

## Caries prevalence after submandibular duct retroposition in drooling children with neurological disorders

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### Abstract

*This study is a long-term follow up of 17 patients surgically treated for uncontrolled drooling, by retroposition of the ducts from the submandibular glands. Mean age was 16.8 years (range 7–31), with an average postoperation time of 9.2 years (range 1–18). Clinically, no subject revealed an impression of an extremely dry mouth, but most patients showed obvious permanent decrease in drooling after the surgical treatment. They had a highly significant increase in caries prevalence of the mandibular incisal and canine area, and this caries prevalence was related to the severity of cerebral palsy.*

### Introduction

Salivary drooling often is seen in patients with neurological disorders. In many cases, improvement of orofacial motor control, keeping the head in an upright position, and substituting the lost reflex by willpower-controlled swallowing will take care of this problem (Crysdale et al. 1985). Infrequently, however, these techniques do not work due to mental retardation and/or poor cooperation, even when combined with anticholinergic therapy. The problems created by drooling mainly are social (Brown et al. 1985), but they also can result in maceration of the skin and other medical problems, particularly in cold climates. For these cases, different surgical approaches have been utilized (Wilkie 1967; Ekedahl 1974), where saliva from major salivary glands is eliminated from the oral cavity. This involves changes in the property of the saliva as well as a reduction in the salivary flow rate. It may affect lubrication and protection of oral mucosa, oral cleaning, buffering action, antibacterial activity, and tooth integrity (Mandel and Wotman 1976). In other words, this kind of treatment affects several factors vitally important for resistance to dental decay (Mandel 1974), and it has been suggested that these patients will be more susceptible to dental caries after the operation (Ericson et al. 1973). Local rampant carious lesions also have been observed in areas where there is a lack of salivary secretion (Gurley 1939; Hill 1972).

The purpose of the present study was to clarify whether children were more susceptible to dental decay or not — especially in the mandibular anterior teeth — after retroposition of the two submandibular ducts.

### Methods

The patients were 17 children (10 boys and 7 girls) who had been surgically treated at the Medical Center Hospital in Örebro, Sweden, for a socially unacceptable and uncontrolled drooling during the years 1968–1985. The technique used is similar to that described by Ekedahl (1974) and involves retroposition of the ducts from the submandibular glands as far as the palatal arches, if possible. At the time of the present investigation the mean age of the patients was 16.8 years (range 7–31). The time elapsed since the surgical treatment was performed (postop time) varied from 1 to 18 years (avg. = 9.2 years). Of the 17 subjects, 13 were suffering from cerebral palsy (CP) but were mentally sound. In eight cases the CP was combined with mental retardation, and in seven with epilepsy. All four patients without CP were mentally retarded, and two also were epileptic.

All medical records were reviewed, and together with a responsible guardian, usually one of the parents, all the patients answered a standardized anamnestic questionnaire and a food habit history *ad modum* Holm et al. (1986). The anamnestic questionnaire included general health history, medications, parent's opinion of the surgical effect on the drooling, use of additional aids to reduce salivary flow rate, previous dental treatment, toothbrushing habits, and use of other dental preventive measures.

### Diagnostic Criteria

**Caries.** The clinical examination was supplemented with bite-wing radiographs, and dental caries was diagnosed in accordance with the criteria described by Koch (1967).

**Gingival Status.** The inflammatory state of the gingiva was estimated in accordance with the criteria of Loe and Silness (1963). The number of scores of 2 and 3 were used to describe gingival status as healthy (no or only occasional score 2), gingivitis (presence of scores 2 or 3), and severe gingivitis (general presence of scores 2 or 3).

**Saliva Collection.** It was possible to obtain salivary samples from 10 of the 17 patients. The number of lactobacilli in saliva was determined in all 10 subjects using the Dentocult® dip-slide technique (Larmas 1975; Crossner and Hagberg 1977). However, only three of the 10 patients were able to cooperate well enough for a reliable determination of stimulated salivary flow rate by chewing a piece of paraffin wax. The rest of the samples consisted mainly of residual saliva.

## Results

### Caries

The prevalence of caries is reported as the total DMFS value, as well as the number of DMFS in the mandibular incisal and canine area (involving teeth 33-43). The relative caries prevalence of the mandibular anterior teeth was estimated by determining the quotient DMFS 33-43/DMFS total. The mean DMFS values in relation to the postop time are presented in Table 1. One patient showed a very high caries prevalence (DMFS total = 37; DMFS 33-43 = 14), and in order to compensate for the penetration of an extreme value in a patient base as small as this, the median DMFS quotient is given as well. Twenty-five per cent of all restorations and carious lesions were situated in the mandibular anterior teeth, and the relative proportion of caries prevalence in this area increased with increasing postop time (Table 1).

TABLE 1. Total and Local DMFS as Related to Postop Time.

Postop Time (yrs)	No. of Patients	DMFS				
		Mean ± SD		Mean	Median	
		Total	33-43	33-43/Total	33-43/Total	
1 - 3	6	4.2 ± 4.9	0	0	0	
4 - 12	5	14.6 ± 14.2	5.6 ± 5.8	0.38	0.21	
13 - 18	6	14.0 ± 12.6	2.8 ± 3.0	0.20	0.31	
Total	17	10.7 ± 11.5	2.6 ± 4.1	0.25	0	

TABLE 2. DMFS in Relationship to Severity of Cerebral Palsy.

CP	No. of Patients	Mean Age	Mean Postop Time (yrs)	DMFS		
				Mean ± SD		Mean
				Total	33-43	33-43/Total
No	4	10.0	2.0	5.0 ± 5.8	0	0
Moderate	6	19.3	11.7	11.8 ± 12.0	1.2 ± 1.3	0.10
Severe	7	18.4	11.1	13.0 ± 13.7	5.4 ± 5.2	0.42

According to the opinion of the guardian, 12 of the 17 patients showed obvious reduction in their drooling after the surgical treatment. The average total DMFS value for this group was 12.0, as compared to 7.6 for the remaining subjects. However, even in the group with no obvious effect on the drooling, the surgical treatment resulted in a rather high relative proportion of DMFS in the mandibular anterior teeth (21%).

### Oral Hygiene

In all subjects except two the oral hygiene was performed by a guardian. This included regular tooth brushing twice a day using fluoridated tooth paste. Proximal cleaning never was utilized. Neither had any kind of additional preventive measure ever been recommended, such as regular use of trays for chlorhexidine and/or fluoride gel after the surgical treatment was performed. Gingivitis was registered in 13 patients, and in six of these it was diagnosed as severe.

### General Health Status

According to records and anamnestic data, the patients were subgrouped into no CP, moderate CP (hemiplegia or diplegia), or severe CP (tetraplegia). The groups defined as moderate and severe were quite similar concerning age, postop time, and total DMFS value, but the relative caries prevalence in the mandibular incisal and canine area was four times higher in the group with severe CP (Table 2).

### Salivary Data

High numbers of salivary lactobacilli ( $>10^5$ /ml) were found in six subjects, and they had an average total DMFS value of 16.3, which was almost five times as high as for the four subjects with low numbers of lactobacilli ( $<10^4$ /ml; DMFS = 3.5). In spite of the large difference in caries prevalence between the two groups, however, there was no obvious difference in 33-43/total DMFS quotient.

In no case did the clinical examination reveal an impression of an extremely dry mouth. The three cases in which it was possible to obtain stimulated saliva all belonged to the group with a positive drooling effect after surgery, and their flow rates were 1.0, 0.9, and 0.5 ml/min, respectively.

## Food Habits

For all 17 patients, regular meals were well composed, and no case of malnutrition was evident. However, obvious differences occurred concerning the between-meal eating of easily fermentable carbohydrates in the form of snacks, soft drinks, and candy. A low frequency of this between-meal eating resulted in low numbers of salivary lactobacilli, as well as in a low caries prevalence. This low prevalence of caries was not only restricted to the mandibular anterior teeth, but was evenly distributed throughout the whole dentition. A notable finding was that the most frequent between-meal eating was found in the five mentally sound CP patients. These five patients also had a higher total mean DMFS value (19.4) than the rest of the patients (7.1).

## Discussion

From the standpoint of dental caries, this group of patients consisted of a very heterogeneous group considering important background variables such as age, postop time, medical status, mental status, etc. Consequently, no statistical analysis was performed, and for the same reason no suitable control group was available. Instead, the susceptibility of dental caries due to surgical treatment of drooling was measured by the design of an intraindividual study where the prevalence of caries in the primary affected mandibular incisal and canine area was compared to the total prevalence. Furthermore, the caries prevalence in these patients can be related to what generally is found in a healthy population by comparing the results with an epidemiologic study performed in the same part of Sweden (Crossner and Unell 1986). According to that study, 98% of the 16 year olds have no decayed, missing, or filled tooth surfaces in the 33–43 area, and the 33–43/total DMFS quotient is 0.002 — a figure that in comparison to the present group of patients is more than 100 times lower (0.25). The total number of DMFS in our group of patients (10.7) with a mean age of 16.8 years, however, was similar to the average healthy 16 year olds (11.9). In other words, in spite of having an average caries experience (compared to the general population) these patients, who were surgically treated for drooling by eliminating the saliva from the two submandibular glands, had a highly significant increase in caries prevalence of the mandibular anterior teeth.

In mammals, the ability of saliva to rinse, clean, protect, and maintain ecological balance in the oral cavity is of overwhelming importance for dental health. Of course, this is true for the long period of human existence, as well. However, modern knowledge concerning the importance of good food habits and plaque control, together with the use of fluorides, seems to have moderated the importance of saliva. At least, as far as

the relationship between dental caries and normal ranges of salivary flow rate in healthy individuals is concerned (Klock and Krasse 1979; Crossner 1981). In our patients the oral hygiene, which almost always was dependent on a guardian, was generally poor, and in no case were any additional preventive measures utilized. Other factors of importance for cleaning and oral sugar clearance, such as swallowing (Lagerlöf and Dawes 1985) and normal tongue and lip movements (Swenander-Lanke 1957), were more or less lacking in these patients. In consequence, the relative importance of saliva for maintaining good dental health was greater in our group of patients, compared to a healthy population, and the effect of the surgical procedure was more severe, matching the severity of the CP.

Mental retardation showed a negative relationship with caries prevalence. This was not, however, restricted to the mandibular anterior teeth and could not be explained by differences in salivary protection but by differences in food habits. While the mentally retarded patients, to a large extent, were restricted to served meals, the mentally sound were able to support their own between-meal intakes. This also was verified by the numbers of salivary lactobacilli; the high numbers were most likely due to frequent sugar intake (Crossner 1981).

It only was possible to make a reliable determination of stimulated salivary flow rate in three patients. In comparison to a normal range of flow rate in corresponding ages (Crossner 1984), these children were in the 5th percentile, and a low flow rate was to be expected since the two submandibular glands seem to be responsible for more than 50% of the production of stimulated saliva (Rhodres 1987). Still, no patient complained of discomfort or dryness, and from anamnestic data and a clinical examination only, it appears to be exceedingly difficult to determine whether a particular patient has an abnormally low flow rate (Dawes 1987). Even the subjects who were reported to have no effect or only slight effect on drooling after surgery had 21% of their caries prevalence located in the mandibular anterior teeth.

The functions of saliva are digestive as well as protective, and include several systems for protection of both hard and soft oral tissues (Mandel 1987). Consequently, other possible negative effects on oral mucosa and periodontal status have to be taken into account due to lack of saliva. The management of unacceptable drooling should be a team effort among the physician, the dentist, the speech pathologist, and the physiotherapist, and before surgical intervention is determined, other treatment methods should be tried, such as willpower-controlled swallowing, alteration of head posture, etc. (Brown et al. 1985; Crysedale et al. 1985). However, when

the salivary secretion has to be medically or surgically influenced, individually designed preventive programs must be designed and followed in order to minimize the oral side effects as far as possible.

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## Dental fears

American Health's May 1989 issue lists reasons why people fear a visit to the dentist. Not surprisingly, the drill and injections rate high on the list, but new studies point to the following other reasons:

- making an appointment
- losing control
- getting teeth cleaned
- choking or gagging
- dentists who won't listen or who ignore requests
- criticisms or insults about personal oral health
- extractions
- post-treatment swelling