



# Testings of the ostial patency and penetrance

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## SUMMARY

*In the present study, consisting of 118 cases of maxillary sinusitis with retention of secretion, ostial patency and penetrance were examined three times during each examination, natively, postsuctionally and postirrigationally, by using consecutive measuring technique.*

*Results indicate that, when both ostial respiratory patency and sniff/blow penetrance were tested in these afore-mentioned three phases at each examination that the information gained about ostial patency and penetrance is most representative when the most normal of these results, i.e. the optimal result, is taken as the finding. This is particularly important when testing the ostial penetrance. Observed inconsistencies between the results of the patency and penetrance tests are apparently due to the different pressures used in testing ostial patency and penetrance.*

## INTRODUCTION

An open ostium transmits respiratory pressure fluctuations from the nasal cavity into the maxillary sinus unchanged (Proetz, 1932). Flottes et al. (1960) stated that by comparing these nasal and antral pressure fluctuations, conclusions can be drawn about the ostial patency. Pressure measurements can be performed either consecutively or simultaneously (Proetz, 1932; Drettner, 1965; Cottle, 1968). Both methods have their advantages and disadvantages. When using the consecutive measuring technique 25% difference should be allowed in the peak values of pressures between nasopharynx and antrum during quiet respiration (Rantanen, 1974). The physical accuracy of the simultaneous method is offset by its poor applicability in practice. In addition to these measuring techniques a direct pressure difference recording between the maxillary sinus and the nasal cavity or the nasopharynx has been suggested (Kortekangas, 1970). In clinical practice the ostial respiratory patency is most often determined. It has, however, been suggested that measuring of the ostial penetrance, i.e. ostial patency for great pressure changes produced by sniffing and blowing, is an applicable alternative to the ostial patency test. The reason for this is that by determining the ostial sniff/blow penetrance a great deal of the errors in the measuring results produced by secretion in the equipment or in the ostium itself can be eliminated (Rantanen, 1974).

The aim of this study was to attempt to determine and evaluate the most relevant technique for the determination of ostial patency and penetrance.

#### MATERIAL AND METHODS

This study is based on 86 patients with acute untreated maxillary sinusitis, the number of infected sinuses being 118. There was retention of secretion in all sinuses and only cases which subsequently recovered were included in this study. Irrigation of the diseased sinuses and testing of the ostial patency and penetrance were performed once a week. The tests were repeated until recovery. For the evaluation the observations were grouped as follows:

1. Tests performed in conjunction with the diagnostic puncture.
2. Tests performed in conjunction with the therapeutic punctures i.e. repeated irrigations in which secretion was found.
3. Tests performed at the time of the last puncture, i.e. when secretion was not found any more.

At each examination the sinus was punctured through the inferior meatus with a Lichtwitz trocar. Nasopharyngeal pressure changes were recorded by the anterior rhinomanometric technique and antral pressure changes through the Lichtwitz trocar by making an airtight connection to an electromanometer.

The nasopharyngeal and antral pressure changes were measured during quiet respiration using the consecutive measuring technique, as well as the antral pressure changes during sniffing. The recording of antral pressure changes was performed in the following three phases of each examination:

natively: immediately after withdrawal of the stylet an airtight connection was made between the trocar and the manometer

postsuctionally: after cleansing the trocar by suction

postirrigationally: after irrigating the sinus with 100 cc

of saline and cleansing the trocar by suction.

In the clinical evaluation of the respiratory patency, means were calculated from five successive peak values of the inspiratory pressure decrease both in the nasopharynx and the sinus. The ostial patency was evaluated by comparing these means with each other:

open ostium: the mean of the antral inspiratory peak values of the pressure decrease was at least 75% of the corresponding peak value of the pressure decrease in the nasopharynx

partially open ostium: a regular pressure decrease occurred inside the sinus, but its mean was less than 75% of the corresponding peak pressure decrease in the nasopharynx

obstructed ostium: no regular inspiratory pressure decrease occurred inside the sinus.

The most normal of the results obtained by testing the ostial patency or penetrance natively, postsuctionally or postirrigationally was called in this study optimal patency or optimal penetrance.

In the evaluation of the results of the sniff test the ostial penetrance was regarded



as normal when the antral pressure change produced by sniffing was more than 60 mm of water. The penetrance was called diminished if the antral pressure change was 60-1 mm of water. There was no ostial penetrance in cases in which the sniff pressures did not produce any antral pressure change.

In all statistical comparisons the Chi square test was used. The difference was called significant if  $p < 0.05$ .

## RESULTS

In comparing postsuctional distribution frequencies of open, partially open and obstructed ostia with corresponding optimal frequencies the difference was significant, when all 326 examinations were taken into account (Table 1). When partially open ostia were grouped together with the open ones and the frequencies of this group and obstructed ostia were compared between the postsuctional and optimal results, it was noted that this difference was also significant ( $0.05 > p > 0.01$ ).

Table 1. Ostial respiratory patency in acute maxillary sinusitis with retention of secretion. The comparison between the postsuctional and optimal patency. Figures refer to numbers of sinuses examined.

(Significance: \* =  $0.05 > p > 0.01$ ).

	Ostium			Statistical comparison $\chi^2$ , df = 2	No. of sinuses
	Open	Partially open	Obstructed		
At diagnostic puncture					
Postsuctional patency	26 (22.0%)	25 (21.2%)	67 (56.8%)	2.54	118
Optimal patency	34 (28.8%)	29 (24.6%)	55 (46.6%)		
During treatment					
Postsuctional patency	20 (22.2%)	19 (21.1%)	51 (56.7%)	2.88	90
Optimal patency	28 (31.1%)	22 (24.4%)	40 (44.5%)		
At end of treatment					
Postsuctional patency	63 (53.4%)	40 (33.9%)	15 (12.7%)	4.54	118
Optimal patency	79 (67.0%)	28 (23.7%)	11 (9.3%)		
Total					
Postsuctional patency	109 (33.4%)	84 (25.8%)	133 (40.8%)	7.30*	326
Optimal patency	141 (43.3%)	79 (24.2%)	106 (32.5%)		

The ostial patency was normal more often in the optimal than postsuctional results.

There was a similar significant difference when the postirrigational ostial sniff penetrance was compared with the optimal penetrance at each examination (Table 2). The optimal sniff penetrance, was significantly more often normal than the postirrigational penetrance, when the cases of diminished penetrance also were included among the normal ones ( $0.01 > p > 0.001$ ). In comparing the postsuctional and optimal patency results of each examination

Table 2. Ostial sniff penetrance in acute maxillary sinusitis with retention of secretion. The comparison between the postirrigational and optimal penetrance. Figures refer to numbers of sinuses examined.

(Significance: \*\* =  $0.01 > p > 0.001$ ).

	Sniff penetrance			Statistical comparison $\chi^2$ , df = 2	No. of sinuses
	Normal	Diminished	No penetrance		
At diagnostic puncture					
Postirrigational penetrance	43 (36.4%)	48 (40.7%)	27 (22.9%)	3.87	118
Optimal penetrance	53 (44.9%)	49 (41.5%)	16 (13.6%)		
During treatment					
Postirrigational penetrance	43 (47.8%)	29 (32.2%)	18 (20.0%)	4.72	90
Optimal penetrance	52 (57.8%)	30 (33.3%)	8 ( 8.9%)		
At end of treatment					
Postirrigational penetrance	100 (84.8%)	13 (11.0%)	5 ( 4.2%)	3.89	118
Optimal penetrance	106 (89.8%)	12 (10.2%)			
Total					
Postirrigational penetrance	186 (57.1%)	90 (27.6%)	50 (15.3%)	10.72**	326
Optimal penetrance	211 (64.7%)	91 (27.9%)	24 ( 7.4%)		

in the 208 cases where there was retention of secretion inside the sinuses, i.e. at diagnostic puncture and during the treatment, the difference between the groups was not significant ( $0.1 > p > 0.05$ ). In the corresponding comparison between the results of the penetrance test this difference was significant ( $0.05 > p > 0.01$ ); no penetrance occurred more often postirrigationally.

In comparing the postsuctional patency or postirrigational penetrance results with the corresponding optimal results of each examination separately, at diagnostic puncture, during treatment or at the end of treatment, differences between the results were not significant, also when partially open ostia were included among the open ones or the diminished penetrance regarded as normal. The ostial patency and penetrance corresponded, however, more often to normal if the optimal result was chosen as the finding rather than the postsuctional patency or the postirrigational penetrance.

## DISCUSSION

Secretion inside the sinus may cause errors in the measuring of results in the patency test (Drettner, 1965; Cottle, 1968). The ostial obstruction revealed by the testing can be due to either the swelling of mucosa or/and to the secretion in the ostial canal.

The present writer has previously (1974) examined changes in the ostial patency by using consecutive measuring technique in acute maxillary sinusitis with retention of secretion. One observation of that study was that the ostium is open significantly more often in the optimal results than in the postsuctional results



and that the postsuctional result usually is more informative than the native or postirrigational patency test result.

In the present study the material and the measuring technique were the same as in the afore-mentioned study. The aim of this study was to re-examine methodically the ostial patency and penetrance tests and the evaluation of these test results.

The study showed that the results both in the patency and penetrance tests correspond to normal significantly more often when the optimal result is chosen as the finding instead of the postsuctional patency or postirrigational sniff penetrance finding.

In comparing the results separately at diagnostic puncture, during treatment and at the end of treatment there were no significant differences in corresponding comparisons. The information, however, about ostial patency and sniff penetrance was more reliable, when the tests were made in three phases at each examination. The present study showed also that in testing sniff penetrance in cases in which there is secretion inside the sinus, the ostial penetrance can be proved normal significantly more often at a threephase examination than at a postirrigational one. The difference was not significant when the corresponding results of the patency test were compared. This difference between the results of the patency and penetrance tests is due to the different pressures used in testing ostial patency and penetrance. My opinion is, that the inspiratory pressure decrease and the expiratory increase in the nasal canal during quiet nasal respiration are not great enough to open the ostial obstruction caused by the swelling of the ostial mucosa. Therefore, the results in testing of the respiratory patency at the native, post-suctional and postirrigational examinations are similar. On the other hand, forced sniffing and blowing have sufficient capability to transmit pressure changes from the nasal canal through the ostium into the sinus, even though the ostial obstruction is caused by the thickened ostial mucosa. The greater variations in the results of the penetrance than patency test are due partly to this fact and partly to the secretion which is more mobile on sniffing than during quiet respiration.

According to this study the ostial respiratory patency and the sniff penetrance should be tested at each examination in three phases: natively, postsuctionally and postirrigationally and the optimal result, i.e. the most normal one of these three observation results should be taken as the finding. This is particularly important in testing the ostial sniff penetrance.

#### ZUSAMMENFASSUNG

Die Durchgängigkeit des Ostiums unter Respiration und das Penetranz unter Schnüffeln wurden bei jedem Untersuchungsgang in drei Phasen, unmittelbar nach der Kieferhöhlenpunktion und sowohl vor als nach Irrigation in 118 Fälle mit akuter Kieferhöhlenentzündung untersucht.

Die Untersuchungsergebnisse ergaben erstens, dass man sowohl die respiratorische Durchgängigkeit als das Penetranz des Ostiums in drei obenerwähnten Phasen

an jedem Untersuchungsgang untersuchen sollte. Zweitens die Information über das Kieferhöhlenostium ist am meisten repräsentativ, wenn das nächst normal Resultat, das sogenannte optimal Resultat, als Befund ausgewählt wird. Dies ist wichtig speziell in der Untersuchung des Penetranz des Ostiums.

Differenzen zwischen Observationsresultaten der Durchgängigkeit und Penetranzteste entstehen aus den verschiedenen Drücken, die in der Untersuchung gebraucht werden.

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