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Adenoidectomy

A prospective study to show clinical and radiological changes two years after operation

by

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Introduction

The adenoids have been said to cause a variety of symptoms. These include nasal obstruction, which gives rise to mouth breathing and snoring. Reduction of nasal resonance or hyponasality results from obstruction of the posterior choanae by enlarged adenoids. In a very small number of children, obstruction may be severe and prolonged enough to cause the hypersomnolent 'sleep apnoea' syndrome and very rarely pulmonary hypertension and cor pulmonale. Middle-ear disease, including both middle-ear effusion and recurrent acute suppurative otitis media, has been traditionally related to eustachian tube dysfunction resulting from enlargement or infection of the adenoids (Ballantyne, 1976) but there are still differences of opinion regarding concomitant reduction of aural symptoms following adenoidectomy (McKee, 1963a and b; Roydhouse, 1970; Sadé, 1979). Furthermore, there is evidence that adenoids are no larger in children with middle-ear effusion than in controls (Hibbert, 1980). It is difficult to define objective criteria by which to judge many of the other less specific symptoms previously attributed to enlargement and infection of the adenoids.

If adenoid enlargement is responsible for snoring, mouth breathing and hyponasality, the operation of adenoidectomy should produce relief of these signs and symptoms. Similarly, if eustachian tube dysfunction is due to adenoidal enlargement or infection, resolution of middle-ear effusion should follow adenoid removal. Furthermore if the size of the adenoid is related to the symptoms one would expect greater improvement after removal to occur in those cases with larger adenoids.

This study reports the effects of adenoidectomy on a group of children assessed clinically and radiologically, at the same time of the year, immediately before operation and subsequently 24 months post-operatively.

Materials and Method

Thirty-eight children scheduled for adenoidectomy and myringotomies for middle-ear effusions were studied. There were 24 boys and 14 girls in the age range three to eight years.

Clinical assessment for mouth breathing and hyponasality was made by a consultant and senior registrar. Each sign was noted as present or absent and if present a severity rating of mild, moderate or severe was recorded. A history from the parents of

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snoring was recorded as present or absent. Three days before adenoidectomy a lateral cephalometric radiograph of the naso-pharynx was taken, and measurements of the post nasal space (PNS), soft-tissue shadow, airway, and nasopharynx were recorded by a method previously reported (Jeans *et al.*, 1981). One surgeon performed all of the adenoidectomy operations by a standard curettage technique. The tissue removed at operation was dried and weighed, and its volume was measured in a 10 ml. syringe, carefully removing all of the trapped air. A second surgeon performed bilateral antero-inferior myringotomies in all cases. In 23 cases a lateral cephalometric radiograph was taken six months following operation. Two years after surgery, during the same months as the initial assessment, 34 of the children were re-examined either by the same consultant or a senior registrar and similar assessments of mouth breathing and hypo-nasality were recorded. The presence or absence of middle-ear effusion and snoring was noted and two further cases responded to a written questionnaire regarding snoring habits. A further lateral cephalometric radiograph was taken on the day of re-examination.

Results

1. *Changes in nasal and aural signs and symptoms after two years* (Table I)

(a) *Mouth breathing*

Mouth breathing was present initially in 29 of the 38 children (76 per cent), and in 27 (79 per cent) of the 34 children followed up. There was complete resolution in eight (30 per cent), improvement in five (19 per cent) and in two it was worse (6 per cent); there was no change in 19 (56 per cent). Thus complete or partial improvement occurred in 13 out of 27 children (48 per cent).

(b) *Hyponasality*

Hyponasality was present initially in 17 of the 38 children (45 per cent), and in 14 (41 per cent) of the 34 children followed up. There was complete resolution in six (43 per cent), improvement in three (21 per cent) and in five (35 per cent) the sign was thought to be worse; there was no change in 20 (59 per

TABLE I

INCIDENCE AND IMPROVEMENT RATES FOR SIGNS AND SYMPTOMS

	Mouth breathing	Hyponasality	Snoring	Middle-ear fluid (ears)
Total initial group	38	38	38	76
Present initially	29	17	28	60
Total follow-up group	34	34	36	68
Present initially	27	14	27	54
Complete resolution	8	6	13	40
Resolution rate	30%	43%	48%	74%*
Improvement	5	3	4	0
Improvement rate	19%	21%	15%	0%
Worse	2	5	0	2
Deterioration rate	6%	15%	0%	3%
No change	19	20	19	26
No change rate	56%	59%	53%	38%
Complete or partial improvement	48%	64%	63%	74%

* Resolution rate for middle-ear fluid significantly higher than for others $p<0.05$.

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cent). Thus complete or partial improvement occurred in nine of 14 children (64 per cent).

(c) *Snoring*

Snoring was present initially in 27 (75 per cent) of the total follow-up group of 36 children (including two additional replies to a postal questionnaire). There was complete resolution in 13 children (48 per cent), improvement in four (15 per cent) and no change in 19 (53 per cent). Complete or partial improvement occurred in 17 children (63 per cent).

(d) *Middle-ear fluid*

Fluid had been present initially in 54 of 68 ears (79 per cent) re-examined at two years. There was complete resolution in 40 (74 per cent) but in two cases fluid was present where previously it had been absent (3 per cent). There was no change in 26 (38 per cent). Thus complete improvement occurred in 40 of 54 ears (74 per cent).

2. *Adenoid volume in relation to change in nasal and aural signs and symptoms* (Table II)

The volume of adenoid removed was related to the alteration in mouth breathing, hyponasality and snoring and to the change in state of the middle ear over the two year period.

(a) *Mouth breathing, hyponasality and middle-ear effusion*

Adenoid volume was *not* found to be significantly related to presence or absence of mouth breathing, hyponasality or middle-ear fluid on initial examination; or to any change in the signs or symptoms which might have occurred after two years.

(b) *Snoring*

Mean volume of adenoids removed from children in whom snoring was absent before and after operation was significantly less than in those who snored, both before and after operation ($p<0.01$). In 13 children snoring stopped after adenoidectomy and in these the adenoid volume removed was significantly greater than in those in whom no change in snoring habit occurred ($p<0.05$).

3. *Radiological changes* (Fig. 1)

Twenty-four children had cephalometric lateral radiographs of the nasopharynx before, at six months and two years after operation; and a further five had radiographs before operation and two years afterwards.

The radiological changes seen after operation were as follows:

(a) Change from the forward convexity of the PNS soft-tissue outline to the forward concavity seen in adults (82 per cent).

(b) Diminution, no change or slight enlargement of the PNS soft-tissue outline (18 per cent).

(c) Little change was seen in the shape of the PNS soft-tissue outline between six months and two years following operation. Irregularity and ill-definition of the margin of the soft tissues was present whatever the general outline in two-thirds of the radiographs.

Measurement of areas on lateral films of the nasopharynx (Table III) showed that there was a significant fall in the mean size of the soft tissues at six months after operation, from 631 sq. mm. before operation to 513 sq. mm. ($p<0.001$). The mean airway area increased from 272 sq. mm. before operation to 534 sq. mm. six months after operation ($p<0.001$) with little change in the following 18 months (Fig. 2). The mean area of the nasopharynx increased from 901 sq. mm. before operation to 948 sq. mm. at six months and 991 sq. mm. two years after operation.

There is no significant change in soft-tissue outline, airway or nasopharynx size between six months and two years after operation, but there is a significant increase in size of the nasopharynx between pre-operative and two year post-operative assessments ($p<0.001$).

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TABLE II

CHANGES IN SIGNS AND SYMPTOMS IN RELATION TO ADENOID VOLUME

	Middle-ear effusion				Snoring				Mouth breathing				Hyponasality			
	No of ears	Range adenoid volume (mls.)	Mean	SD	No of cases	Range adenoid volume (mls.)	Mean	SD	No of cases	Range adenoid volume (mls.)	Mean	SD	No of cases	Range adenoid volume (mls.)	Mean	SD
No change after two years	26	1.5–8.0	3.5	1.5	23	1.5–5.5	3.1	1.1	24	1.5–6.1	3.5	1.4	24	1.5–6.1	3.4	1.2
Absent/absent	12	1.5–8.0	3.4	2.3	9*	1.5–3.0	2.2	0.6	5	1.5–5.0	2.9	1.4	16	1.5–5.5	3.3	1.2
Present/present	14	1.5–5.5	3.9	1.4	14	2.5–5.5	3.7	0.9	19	1.5–6.1	2.7	1.3	8	2.0–6.1	3.5	1.3
Change after two years	42	1.5–6.1	3.2	1.1	13†	1.5–8.0	4.3	1.9	10	1.5–8.0	3.7	1.9	10	1.5–8.0	4.0	2.1
Present/absent	40	1.5–6.1	3.6	1.3	13	1.5–8.0	4.3	1.9	8	2.0–8.0	4.1	1.9	6	2.1–8.0	4.7	2.1
Absent/present	2	2.0–2.5	2.3	0.4					2	1.5–2.5	2.0	0.7	4	1.5–5.5	2.9	1.8
Not known	8	3.0–6.0	3.9	1.3	2	3.5–5.0	4.3	1.1	4	3.0–6.0	3.9	1.4	4	3.0–6.0	3.9	1.4

* Absent/absent significantly lower than other two valid groups $p<0.01$.
† Change/no change for snoring shows significant difference $p<0.05$.

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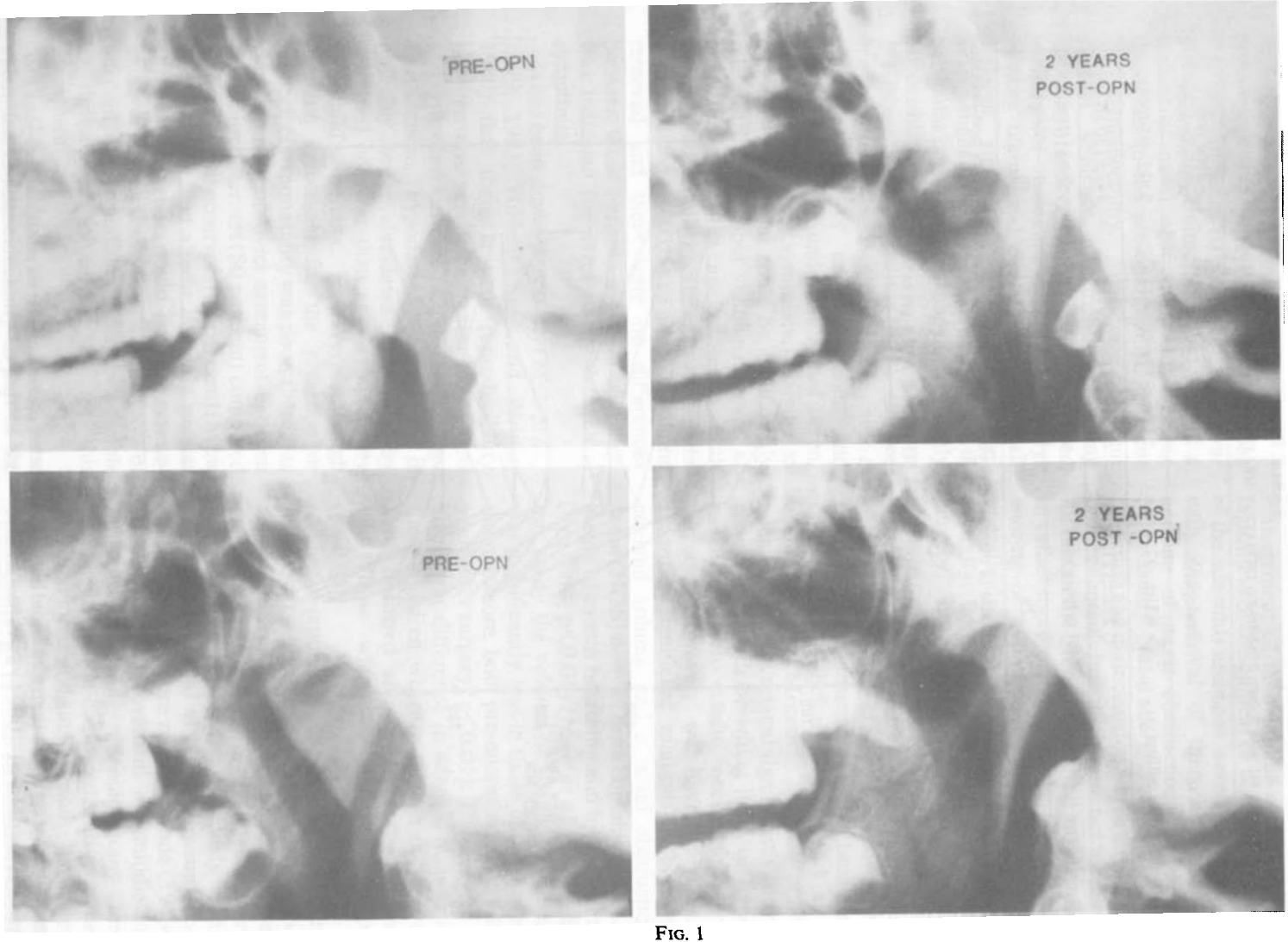


FIG. 1

Lateral cephalometric radiographs of two children before and two years after adenoidectomy. In both, the nasopharyngeal outline remains ill-defined two years after operation. In one the irregular outline is very noticeable

TABLE III

MEAN AREAS IN SQ. MM.±ONE STANDARD DEVIATION MEASURED ON LATERAL RADIOGRAPHS OF NASOPHARYNX

Areas of	Pre-operation	Six months post-operation	Two years post-operation
PNS soft-tissue outline	631± 92	513± 97 ($p<0.001$)	540± 93 (NS)
Airway	272±111	434± 94 ($p<0.001$)	442±130 (NS)
Nasopharynx	901±126	948±101 (NS)	991±110 (NS)
No of patients	29	24	29

There is a significant change in the size of the nasopharynx from before operation to two years post-operation ($p<0.001$).

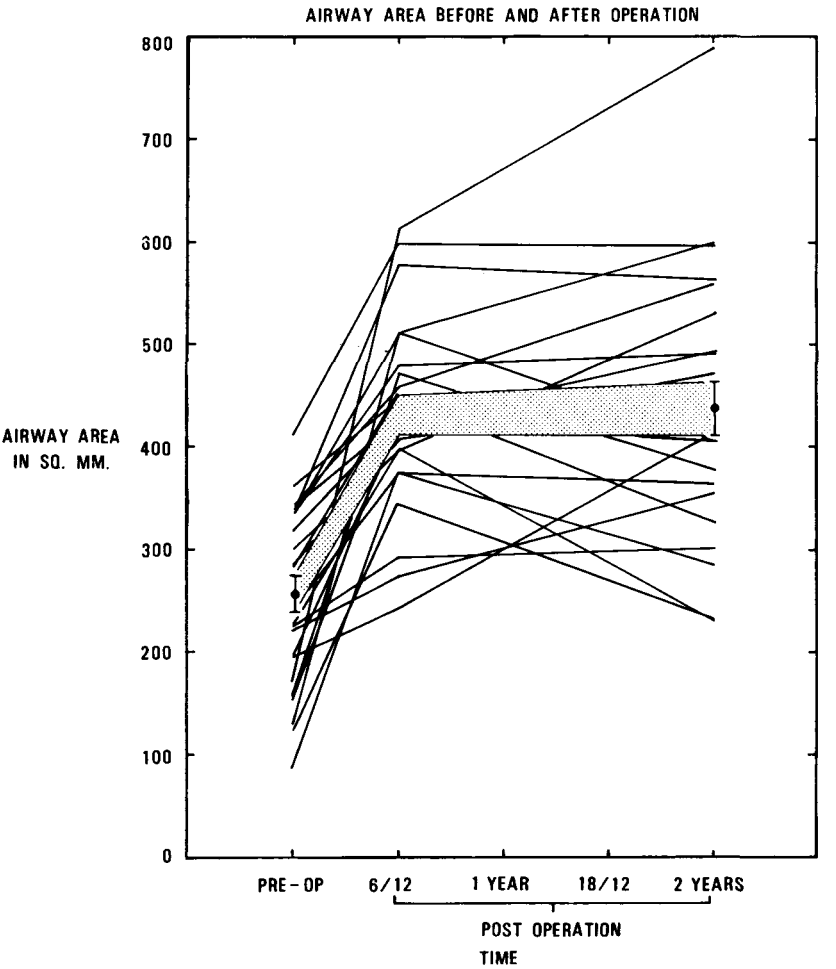


FIG. 2

Individual changes in airway area measured in 24 children before operation and at six months and two years after operation with the mean and standard error.

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Discussion

Hibbert (1977) reported that 80 per cent of a sample of 10 per cent of Otolaryngologists in the United Kingdom thought a history of nasal obstruction and snoring important in the pre-operative assessment for adenoidectomy. Sixty-five per cent thought evidence of mouth breathing important and very few routinely used radiological assessment pre-operatively. History taking and examination of small children suspected of suffering from enlargement of the adenoids is difficult and in particular posterior rhinoscopy is frequently impossible to perform.

Hibbert and Tweedie (1977) showed snoring to be a significant but not a good predictor of adenoid weight and demonstrated that, under the age of seven, none of the signs and symptoms attributed to adenoid enlargement could be significantly related to the adenoid volume removed at operation. Over the age of seven, both snoring and mouth breathing were significantly related ($p<0.05$) to adenoid volume removed and there were no differences between those patients in whom operation was indicated for aural rather than nasal symptoms.

It has been shown previously (Maw *et al.*, 1979, 1981; Hibbert, Stell and Wright, 1980) that there is poor reproducibility between observers in the assessment of signs and symptoms attributed to adenoid disease. Furthermore, hyponasality of speech is probably better elucidated as a sign by a trained observer than as a symptom by the child's parents. However, although absolute agreement for the presence or absence of hyponasality was poor, there was considerably improved agreement between two senior observers (80 per cent) compared with two junior observers (58 per cent) (Maw *et al.*, 1981); and almost certainly greater clinical experience would improve assessment of hyponasality as a predictor of adenoid size. In addition it may be possible to develop an objective test for this assessment.

All the children in this study were submitted to adenoidectomy as part of the management of their middle-ear effusions, regardless of the clinical or radiological size of the adenoids and none were listed specifically for removal of their adenoids on account of nasal obstruction, snoring or hyponasality. Nasal allergy, infection, septal deviation and malocclusion which might also produce mouth breathing were not assessed for this study. From the results it appears that in rather more than half of the cases where snoring or hyponasality was present pre-operatively it was either completely or partially improved two years following surgery, but for mouth breathing the improvement was somewhat less marked. In these cases there was no relationship between the volume of adenoid removed and the presence or absence of mouth breathing or hyponasality before or two years after adenoidectomy. Moreover the size of the adenoids was not related significantly to any change in mouth breathing habit or hyponasality which might occur following surgery. However, we have previously shown a significant relationship between adenoid volume and a nasal obstruction score (NOS) derived from combined assessments of mouth breathing and hyponasality ($r = 0.64$, $p<0.01$) (Maw *et al.*, 1981). In this study the volume of adenoid removed was significantly less in those children who did not snore, both pre-operatively and two years after surgery ($p<0.01$). There is also a significant difference in adenoid volume in those children where a change in snoring habit occurred after two years compared with those where no change occurred ($p<0.05$).

The relationship of the adenoids to middle-ear effusion is still unproven, and several studies have demonstrated middle-ear effusions where either the adenoids are not enlarged or have previously been removed (Dawes, 1970; Mawson and Fagan, 1972). More recently, Sadé (1979) showed no improvement in middle-ear effusions following adenoidectomy and grommet insertion compared with grommet insertion alone and similar results have been reported in a small study by Fiellau-Nikolajsen *et al.* (1980). In addition Hibbert

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(1980) demonstrated that the presence of middle-ear fluid was not related to adenoid size and there was no difference in adenoid size in children with middle-ear fluid compared with matched controls.

In the present study over a two-year period there was complete resolution of middle-ear fluid in 74 per cent of ears. The study demonstrates the usually accepted rate of improvement in middle-ear effusions which follows almost all reported medical or surgical procedures designed to alleviate the disorder. Furthermore, adenoid volume has not been found to be significantly related to the presence or absence of middle-ear fluid either at initial examination or to any change in the status of the middle ear which might occur two years after surgical treatment by adenoidectomy and myringotomy. Finally the study takes no account either of the spontaneous improvement in signs and symptoms occurring naturally, or the significant growth of the nasopharynx, with the passage of time which has been demonstrated by this work.

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