The new era of pretracheal/precordial stethoscopes

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Vigilance is the motto for the American Society of Anesthesiologists.[1] Vigilance over the sedated pediatric dental patient is essential for safe and successful treatment. Especially important is vigilance over the patient's airway.

If airway compromise can be quickly detected and corrected, then the likelihood of the patient experiencing a decrease in oxygen saturation will be low. Hypoxia caused by airway obstruction is a challenge faced by every pediatric dentist who chooses sedation as an alternative mode of treatment. Airway obstruction may be caused by several factors: poor patient positioning, blockage of the oropharynx by the tongue, fluids accumulating in the back of the throat, excess secretions, or collapse of soft tissues due to decreased muscle tone. These factors can lead to laryngospasm or bronchospasm, thus further compromising the airway.

Table 1. Advances and Limitations of Pulse Oximeter and Capnograph Use in Pediatric Dental Sedations

Monitor	Advantages	Limitations
Pulse oximeter	-Reliable -Non-invasive -Affordable -Alarm for low O_2 saturation -Continuous monitoring of rates (alarms) -Considered "gold standard" in detecting hypoxia	-Not a "real-time" monitor (delayed reading) -Placement of sensor critical to accuracy of reading -Excess ambient light may affect reading -Hypothermia affects reading -Movement affects reading
Capnograph	-"Real-time" monitor -Reliable -Non-invasive -Good indicator of patient behavior (retrospective) -Good for deeper sedations -Respiratory rate measured	-Expensive -Ports are prone to dislodgment -Ports may occlude against tissues -Ports may be too far away from nares -Expired air may be shunted through the oral cavity

While it has been reported that some pediatric dentists and pediatric dentistry training programs have decreased their use of sedation,[2] many practitioners still view the use of sedative agents as acceptable treatment for the pre-cooperative child.[3,4]

The pediatric dentist today has an array of monitoring devices to protect the sedated patient. These monitors have been reviewed and discussed in great detail in the literature.[5,6,7,8] Pulse oximeters and capnographs are two electronic monitors that have been described as the "favorites."[5] While these devices have brought many advances to the dental and medical fields, they are not without their limitations, especially when dealing with pediatric dental sedations (Table 1).

AAPD Guidelines for the Elective Use of Conscious Sedation, Deep Sedation and General Anesthesia in Pediatric Dental Patients (revised May, 1998), requires that patients be monitored continuously for patient responsiveness and airway patency.[9] One of the most useful devices in the armamentarium of the pediatric dentist for continuous monitoring of the airway is the pretracheal/precordial stethoscope.

The use of the stethoscope in the monitoring of the anesthetized patient can be traced back to Cushing in 1909.[10] The pretracheal/precordial stethoscope is a simple, yet highly effective device for the monitoring of respiratory and cardiac sounds.[11] Traditionally, the device was comprised of an earpiece (universal or custom) which was connected to a weighted chestpiece through rubber or plastic tubing. The conventional stethoscopes operated on the basis of acoustic transmission,[11] with the chestpiece placed above the patient's sternal notch.

AAPD Guidelines also state that "a precordial/pretracheal stethoscope shall be used for obtaining additional information on heart and respiratory rates and for monitoring airway patency during Level 3 sedations."[9]

The use and effectiveness of the pretracheal/precordial stethoscope has received mixed reviews in the literature.[1,4,12,13] It has even been observed that one trend among anesthesiology trainees and providers is to replace (rather than supplement) pulse oximetry and capnography with the pretracheal/precordial stethoscope.[1]

Fig 1. Required parts for assembly.

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Fig 2. Step 1: Insert Wegner chest piece into Luer adapter.

Fig 3. Step 2: Insert Luer adapter into one end of rubber tubing.

Although much of the criticisms about the limitations of the pretracheal/precordial stethoscope stem from the medical field and usually involve general anesthesia and the operating room, where more sophisticated monitors are usually available,[11,12,14,15] it is the authors' opinion that the pretracheal/precordial stethoscope can play a vital role in the safe and efficacious use of sedative agents in the pediatric dental setting.

The stethoscope's ability to detect causes of airway obstruction makes it the first line of defense against potential disaster. It also gives the practitioner a more sensitive measure of the quality of the airway. As one author states: the anesthesiologist is still the most important monitor in the operating room and the choice of monitors should extend his or her senses. This is the most appropriate route to safe patient management.[16] While pulse oximeters and capnographs give quantitative data; the stethoscope gives the clinician a plethora of qualitative information that can help diagnose potential risks (Table 2).

Table 2. Breath Sounds and Interpretations

Breath Sound	Interpretation
Snoring	Airway blockage by tongue/ soft tissues
Gurgling	Fluids in throat/excess secretions
Wheezing	Bronchospasm
Obstruction	Poor patient position
No breath sounds	Complete laryngospasm
	Complete bronchospasm
	Complete obstruction

Like the pulse oximeter and the capnograph, the pretracheal/precordial stethoscope also has its limitations. It has been described how the traditional stethoscope "physically tethers the anesthetist to the patient."[15] One author explained how the traditional earpiece is quite uncomfortable and how only one listener can use the device at a time.[17]

Electronic wireless stethoscopes were developed to overcome some of these limitations and have been available to anesthesiologists for some time but carry a hefty price, approximately $900.[15]

Several have described different variations of the traditional pretracheal/precordial stethoscope and tested them in the medical arena (operating room/general anesthesia),[10,11,15,17,18,19] but none have been described in the dental literature. We describe a wireless version of the traditional stethoscope and demonstrate how easy and economical it is to fabricate.

This version of the wireless pretracheal/precordial stethoscope functions on the basis of radio-wave transmission. It allows for more than one practitioner to listen at a time (teaching purposes), permits the practitioner to freely move around without being "tethered" to the patient, and provides clearer breath and heart sounds at a higher volume. The device will cost approximately $80 to make and takes about 15 minutes to put together. The necessary parts are shown in Figure 1 and listed in Table 3.

The wireless pretracheal/precordial stethoscope is an extension of the anesthetist's senses, allowing close and continuous contact with the patient. It grants the anesthetist the ability to be more "vigilant" with auditory senses, thus protecting the patient's safety.

Table 3. Parts Required for Fabrication of an FM Wireless Pretracheal Stethoscope

Part	Catalog #	Company
Pediatric Wenger chestpiece	16SUN002502	Southern Anesthesia and Surgery
Luer adapter	K04BD385115	Southern Anesthesia and Surgery
(1 in) rubber tubing	From any BP Cuff	N/A
FM wireless microphone system-transmitter/receiver	WCS-990T/WDS-990R	*Sony
Double-sided sticker	2,181	3M

*Can be replaced with any FM wireless microphone system.

Instructions (Fig 2-5)

1. Insert Wenger chestpiece into Luer adapter.
2. Insert Luer adapter into one end of the rubber tubing.
3. Insert transmitter microphone into the other end of the rubber tubing.

Fig 4. Step 3: Insert transmitter microphone into other end of rubber tubing.

Fig 5. Completed stethoscope transmitter and receiver.

4. The 3M double-sided sticker is placed on the Wenger chestpiece and the chestpiece is placed above the patient's sternal notch.
5. The receiver's earpiece is placed in the listener's ear.

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