
Removing nasal valve obstruction in peak nasal inspiratory flow measurement

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Background: Peak nasal inspiratory flow (PNIF) measurements are used to evaluate nasal obstruction and as a surrogate for disease activity in allergic rhinitis and other nasal complaints. This measurement can give erroneous results when forced inspiration leads to nasal valve collapse.

Objective: To determine the effects of 2 different nasal stents (Sinuscone and Nozovent) on valve collapse and repeatability of PNIF measurements.

Methods: Repeated measurements of PNIF were obtained in 74 individuals with and without 2 different nasal stents: Sinuscone and Nozovent.

Results: The mean (95% confidence interval) improvement in PNIF was 1.7 L/min (−2.4 to 5.8 L/min; $P = .42$) with Nozovents and 25.4 L/min (11.4 to 39.4 L/min; $P = .001$) with Sinuscones. The PNIF coefficient of variation for repeatability was 11.6% without stents, 16.0% using Nozovents, and 10.4% using Sinuscones.

Conclusions: Sinuscones, but not Nozovents, significantly improved PNIF. Repeatability of PNIF measurements was worse with Nozovents and only marginally improved with Sinuscones.

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INTRODUCTION

One of the greatest criticisms of peak nasal inspiratory flow (PNIF) measurement is the propensity for nasal valve collapse in forced inspiration,^{1,2} leading to erroneously low measurements in individuals who may have very little nasal obstruction during normal tidal breathing. In an attempt to eliminate this error from the measurement, we made assessments of PNIF with and without 2 different nasal stents, quantifying effects on PNIF measurements and their repeatability in the same patients. We hypothesized that the use of nasal stents would not only reduce erroneous measurements and increase PNIF but also potentially improve the repeatability of the measure itself.

METHODS

We took 3 measurements with and without nasal stents for each of 2 different stent types (Nozovent [Pharmacure Healthcare AB, Västra Frölunda, Sweden] and Sinuscone [Sanostec, Beverly, Massachusetts]) (Fig 1). Participants were taken from study volunteers and patients in screening at the Asthma and Allergy Research Group, University of Dundee, including patients with intermittent or persistent allergic rhinitis. All the study participants gave informed consent, and each study was given a favorable opinion by the



Figure 1. Sinuscone (top) and Nozovent (bottom) nasal stents.

Tayside Committee on Medical Research Ethics, Dundee. Retrospective inclusion of data from screening volunteers was approved by the institution's Caldicott Guardian and was, therefore, exempt from further ethical review.

Means and 95% confidence intervals (CIs) were obtained for PNIF baseline values using 1-sample t tests. Improvements vs baseline for each stent were tested using paired-sample t tests. Coefficients of variation for within-subject repeatability were calculated for the 3 repeated measurements and represent test-retest repeatability across less than 5 minutes.

RESULTS

Three repeated measurements with and without stents were obtained for 23 individuals using Sinuscones and 51 using Nozovents. Nozovent data were not available for 6 additional individuals who could not insert or keep the stents in position for the measurement. Sinuscones were more reliably adopted, and measurements were obtained for all participants. Mean PNIF without stents was 131 L/min (95% CI, 116 to 147 L/min) for the Sinuscone group and 121 L/min (95% CI, 104

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to 139 L/min) for the Nozovent group. There was no significant difference between these baseline values ($P = .38$). The mean improvement in PNIF (ie, change from baseline) was 1.7 L/min (95% CI, -2.4 to 5.8 L/min; $P = .42$) with Nozovents and 25.4 L/min (95% CI, 11.4 to 39.4 L/min; $P = .001$) with Sinuscones. The PNIF coefficient of variation for repeatability was 11.6% without stents, 16.0% using Nozovents, and 10.4% using Sinuscones.

DISCUSSION

Sinuscones, but not Nozovents, led to statistically significant PNIF improvements vs baseline. Sinuscones gave more repeatable measurements than Nozovents, but any improvement in repeatability over conventional PNIF measurements (ie, without stents) was marginal. Although mean PNIF baseline values differed (121 vs 131 L/min), this was not statistically significant, and stent effects were presented as change from baseline.

In addition to the difficulty experienced by some of the patients, study technicians conducting the measurements made qualitative observations. Nozovents were believed to be more difficult to insert and to keep reliably in situ for the duration of the PNIF measurements. Sinuscones seemed to be less durable. Neither stent was anatomically suited to all patients, and both were difficult to size correctly.

In conclusion, Nozovents were not shown to improve PNIF or the repeatability of PNIF measurements. Sinuscones im-

proved PNIF and seemed to be more effective in comparison. Small improvements in PNIF test-retest repeatability were seen with Sinuscones, but these are unlikely to be of great relevance to future research.

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