

# A Preliminary Study of Nasal Mucociliary Clearance in Smokers, Sinusitis and Allergic Rhinitis Patients

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The mucociliary system is one of the most important and indispensable mechanisms protecting the airway against ambient microorganisms, foreign particles and noxious substances. Its mechanism is delicate but vigorous to entrap and remove particles. Many chronic nasal conditions may have detrimental effects on mucociliary transport.<sup>1</sup> The present study was carried out to determine the effect of various nasal conditions on the nasal mucociliary transport by the saccharin test.

## MATERIALS AND METHODS

### Subjects

This study was performed at the Department of Otolaryngology of Pramongkutklao Hospital. A total of 140 cases, 55 females, 85 males, with age ranging from 14-68 years (mean = 32 years) was divided into 4 groups as follows :

(1) Allergic rhinitis patients (40 cases). These patients had allergic symptoms with positive skin tests for common inhalant allergens, such as house dust mite, molds spores, animal danders, grasses, weeds. There were 25 females, 15

**SUMMARY** Mucociliary clearance of nasal mucosa was evaluated with the saccharin test. A total of 140 subjects was divided into 4 groups : smokers, allergic rhinitis patients, sinusitis patients, and a normal control group. The mean mucociliary transit time for the normal control group (n=40) was 12 minutes, while allergic rhinitis patients (n=40) had a mean of 14.6 minutes. The smoker group (n=40) could be further divided into the following subcategories : (a) those who had been smoking for less than 5 years (n=10) had a mean of 15.2 minutes, (b) those who had been smoking for more than 5 years at less than one-pack a day (n=11) had a mean of 14 minutes, and (c) those who had been smoking for more than 5 years at more than one-pack a day (n=19) had a mean of 16.5 minutes. For the sinusitis patients (n=20) the mean was 16.6 minutes. The study shows that sinusitis patients, along with those smokers who had been smoking for more than 5 years at more than one-pack a day, had a mucociliary transit time that was considered to be prolonged when compared to the normal control group ( $p < 0.05$ ).

males aged from 15 to 61 years (mean = 27.5 years).

(2) Sinusitis patients (20 cases). These patients had nasal symptoms and x-ray films of paranasal sinuses showed sinusitis. There were 11 females, 9 males aged from 17 to 56 years (mean 33.5 years).

(3) Habitual smokers (40 cases). These patients had smoked more than 20 cigarettes/day; they visited the clinic with another nasal problem. All were males aged 18-57 years (mean 30 years).

(4) Normal control group (40 cases). These controls had neither nasal symptoms nor did they smoke

at anytime. There were 19 females, 21 males, aged 14 to 68 years (mean = 34 years).

### Procedure

All subjects had history taking and complete ENT examination to exclude recent upper respiratory

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tract infections or any anatomical nasal problems. Cleansing of the nasal cavity was done before the saccharin granule was placed at 1 cm posterior to the anterior end of the inferior turbinate. The subjects sat, respired gently and were not allowed to eat, drink, sneeze, or sniff during the test. The time required for subjects to experience a sweet taste was measured.

#### Statistical analysis

Kruskal Wallis and Wilcoxon tests were used to compare between major groups and subgroups, respectively.

## RESULTS

#### Normal control group

The saccharin transit time (STT) in males (mean  $\pm$  SD) was  $12.1 \pm 3.1$  minutes and in females (mean  $\pm$  SD) was  $11.9 \pm 2.0$  minutes. Overall mean was 12.01 minutes. No significant difference occurred between males and females ( $p > 0.05$ ).

#### Allergic rhinitis patients

According to the duration of symptoms these were divided into 4 groups; (1)  $< 1$  year ( $n = 6$ ) mean of STT  $10.0 \pm 3.1$  minutes, (2) 1-3 years ( $n = 12$ )  $14.6 \pm 2.2$  minutes, (3) 3-5 years ( $n = 11$ )  $14.7 \pm 2.7$  minutes, (4) 5 years ( $n = 11$ )  $15.54 \pm 3.5$  minutes. Overall mean of STT = 14.6 minutes. The mucociliary transport in allergic rhinitis patients who had suffered more than 1 year showed a significant difference compared to the normal control group ( $p < 0.05$ ).

#### Smokers

These were defined into 3 groups according to duration of smoking: (1)  $< 5$  years ( $n = 10$ ) mean of STT =  $15.2 \pm 3.1$  minutes (2)  $> 5$  years,  $< 1$  pack ( $n = 11$ ) STT =  $14.0 \pm 2.0$  minutes, (3)  $> 5$  years,  $> 1$  pack ( $n = 19$ ) STT =  $16.53 \pm 5.0$  overall

			Mean STT $\pm$ SD
(1) Normal control			
Female	(19)		11.9 $\pm$ 2
Male	(21)		12.1 $\pm$ 3.1
(2) Allergic rhinitis			
< 1 year	(6)		10.0 $\pm$ 3.1
1-3 years	(12)		14.6 $\pm$ 2.2
3-5 years	(11)		14.7 $\pm$ 2.7
> 5 years	(11)		15.5 $\pm$ 3.5
(3) Smoker			
< 5 years	(10)		15.2 $\pm$ 3.1
> 5 years	< 1 pack	(11)	14.0 $\pm$ 2.0
> 5 years	> 1 pack	(19)	16.5 $\pm$ 5.0
(4) Sinusitis			
with allergic rhinitis	(11)		17.4 $\pm$ 3.6
without allergic rhinitis	(9)		16.4 $\pm$ 4.5

mean STT = 15.5 minutes. There was no significant difference between each group ( $p > 0.05$ ), but there was a significant difference compared to the normal control group ( $p < 0.05$ ).

#### Sinusitis patients

Defined as related allergic rhinitis (1) sinusitis with allergic rhinitis ( $n = 11$ ) mean of STT =  $17.4 \pm 3.6$  minutes, (2) sinusitis without allergic rhinitis ( $n = 9$ ) mean of STT =  $16.4 \pm 4.5$  minutes. Overall mean of STT = 16.6 minutes, which is a significant difference compared to the normal control group ( $p < 0.05$ ) (Table 1).

## DISCUSSION

The saccharin test is a simple, noninvasive and reliable screening test to evaluate mucociliary transport. Puchelle *et al.*,<sup>2</sup> reported a significant correlation between standard resin particles tagged with

<sup>99</sup>Tc and the saccharin test. Impaired mucociliary function was demonstrated in smokers,<sup>3</sup> chronic sinusitis<sup>4</sup> and allergic rhinitis.<sup>5</sup> In our study, the mucociliary transit time in the normal control group was 12 minutes. No significant difference was found between males and females. Sinusitis patients, habitual smokers and allergic rhinitis patients showed a trend to retard mucociliary transport. All allergic rhinitis patients, smokers, sinusitis patients had prolonged saccharin transit times compared with the normal control group ( $p < 0.05$ ).

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