

Childhood respiratory disease, sedation and dentistry

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What are the common chronic childhood respiratory diseases?

- Asthma
- Cystic Fibrosis
- Bronchopulmonary dysplasia (Chronic Lung Disease of Prematurity)
- Obstructive sleep apnea
- Restrictive lung disease

Asthma

- Episodic cough, wheeze or shortness of breath, relieved by beta-2 agonist bronchodilators and controlled by steroids, inhaled and enteral, inhaled cromolyn, oral leukotriene modifiers, or theophylline

What are risks of sedation in asthma?

- There were seven deaths from asthma at Children's Hospital National Medical Center from 1944 to 1984. All occurred prior to 1971 despite an increased frequency of admissions for the treatment of asthma. Review of records implicated under-treatment, infection, and sedation as factors that may have contributed to deaths.
 - Nguyen, M.T., Patterson, K., and Sly, R.M. 1985. Causes of death from asthma in children. *Ann Allergy* 55:448-453.
- Uncontrolled asthma and sedation is a high risk situation for respiratory failure and death

How well controlled is the patient's asthma?

ASTHMA ACTION PLAN FOR _____ Doctor's Name _____ Date _____

Doctor's Phone Number _____ Hospital/Emergency Room Phone Number _____

<p>GREEN ZONE: Doing Well</p> <ul style="list-style-type: none"> No cough, wheeze, chest tightness, or shortness of breath during the day or night Can do usual activities <p>And, if a peak flow meter is used, Peak flow: more than _____ (80% or more of my best peak flow)</p> <p>My best peak flow is: _____</p>	<p>Take These Long-Term-Control Medicines Each Day (include an anti-inflammatory)</p> <table border="1"> <thead> <tr> <th>Medicine</th> <th>How much to take</th> <th>When to take it</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>		Medicine	How much to take	When to take it									
Medicine	How much to take	When to take it												
<p>Before exercise</p> <p><input type="checkbox"/> _____ <input type="checkbox"/> 2 or <input type="checkbox"/> 4 puffs 5 to 60 minutes before exercise</p>	<p>YELLOW ZONE: Asthma is Getting Worse</p> <ul style="list-style-type: none"> Cough, wheeze, chest tightness, or shortness of breath, or Waking at night due to asthma, or Can do some, but not all, usual activities <p>-Or-</p> <p>Peak flow: _____ to _____ (50% - 80% of my best peak flow)</p>													
<p>RED ZONE: Medical Alert!</p> <ul style="list-style-type: none"> Very short of breath, or Quick-relief medicines have not helped, or Cannot do usual activities, or Symptoms are same or get worse after 24 hours in Yellow Zone <p>-Or-</p> <p>Peak flow: less than _____ (50% of my best peak flow)</p>	<p>Take this medicine:</p> <p><input type="checkbox"/> _____ <input type="checkbox"/> 4 or <input type="checkbox"/> 6 puffs or <input type="checkbox"/> Nebulizer</p> <p><input type="checkbox"/> _____ mg. (oral steroid)</p> <p>Then call your doctor NOW. Go to the hospital or call for an ambulance if:</p> <ul style="list-style-type: none"> You are still in the red zone after 15 minutes AND You have not reached your doctor. 													
<p>DANGER SIGNS</p> <ul style="list-style-type: none"> Trouble walking and talking due to shortness of breath Lips or fingernails are blue 	<p>Take <input type="checkbox"/> 4 or <input type="checkbox"/> 6 puffs of your quick-relief medicine AND</p> <p>Go to the hospital or call for an ambulance (_____) NOW!</p>													

What is current evidence regarding safe and effective sedation for asthmatic children?

- Evaluate the safety and efficacy of midazolam in asthmatic patients undergoing dental treatment.
- METHODS:** Twenty-four children, aged 19 to 65 months, with a diagnosis of mild to moderate asthma were given an oral dose of 0.5 mg/kg of midazolam.
 - Oxygen saturation, respiratory rate, and pulse rate were monitored
 - Asthma score was also determined before and after treatment
- RESULTS:**
 - Twenty-three of the 24 subjects had asthma scores of "0" before and after treatment.
 - During dental treatment, 2 patients had oxygen saturations of 94% at one point during treatment. However, oxygen saturation increased when the patient's head and neck were repositioned. Twenty-three of the 24 subjects had oxygen saturations above 95% at 30 minutes following treatment.
 - Significant differences did occur in pulse rate between 5 and 10 minutes (mean difference=10+/-3.84) and between 10 and 15 minutes (mean difference=19+/-5.50), as expected.
 - Twelve subjects were assessed to have excellent behavior, 5 subjects were satisfactory, and 7 subjects were unsatisfactory. No treatment was aborted.
- CONCLUSIONS:** With adherence to the AAPD's sedation guidelines, midazolam at a dose of 0.5 mg/kg is a safe and effective mean for sedation of patients with mild to moderate asthma.
- Kil, N., Zhu, J.F., VanWagnen, C., and Abdulhamid, I. 2003. The effects of midazolam on pediatric patients with asthma. *Pediatr Dent* 25:137-142.

Is the incidence of caries greater in asthmatic children?

- British school children with asthma.
- METHODS: A convenience sample of 100 asthmatic children (aged 4-16 years) was examined for dental caries, periodontal condition, and tooth surface loss. School children, equated for age, sex, race, and socioeconomic status were chosen for comparison.
- Asthmatic children had significantly more plaque, gingivitis, and calculus compared with the control group. There was a significant difference in the severity and number of teeth affected by tooth surface loss affecting labial surfaces of the anterior teeth and occlusal surfaces of the posterior teeth of asthmatic children.
- McDerra, E.J., Pollard, M.A., and Curzon, M.E. 1998. The dental status of asthmatic British school children. *Pediatr Dent* 20:281-287.

Is the incidence of caries greater in asthmatic children?

- A representative random sample of adolescents in the East Midlands.
- METHODS: A random sample of 1753 12-year-old children was examined in all schools in Leicestershire and Rutland. 1308 children were re-examined 2 years later. Tooth erosion was assessed using the index employed in the Children's Dental Health in the UK Survey 1993. Asthma presence was recorded on a self-completed questionnaire at the time of the 12 years examination. Data on asthma prescribing over a one year period was obtained from the Prescription Pricing Authority.
- RESULTS: Asthma was present in 16.8% of 12-year-olds. Tooth erosion was recorded in 59% of children with asthma and in 59.7% who were asthma free. There was no significant difference in erosion prevalence between asthmatics and asthma free in a cohort of children at age 12 or 14 years, and the incidence of erosion was 12.8% and 12.3%, respectively. 88% of drugs prescribed for treatment of asthma had a pH above the critical pH of 5.5.
- CONCLUSION: There was no association between asthma and tooth erosion. The majority of drugs prescribed for the treatment of asthma are not potentially erosive.
- Dugmore, C.R., and Rock, W.P. 2003. Asthma and tooth erosion. Is there an association? *Int J Paediatr Dent* 13:417-424.

Is the incidence of caries greater in asthmatic children?

- **OBJECTIVE:** To estimate the risk of dental caries in 5-7 year old Danish children who received prescriptions for asthma-drugs.
- **DESIGN:** Population-based cohort-study based on data from a prescription registry and dental database. Setting The County of North Jutland, Denmark.
- **PARTICIPANTS:** 4,920 children born in 1993, and followed to the end of 2000. Main outcome measures Dental caries in primary canines and molars, and permanent teeth.
- **RESULTS:** Between the age 3 and 5 years 30.4% of the children received one or more prescriptions for asthma-drugs compared to 18.8% between 5 and 7 years of age. Children often received two or more drugs in combination. Approximately 6% of the children received both inhaled cortico-steroids and inhaled beta2-agonists between 3 and 7 years of age.
 - No increased risk of caries could be shown in the primary teeth.
 - Children who received prescriptions of both inhaled beta2-agonists and cortico-steroids between the ages of 3 and 7 years, the relative risk of caries in permanent teeth was estimated at 1.62 (95% C.I.: 1.03-2.56).
 - Children who received prescriptions of both inhaled beta2-agonists and corticosteroids between 5 and 7 years, the relative risk of caries in the permanent teeth was estimated at 1.45 (95% C.I.: 0.99-2.11).
- **CONCLUSIONS:** Asthma-drugs may increase the risk of caries in newly erupted permanent molars
- Wogelius, P., Poulsen, S., and Sorensen, H.T. 2004. Use of asthma-drugs and risk of dental caries among 5 to 7 year old Danish children: a cohort study. *Community Dent Health* 21:207-211.

Other potential risks in Asthma

- **Increased airflow obstruction after NSAIDs, sulfite preservatives in medications such as lidocaine with epinephrine**

Friedlander AH, Friedlander IK, Yagiela J, Eth S. Dental management of the child with developmental dyslexia. *ASDC J Dent Child* 1994;61(1):39-45.

Asthma Conclusions

- Assess risk of asthma—up to 30% of children have this problem
- Avoid sedation in patients with uncontrolled asthma
- Decay in permanent teeth may be increased in young asthmatics (age 3-5) taking beta-2 agonists and inhaled corticosteroids—spacing units and rinsing mouth after inhalation therapy may help reduce risk

Cystic Fibrosis

- Epithelial disease, inherited, autosomal recessive
- Lack or loss of function of the Cystic Fibrosis Transmembrane Regulator (CFTR) protein that acts as a Cl⁻ channel on the apical surface of airway, gut, and ductal epithelia.
- Adhesion and retention of airway mucus
- Chronic airway bacterial infection, progressive airway inflammation leading to bronchiectasis and airflow obstruction
- Malabsorption, malnutrition
- Male infertility

Cystic Fibrosis

- Staying Healthy
- **Make a Plan to Stay Healthy**
- By following a treatment plan developed with their CF care center team, many people with CF can slow down the progression of their disease. A healthier body is better able to deal with bacteria and chronic lung infection.
- **Diet – Watch What You Eat**
- **Pancreatic Enzyme Supplements** – Almost everyone with cystic fibrosis needs to take pancreatic enzyme supplements with meals and snacks. Taken by mouth, the enzymes go to work in the intestines to help digest food so it can be absorbed by the body. Patients should always check with their doctor or dietitian to know the exact amount of enzymes to take.
- **Vitamins and Minerals** – Most people with cystic fibrosis do not absorb fats properly, so certain vitamins, or "fat-soluble" vitamins, are not absorbed. [back to top](#)
- **Cystic Fibrosis-related Diabetes – Keeping Sugar in Check**
- **Avoid the Spread of Germs**
- **Lung Health – Thank You for Not Smoking**
- **Nebulizers – Clearing the Airways**

Cystic Fibrosis and Dental Disease

- **AIM:** To compare the prevalence of dental caries, dental calculus, and enamel defects in children with cystic fibrosis (CF) and children with other chronic respiratory disorders.
- **METHODS:** A cross sectional observational survey. One examiner (AN) undertook oral examinations to assess dental caries, periodontal health, and enamel defects in children attending respiratory outpatient clinics.
- **RESULTS:** A total of 74 patients with CF (35 male; mean age 10.7 years, range 2.5-16.5) were compared with a control group of 106 patients with other chronic respiratory disorders (52 male; mean age 9.1 years, range 3.0-16.5).
- There were significantly more defects of enamel in the permanent teeth of CF patients, compared with the teeth of those children with other chronic respiratory disorders.
- **CONCLUSIONS:** Enamel defects, particularly enamel opacities, which can be disfiguring, are more common in CF patients. Early, regular dental visits may prevent such defects becoming dentally disabling and would also permit the removal of dental calculus deposits.

Narang A, Maguire A, Nunn JH, Bush A. Oral health and related factors in cystic fibrosis and other chronic respiratory disorders. Arch Dis Child 2003;88(8):702-7.

Cystic Fibrosis Risk of Water Borne Infections

- No evidence of increased transmission of *B. cepacia* from water aerosols used during dental procedures to CF patients (Pankhurst CL, Harrison VE, Philpott-Howard J. Evaluation of contamination of the dentist and dental surgery environment with *Burkholderia* (*Pseudomonas*) *cepacia* during treatment of children with cystic fibrosis. *Int J Paediatr Dent* 1995;5(4):243-7)
- One study on *P. aeruginosa*, a more common water-borne organism showed it to be present in 2.9% of 103 water samples (two triple function syringes and one turbine). 10 CF patients attended this dental clinic regularly. 5 of these harbored *P. aeruginosa*. One of 14 isolates from these 5 patients with *P. aeruginosa* who attended this clinic matched that in the water from the triple function syringe by pulse field gel electrophoresis. The observed transmission rate is estimated at 1.2 cases per 100 sessions. Cleansing equipment each day with chlorine or H₂O₂, or use of sterile water for dental washing on CF patients was recommended (Jensen ET, Giwercman B, Ojeniyi B, Bangsberg JM, Hansen A, Koch C, et al. Epidemiology of *Pseudomonas aeruginosa* in cystic fibrosis and the possible role of contamination by dental equipment. *J Hosp Infect* 1997;36(2):117-22)

Cystic Fibrosis Conclusions

- No increased risk in children of caries but increased risk of enamel defects especially discoloration
- An observed transmission rate of 1.2 cases per 100 sessions of *P. aeruginosa* in CF. For those clinics seeing CF or immunocompromised patients, cleansing equipment each day with chlorine or H₂O₂, or use of sterile water for dental washing on those patients was recommended

Bronchopulmonary Dysplasia

- Surfactant deficiency from premature birth
- Positive pressure ventilation treatment
- Areas of airway inflammation, alveolar hyperinflation and alveolar collapse
- Chronic obstructive pulmonary disease that gradually improves with growth
- Associated with other problems of prematurity such as neurologic dysfunction

Bronchopulmonary dysplasia

- No information on increased risks to dentition
- No information on increased risks of dental treatment
- Sedation precautions appropriate to chronic obstructive pulmonary disease—some patients may be hypoxemic and hypercarbic at baseline, some may have symptoms of asthma

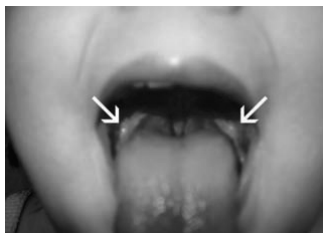
Diseases that may present to the dentist and have pulmonary implications

- Increased caries
 - GE reflux
 - Familial dysautonomia
- Mandibular hypoplasia, retrognathia
 - Pierre-Robin syndrome, intermittent airway obstruction
- Cleft palate--aspiration
- Neonatal teeth--incomplete crown and root make some mobile and aspiration of tooth shells a risk
- Ankyloglossia—deviation of larynx and epiglottis→dyspnea
- Oral-Facial-Digital syndrome—malpositioned, supernumerary teeth, dental caries, multiple frenulae, midline hypoplasia, respiratory infections
- Ranulas—continued growth→respiratory distress
- Periodontal disease—neutropenia, chemotactic defects→pneumonia

Tonsillar hypertrophy

■ Tonsillar and adenoid hypertrophy

- Capua, M., Ahmadi, N., and Shapiro, C. 2009. Overview of obstructive sleep apnea in children: exploring the role of dentists in diagnosis and treatment. *J Can Dent Assoc* 75:285-289.



Obstructive Sleep Apnea

- If 3-4+ may be associated with sleep apnea
 - Snoring
 - Daytime sleepiness or hyperactivity
 - Refer to primary MD for Obstructive Sleep Apnea evaluation and possible tonsillectomy and adenoidectomy with repeat sleep study

Obesity

- Oral sedation may be problem:
 - If dosed by weight may overdose
 - If dosed by lean weight may underdose
 - Restrictive lung disease in massively obese
 - Pneumonia and aspiration risks
 - Airway may become obstructed during sedation

An asthma score (Kil,N et al *Pediatr Dent*
25:137-142)

Table 2. Asthma Score Classification*

Indicator	0	1	2
SpO ₂	>94% (air)	<94% (air)	<94% (40% O ₂)
Cyanosis	No	Yes	Yes
Breath sounds	Equal	Unequal	Absent
Wheezing	None	Moderate	Marked
Accessory muscles	None	Moderate	Marked
Level of consciousness	Alert	Agitated or depressed	Comatose

*Modified from Wood et al, 1972.