

Diagnostic and Therapeutic Significance of Sinoscopy in Maxillary Sinusitis

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Sinoscopy as an endoscopic investigative method of examining the maxillary sinus offers the advantage of a direct local interpretation in contrast to the usual indirect methods. The beginning of sinoscopy dates back to Hirschmann (1903) and Spielberg (1922). During the last 20 years, this method has been reintroduced and refined. In spite of a large number of articles about sinoscopy from Europe, there have been no articles about sinoscopy from Korea. In the present study, 182 maxillary sinuses were examined by sinoscopy and PNS Xray for diagnostic reasons. The failure rate in sinoscopy was 3.8% and the rate of incomplete sinoscopy was inferior to X-ray. The detection rate of antral secretion by sinoscopy was higher than by Xray. In the bacteriological study of antral secretions the percentage of no-growth specimens was 75.7%. In all approximately ten strains of bacteria were isolated from the secretions. Among them, streptococcus was the most common organism found. Therapeutic sinoscopy was performed in 16 patients who suffered from subacute or chronic maxillary sinusitis. In 8 of these patients, local treatment during therapeutic sinoscopy improved the mucosal appearance.

Key Words: Sinoscopy, Maxillary Sinus, Maxillary Sinusitis, Streptococcus

The beginning of sinoscopy dates back to Hirschmann (1903) who tried to use a cystoscope for the diagnosis of maxillary sinusitis through the canine fossa for the first time. In 1922, Spielberg developed the transnasal approach. He inserted an endoscope into the maxillary sinus through the inferior meatus using a trocar under local anesthesia.

But during the next several decades, there were few articles about sinoscopy because of poor light sources and coarse lenses. Because of the introduction of cold lights and special lenses, this method has been reintroduced and refined especially during the last 20 years (Timm, 1956, 1965; Bauer & Wodak, 1957, 1960; Hally, 1960; Rosemann, 1961; Schobel, 1961; Knudstrup, 1970).

In 1946, Halvor Christensen took photographs of the maxillary sinus using an endoscope for the first time. Recently, Illum & Jeppesen (1972) and Kuske & Karduck (1976) classified the disease entities of the

maxillary sinus morphologically using photographs. Thus sinoscopy can guide physicians in the choice of a therapeutic method and can be useful for follow-up concerning disease processes. And what is more, it has become a teaching aid for medical students.

Illum *et al.* (1972) and Draf (1978) mentioned the indications for diagnostic sinoscopy and insisted that sinoscopy was superior to X-ray study for evaluating maxillary sinus disease. Kuske & Karduck (1976) mentioned the advantages of the canine fossa approach and indicated that sinoscopy was the best method for early detection of a malignant tumor of the maxilla. Meanwhile, Willemot (1979) and Terrier & Friedrich (1979) explained the findings of allergic maxillary sinusitis.

Besides numerous papers on the significance of diagnostic sinoscopy, there were also a number of papers on the significance of therapeutic sinoscopy. Draf (1978) reported the indications and the advantages of therapeutic sinoscopy. Wigand *et al.* (1978) reported the results of conservative surgical treatment without a radical operation for the patients with chronic maxillary sinusitis. He removed only the diseased mucosa during the operation under the control

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of sinuscopy. He intended that the removed portion of the mucosa would be replaced by regrowth of the healthy mucosa nearby. He treated 325 patients with chronic maxillary sinusitis using this method. The radiological findings changed to normal in 46% of the patients, and the radiological findings improved in 45%.

In this study, diagnostic sinuscopy and X-ray examination were performed on 120 patients who suffered from subacute, chronic or allergic maxillary sinusitis. Therapeutic sinuscopy was performed on 16 patients who were suitable for conservative management.

The purpose of this study was to compare the diagnostic significance between sinuscopy and X-ray examination and to determine the effectiveness of therapeutic sinuscopy for patients with maxillary sinusitis.

MATERIALS AND METHODS

The selection of subjects was based on clinical findings of patients suffering from subacute, chronic or allergic maxillary sinusitis who visited the OPD of the Department of E.N.T. in Severance Hospital from December, 1981, to April, 1982. Of the 120 subjects 74 were male and 46 were female. The ages ranged from 8 to 64 years (Table 1).

1) Diagnostic sinuscopy

One hundred eighty-two maxillary sinuses (including bilateral cases) were examined using the following procedures:

a) History taking and physical examination

The patients were grouped into subacute, chronic or allergic maxillary sinusitis group according to their histories and to the findings of the physical examinations. The patients who suffered from mucopurulent rhinorrhea for less than one month after the disappearance of the symptoms of acute maxillary sinusitis (such as fever and tenderness of the cheek) were included in the subacute maxillary

sinusitis group.

The patients who suffered from mucopurulent rhinorrhea over several months and showed polyps or other pathologic findings in the middle meatus were included in the chronic maxillary sinusitis group.

And the patients who suffered from watery rhinorrhea, itching, sneezing and pale nasal mucosa were included in the allergic maxillary sinusitis group.

b) Radiological examination of the maxillary sinus

In all subjects (120 patients, 182 maxillary sinuses), Waters', Caldwell's and lateral views were taken. Decubitus Waters' view was added in ten patients to determine the presence or absence of secretion in the maxillary sinus.

Mucosal thickening of the maxillary sinus was measured by the distance of the haziness from the inner bony margin at the lateral wall on Waters' view, and divided according to thickness: less than 2mm, 2-6mm, over 7mm and total opacity. Cysts and air-fluid lines were grouped individually. Thus all subjects were divided into a total of 7 groups according to the X-ray findings.

c) Sinoscopic examination of the maxillary sinus

Using the Olympus sinoscope set (Fig. 1,2), sinoscopic examination of the maxillary sinus was performed under local anesthesia through the inferior meatus.

With the patient in a sitting position, cotton soaked with 0.5% tetracain was inserted into the inferior meatus for 10 minutes. After removal of the cotton, a puncture was made with the trocar and cannula at the anterior 1/3 of the inferior meatus. The trocar was removed and the sinoscope was inserted.

The inside of the maxillary sinus was thoroughly examined and pictures were taken for the follow-up (Fig. 3).

According to color of the mucosal surface, vascularity, the sinoscopic findings of the maxillary sinus were classified into five categories: normal mucosa, subacute mucosal infection, chronic

Table 1. Age and sex distribution

Age Sex	-9	10-19	20-29	30-39	49-49	50-59	60-	Total (%)
Male	7	45	15	4	1	0	2	74(61.7)
Female	7	23	6	5	3	0	2	46(38.3)
Total	14	68	21	9	4	0	4	120
(%)	(11.7)	(56.7)	(17.5)	(7.5)	(3.3)	(0)	(3.3)	(100.0)

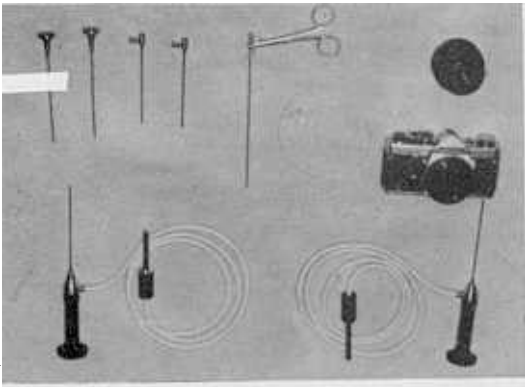


Fig. 1. Olympus sinoscope set.

1. SFA-II, telescope with fiberoptic cable straight
2. SFA-I, telescope with fiberoptic cable 45°
3. Endocamera olympus with adaptor lens model O.M-1
4. Trocar and cannula
5. Polyethylene tube (25 gauge)



Fig. 2. Cold light fountain model SC-5, Olympus.

mucosal infection, polypoid change, and allergic mucosal change (Table 3 and Fig. 4, 5, 6, 7, 8).

d) Examination of the secretion

When diagnostic sinoscopy was performed, the presence or absence of secretion in the maxillary sinus was confirmed. If secretion existed, it was



Fig. 3. Sinoscopy under the local anesthesia (Inferior meatal approach).

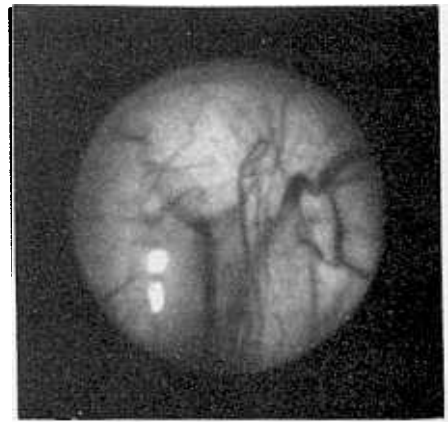


Fig. 4. Normal mucosa.

aspirated using a polyethylene tube and syringe and sent to the laboratory for bacteriological study. In all cases except those with normal findings, antral irrigation with warm saline was performed to confirm the presence of secretion. A blood-agar plate and a MacConkey-agar plate were used for the aerobic culture and Thioglycollate broth was used for the anaerobic culture. The culture time was 48 hours.

Table 2. Performance of sinoscopy

	Complete sinoscopy	Incomplete sinoscopy Bleeding Secretion	Failure Non-cooperation Thickness of wall	Total (%)
Number of max. sinuses	161	10 4	3 4	182
Total (%)	161 (88.5)	14 (7.7)	7 (3.8)	182 (100.0)

Table 3. Classification of maxillary sinus mucosa by sinuscopy

Sinoscopic Finding	Color	Vascularity	Mucosal thickness	Secretion
Classification of mucosa				
Normal mucosa	Yellow, lucid	Normal	Normal	None
Subacute mucosal infection	Red	Increased	Edematous	Mucoid or purulent
Chronic mucosal infection	Dark red	Increased	Thickened	Mucoid or purulent
Polypoid change	Grey or white	Decreased	Polypoid	Mucoid or purulent
Allergic mucosal change	White	Decreased	Edematous	Serous

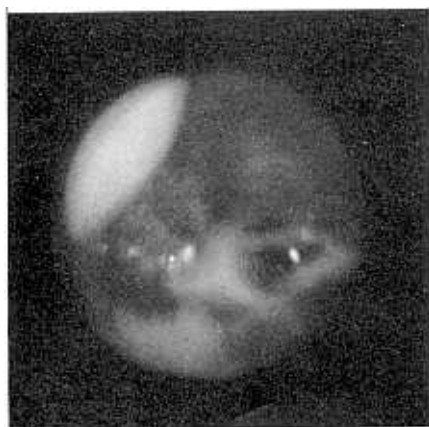


Fig. 5. Subacute mucosal infection.



Fig. 7. Polypoid change.



Fig. 6. Chronic mucosal infection.

2) Therapeutic sinuscopy

Sixteen patients were selected for therapeutic sinuscopy among patients whose mucosal pathology

was not severe according to diagnostic sinuscopy. Eight patients were male and 8 were female. The ages ranged from 8 to 19 years.

During the first sinuscopy examination, the secretion was aspirated and sent to the laboratory for sensitivity testing of the culture. After that, antral irrigation was performed with 200 ml of warm saline. Suitable antibiotics were prescribed later based on the results of the sensitivity testing. Sinuscopy with antral irrigation was performed once a week until the symptoms were relieved.

RESULTS

Diagnostic sinuscopy was performed on 182 maxillary sinuses including bilateral cases. Therapeutic sinuscopy was performed 2 to 16 times on 16 patients.

Among the 182 cases of diagnostic sinuscopy, we were unable to perform the procedure in 7 patients

(3.8%) and incomplete sinuscopy was performed on 14 patients (7.7%). Thus complete sinuscopy was performed on 161 maxillary sinuses (88.5%). Of the 7 patients who received no diagnostic sinuscopy, 3 were due to the patient's lack of cooperation and 4 were due to the thickness of the bony wall. Incomplete sinuscopy means that the maxillary antrum could not be examined clearly due to bleeding (10 cases) or profuse secretions (4 cases) (Table 2).

In order to compare the diagnostic significance between radiological and sinuscopy examination for various maxillary antral infections, we divided the subjects (161 maxillary sinuses) into three groups, based on history taking and on physical examination. Thirty-nine cases (24.4%) were included in the subacute maxillary sinusitis group, 112 cases (69.6%) were included in the chronic maxillary sinusitis group, and 10 cases (6.2%) were included in the allergic maxillary sinusitis group (Table 4).

Table 5 shows the results of the radiological and sinuscopy examination of the subacute maxillary

sinusitis group, and Table 6 shows the results of the chronic maxillary sinusitis group. Statistically, there is no significant difference in the radiological findings of the subacute and chronic maxillary sinusitis groups (Table 7, $p>0.05$). By sinuscopy examination, however, there is a significant difference between the two groups (Table 6, $p<0.001$). In other words, sinuscopy examination is superior to radiological ex-

Table 4. Classification of subjects into clinical groups by history and physical examination

Clinical group	No. of max. sinuses (%)
Subacute max. sinusitis group	39 (24.2)
Chronic max. sinusitis group	112 (69.6)
Allergic max. sinusitis group	10 (6.2)
Total	161 (100.0)

Table 5. Comparison of mucosal finding between radiological and sinuscopy examination for subacute max. sinusitis group (%)

Mucosal thickness (Waters' view)	Less than 2mm	2-6mm	Over 7mm	Total opacity	Cyst	Air-Fluid line	Total
Sinuscopy finding							
Normal mucosa	6	0	2	0	0	0	8 (20.5)
Subacute mucosal infection	2	7	5	7	0	2	23 (59.0)
Chronic mucosal infection	0	1	1	1	0	0	3 (7.7)
Polypoid change	0	1	0	1	0	0	2 (5.1)
Allergic mucosal change	0	2	0	1	0	0	3 (7.7)
Total	8	11	8	10	—	2	39
(%)	(20.5)	(28.2)	(20.5)	(25.6)	(0)	(5.1)	(100.0)

Table 6. Comparison of mucosal finding between radiological and sinuscopy examination for chronic max. sinusitis group (%)

Mucosal thickness (Waters' view)	Less than 2mm	2-6mm	Over 7mm	Total opacity	Cyst	Air-Fluid line	Total
Sinuscopy finding							
Normal mucosa	7	3	0	1	1	0	12 (10.7)
Subacute mucosal infection	2	2	0	2	0	0	6 (5.4)
Chronic mucosal infection	0	9	16	23	2	7	57 (50.1)
Polypoid change	0	5	7	19	1	4	36 (32.1)
Allergic mucosal change	0	0	0	0	0	0	1 (0.9)
Total	9	19	24	45	4	11	112
(%)	(8.0)	(17.0)	(21.4)	(40.2)	(3.6)	(9.8)	(100.0)

Table 7. comparison of mucosal finding by X-ray study between subacute and chronic maxillary sinusitis group

Sinoscopic finding	Mucosal thickness (Waters' view)		Total opacity	Cyst	Air-Fluid line	Total
	Less than 2mm	2-6mm				
Subacute maxillary sinusitis group	8	11	8	10	0	39
Chronic maxillary sinusitis group	9	19	24	45	4	112
Total	17	30	32	55	4	151

 χ^2 test: $p>0.05$ **Table 8. Comparison of mucosal finding by sinuscopy between subacute and chronic maxillary sinusitis group**

Clinical group	Sinoscopic finding	Normal mucosa	Subacute mucosal infection	Chronic mucosal infection	Polypoid change	Allergic change	Total
Subacute max. sinusitis group		8	23	3	2	3	39
Chronic max sinusitis group		12	6	57	36	1	112
Total		20	29	60	38	4	151

 χ^2 test: $p<0.001$ **Table 9. Comparison of mucosal finding between radiological and sinoscopic examination for allergic maxillary sinusitis group (%)**

Sinoscopic finding	Mucosal thickness (Waters' view)		Total opacity	Cyst	Air-Fluid line	Total
	Less than 2mm	2-6mm				
Normal mucosa	3	0	0	0	0	3 (30.0)
Subacute mucosal infection	0	0	0	0	0	0
Chronic mucosal infection	0	0	0	0	0	0
Polypoid change	0	1	0	0	0	1 (10.0)
Allergic mucosal change	1	3	1	0	0	6 (60.6)
Total	4	4	1	1	0	10 (100.0)
(%)	(40.0)	(40.0)	(10.0)	(10.0)		

amination for evaluation of the mucosal status in the maxillary antrum.

Among ten subjects with allergic maxillary sinusitis, six showed typical allergic mucosal change (Table 9, Fig. 8).

Meanwhile, secretions could be found in only 43 subjects (8.1%) by Waters' view (Fig. 9), but secretions in the maxillary antrum were found in 136 subjects

by sinoscopic examination with saline irrigation. Thus a radiological study to detect secretion in the maxillary antrum is inferior to a sinoscopic study (Table 10). But when a decubitus Waters' view was added to the routine paranasal sinus series in ten subjects, the detection rate for secretion increased to 60% (Table 11).

In the bacteriological study of antral secretion, no-

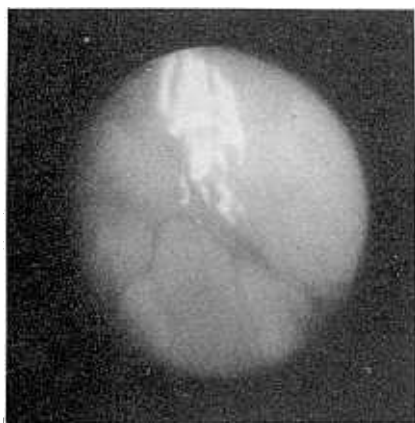


Fig. 8. Allergic mucosal change.

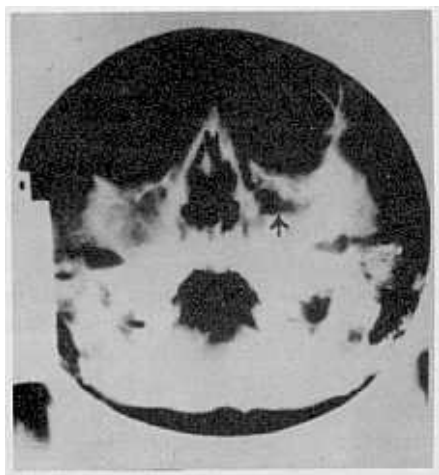


Fig. 9. Air-fluid line visible in Lt. maxillary sinus in Waters' view.



Fig. 10. Air-fluid line visible in Lt. maxillary sinus in decubitus Water's view.

Table 10. Comparison of the X-ray and sinuscopy findings about the secretion of the maxillary sinus (%)

Sinoscopy X-ray	Secretion percent	Secretion absent	Total
Secretion present	11	2	13 (8.1)
Secretion absent	125	23	148 (91.9)
Total (%)	136 (84.5)	25 (15.5)	161 (100.0)

Table 11. Comparison of the X-ray including decubitus Waters' view and sinuscopy finding about the secretion of the maxillary sinus (%)

Sinoscopy X-ray	Secretion present	Secretion absent	Total
Secretion present	6	0	6 (60.0)
Secretion absent	2	2	4 (40.0)
Total (%)	8 (80.0)	2 (20.0)	10 (100.0)

Table 12. Number of bacterial strains isolated from the secretions

No. of strain	No. of specimens (%)
0	25 (75.7)
1	6 (18.2)
2	2 (6.1)
Total	33 (100.0)

Table 13. Micro-organisms cultivated from the secretion of the maxillary sinus

Bacteria	No. of strain
Aerobic	9
β -streptococcus	4
Streptococcus pneumoniae	4
Staphylococcus epidermidis	1
Pseudomonas aeruginosa	1
Hemophilus influenzae	1
Acinebacter calcoaceticus	1
Anaerobic	1
Streptococcus morbillorum	1
Total	10

Table 14. Results of therapeutic sinuscopy

Name	Sex	Age	Sx. duration	No. of sinuscopy	Symptom relief	Improvement of mucosal finding
1. W. Yang	M	19	1 yr.	2	Yes	Yes
2. J. Kwan	F	18	5 yrs.	2	Yes	No
3. H. Lee	F	15	1 yr.	6	Yes	Yes
4. W. Lee	M	15	2 yrs.	2	Yes	Yes
5. U. Lee	M	10	3 yrs.	5	Yes	Yes
6. E. Ko	F	10	2 mons.	5	Yes	Yes
7. H. Jang	F	19	1 yr.	3	Yes	No
8. S. Cho	F	18	1 yr.	2	Yes	No
9. K. Whang	M	8	2 yrs.	2	Yes	No
10. A. Chi	M	10	1 yr.	3	Yes	No
11. Y. Park	M	10	1 yr.	3	Yes	Yes
12. J. Choi	M	10	1 yr.	5	Yes	No
13. K. Choi	M	9	1 yr.	3	Yes	No
14. W. Ahn	F	11	2 yrs.	2	Yes	No
15. W. Han	M	11	4 mons.	4	Yes	Yes
16. Y. Lee	F	11	2 mons.	2	Yes	Yes

growth specimens numbered 25 (75.7%) out of 33 specimens. In all, ten strains of bacteria were isolated from the secretions. Among them, nine strains were aerobic and one strain was anaerobic. Streptococcus was the most common organism found (Table 12, 13).

Therapeutic sinuscopy was performed in 16 patients who suffered from subacute or mild chronic maxillary sinusitis. Symptoms of all 16 patients improved after therapeutic sinuscopy was performed two to six times. Local treatment during sinuscopy also improved the mucosal appearance in 8 patients (50%). There was little mucosal change in the remaining 8 patients as demonstrated by follow-up photographs (Table 14).

DISCUSSION

It is the main advantage of sinuscopy that is a direct method for evaluating the mucosa lining the maxillary antrum, in contrast to indirect methods such as roentgenographic or ultrasonographic examination. Moreover, it can be performed in an out-patient clinic under local anesthesia without difficulty.

There are two ways to approach the maxillary antrum. One is through the inferior meatal and the other is through the canine fossa. In this study, the inferior meatal approach was used because it was easier to puncture the wall of the maxillary antrum. Also, patients were less afraid when this approach was used.

Buk Kuske & Karduck (1976) insisted that the canine fossa approach has the following advantages: 1) It is

easier to handle the endoscope, and the "radius of action" of the sinuscope is greater because mechanical hindrances such as turbinates, septum, and nasal floor are not present. 2) The overview of the entire maxillary sinus, in particular of the ostium which is important for drainage, is significantly better than in the inferior meatus approach. 3) The possibility of complications such as post operative bleeding is less.

Meanwhile there is limited use of the canine fossa approach with children under 9 years of age because of the danger to the tooth buds in final dentition.

Although a radiological study is one of the most important tools for diagnosing maxillary sinusitis, a radiological abnormality does not always agree with the real mucosal pathology. Fascenelli (1969) reported that among 400 normal adults who had a radiological examination of the paranasal sinuses, 104 (26%) showed abnormal findings. Meanwhile, Illum *et al.* (1972) compared the roentgenographic with sinuscopy findings of the same subjects in order to demonstrate the diagnostic significance of endoscopy of the paranasal sinuses. There was no agreement between the findings of X-ray and sinuscopy in 29% of the subjects, so they insisted that a radiological study alone was not sufficient to evaluate the pathology of the antral mucosa.

In this study, the radiological examination failed to discriminate the difference of mucosal pathology between subacute and chronic maxillary sinusitis (Table 7), while sinuscopy examination was able to differentiate these two more definitely (Table 8). Con-

sequently, it would be possible to evaluate the mucosal pathology of the maxillary sinus more precisely if sinuscopy and X-ray examination were combined.

The X-ray's detection rate of secretion in a maxillary sinus was inferior to that of sinuscopy with saline irrigation (Table 10). Axelsson *et al.* (1970) reported that the detection rate of secretion in the maxillary antrum by routine X-ray was only 24%. When they added a decubitus Waters' view to the routine X-ray, the detection rate of secretion increased to 88%. In this study, similar results were obtained by adding a decubitus Waters' view (Table 11)

In the bacteriological study of antral secretion, the percentage of no-growth specimens was 75.7% (Table 12). It was higher than the 46% found by Karma *et al.* (1978) because it was believed that some of the patients had taken antibiotics prior to the test.

Draf (1978) described the indications for therapeutic sinuscopy: 1) subacute or mild chronic maxillary sinusitis, 2) chronic suppurative or mild chronic maxillary sinusitis, 2) chronic suppurative sinusitis in children, 3) mucosinus, and 4) small cysts.

Among 16 patients who had therapeutic sinuscopy, improvement in mucosal findings was noted in 8 patients by follow-up sinuscopy. So sinuscopy can be used effectively to determine the surgical indication after conservative management.

A small number of patients complained of nasal bleeding and pain, but these were not severe.

Because the inferior meatal approach was performed and only two types of sinusscopes (0 and 45) were used, the visual field was somewhat limited. But that problem can be overcome by use of the canine fossa approach in combination with a fiberoptic sinuscope.

CONCLUSION

1) Diagnostic sinuscopy was performed on 182 maxillary sinuses including bilateral cases. The rate of complete sinuscopy was 88.5%, the rate of incomplete sinuscopy was 7.7%, and the failure rate was 3.8%.

2) In the evaluation of the maxillary antral mucosa, sinuscopy was superior to X-ray.

3) The detection rate of antral secretion by sinuscopy with irrigation in the maxillary antrum was higher than by routine X-ray. When a decubitus Waters' view was added, the detection rate by X-ray was increased.

4) Therapeutic sinuscopy was performed in 16 patients who suffered from subacute or mild chronic maxillary sinusitis. Local treatment during sinuscopy improved the mucosal findings in 8 patients.

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