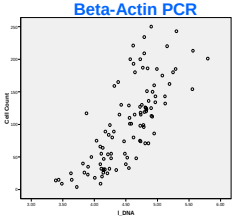
Nasal epithelial cells



Cell counts by swab type



Cell count versus Beta-Actin PCR



NPS Results (n=20) Flocked swabs vs. Rayon swabs

	Flocked Mean (SD)	Rayon Mean (SD)	P-value
NP swabs	145 (43)	55 (30)	P<0.001
Nasal Swabs	136 (53)	32 (22)	P<0.001
P-value	P=0.39	P=0.04	P=0.39

Results

Self sampled Nasal swabs (n=55)

	Self Mean (SD) cells/hpf	Staff Mean (SD) cells/hpf	P-value
Round Nasal (1st swab)	67 (43)	-	P<0.001
Round Nasal (2nd swab)	117 (65)	132 (56)	P=0.06
Nasal-rayon	-	38 (25)	P<0.001
P-value	P<0.001	P<0.001	

- In the 55 volunteers, the second self-collected nasal swab was superior to the initial swab, with a mean (SD) of 117 (65) vs. 67 (43) cells/hpf.
- The 2nd self-collected nasal swab was superior to staff-collected rayon NS {38 (25) cells/hpf}, and comparable to staff-collected flocked NS {132 (56) cells/hpf}.
- In the 20 subjects with NPS, the mean NPS (SD) cell yields were 145 (43) and 55 (30) for the flocked and rayon, respectively; and 136 (53) and 32 (22) for flocked or rayon staff-administered NS.
- A high correlation was found between the cell count and log DNA copies/ml (R=0.9, P<0.001). No difference was found between self and staff administered flocked nasal swab or nasopharyngeal swab.
- Flocked NS performed better than rayon with significant higher mean log DNA count.
- Mild discomfort was reported by 58% of respondents, and 82% reported no or little difficulty in self-swabbing. 40% preferred self-swabbing, 36% were neutral and 24% preferred staff collection.

Conclusions

- The new Copan nasal flocked swab design is superior to rayon NPS or NS, and equivalent to flocked NPS, for sampling respiratory epithelial cells or DNA.
- Self nasal sampling is feasible and easy to perform, and equivalent to staff sampling.
- A cleaning swab may be needed before self collection for optimal cell yield.
- Self-sampling could potentially accelerate diagnosis and surveillance for respiratory tract infections in the community, but first requires validation in symptomatic study populations.
- Validation with symptomatic volunteers is in progress