

Oropharyngeal airway appliance for infant with upper airway obstruction: report of a case

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A palatal appliance with oropharyngeal tube that reduces the upper airway obstructions of an eleven-month-old male infant with severe cerebral palsy is presented. The palatal appliance was composed of the base plate, the outer guide tube that held the oropharyngeal tube inside it, and the extra outer guide tube for the suction catheter. After the setting of the appliance, respiratory distress was improved without side effects.

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INTRODUCTION

The security of the upper airway is a significant problem in infants with inflammatory hypertrophy and tumors of the oral cavity and respiration tract, craniofacial anomalies, and neurological disorders. An upper airway obstruction can cause not only hypoxia, hypercapnia cor pulmonale, congestive heart failure, right sided heart hypertrophy, and neurological impairment, but also failure to thrive, gastro-oesophageal reflux and delay of growth.^{1,4,8,10} Surgical techniques to relieve the upper airway obstruction, besides adenoidectomy and tumor enucleation, include glossopexy, tongue-lip adhesion, hyomandibulopexy, circummandibular wire and subperiosteal release of mouth floor.¹² As the effects of surgical techniques are not certain and surgical techniques might often hurt the growth of the oropharyngeal region of infants, non-surgical techniques have been recommended. In some cases of severe cerebral palsy, the improvement of an upper airway obstruction along with the growth of infant is not possible in the short term, so tracheotomy

may be performed in an early period of life.⁶ However, tracheotomy is preferably avoided and used as a last resort.

Non-surgical techniques, that are used in the management of upper airway obstruction, include downward position of the infant,¹¹ nasal mask with continuous positive airway pressure,⁹ insertion of oropharyngeal or nasopharyngeal tubes,³ insertion of modified tubes^{2,8} and placement of the palatal appliance with or without the tube.^{7,10} Kondo *et al.*⁷ described a case of obstructive sleep apnea, caused by Crouzon disease, which was relieved by a palatal appliance with respiratory tube and in which tracheotomy was avoided.

A case is presented in which the modified palatal appliance, used by Kondo *et al.*,⁷ was used to manage upper airway obstruction caused by cerebral palsy. The procedure that was used to construct the palatal appliances is also presented.

CASE REPORT

An eleven month-old male infant was brought to the Oral Surgery Clinic to improve an upper airway obstruction. He was born at 39 weeks and 2 days by a cesarean section delivery with a birth weight of 4040g. The Apgar score was 10. On the 68 day of birth, he had a cold with a cough and on the next afternoon, after he had drunk some milk, cyanosis and convulsive seizures occurred. He was immediately brought into the emergency room, but on arrival he showed cardiac arrest and respiration standstill. He was diagnosed with ischemic encephalopathy and severe cerebral palsy caused by respiratory obstruction, and the flowing of the milk into lung. Though he escaped death due to cardiopulmonary resuscitation, he did not acquire spontaneous respiration easily. Forty-nine (49) days later, he recovered spontaneous respiration and was able to be removed from the respirator, and subsequently discharged from the hospital.

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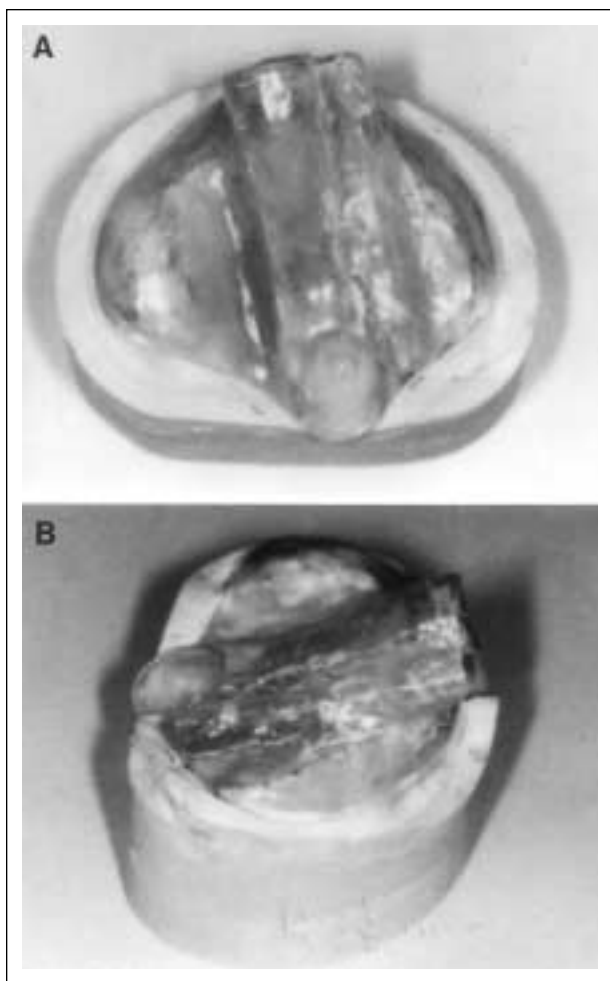


Figure 1. Occlusal (A) and lateral (B) views of the study cast and the palatal appliance.

When he was eight months old, he was readmitted the hospital with severe cyanosis. He was experiencing an upper airway obstruction caused by the glossoptosis and it was reduced by insertion of the oropharyngeal tube. But, after that, although his spontaneous respiration was relatively good, the glossoptosis waxed and waned, and insertion or removal of the oropharyngeal tube with and without the respirator was repeated. Sometimes the respiratory tube fell off from his mouth and a red rash on his face caused by the adhesive tape could be seen. So his pediatrician was consulted for the improvement of the glossoptosis and a way to secure the respiratory tube.

When he visited us, he was an inpatient with a weight of 6430g and lay in bed with the insertion of an oropharyngeal tube. Apparently there were no physical anomalies. The reddened trace of adhesive tape was found on his face. On oral examination, bilateral deciduous central incisors of both mandible and maxilla were half-erupted and there was no significant disorder except for glossoptosis. It seemed to take a long time until we were able to remove the respiratory tube, and reliable

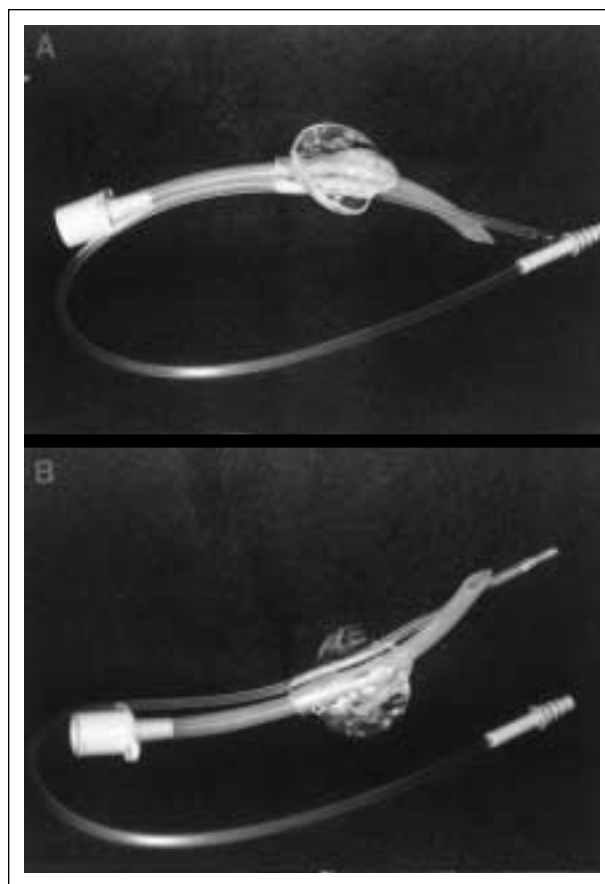


Figure 2. Lateral (A) and lower (B) views of the palatal appliance with oropharyngeal tube and suction catheter.

fixation of the tube was required during that period. We planned to make use of a palatal appliance to hold the oropharyngeal tube.

While the impression of the maxilla was being taken, using a custom tray with silicon impression material, the patient was placed in a supine position that brought his head down slightly without sedation and oxygen was delivered over the nose. The oropharyngeal tube that was used was Portex Tracheal Tube (Portex Ltd, England, diameter of internal: 4.0mm, external: 5.8mm).

On the laboratory the outer guide tube, which held the oropharyngeal tube inside it, was waxed up on the wax base plate. The diameter of the outer guide tube was made approximately 1mm larger than the oropharyngeal tube, and the oropharyngeal tube was able to be fixed with a frictional force inside the outer guide tube. A curved contour was added to the outer guide tube in accordance with the shape of the soft palate and the pharynx also referring to a lateral neck radiograph. An extra outer guide tube, which was used to insert the suction catheter, was added beside the main outer guide tube. The diameter of the extra outer guide tube was



Figure 3. Clinical view after setting of the palatal appliance. Oropharyngeal tube is inserted without anchoring adhesive tape and suction catheter is placed beside the tube.

made large enough to pass through the suctioning tube loosely. The wax pattern of the base plate with the outer guide tube, about 1.5mm thick, was cured in one piece by a heat-curing resin. A clear colored resin was used for the material of the appliance in order to watch changes of the surface of the mucosa easily (Figures 1, 2). Actually two resin models, which were different in the contour of the outer guide tube, were constructed and the tighter one was worn by the patient.

After the placement of the appliance, the oropharyngeal tube was inserted through the outer guide tube and the tube was secured without anchoring adhesive tape, as the frictional force was strong enough (Figure 3). Sometimes he could breath quietly using only palatal appliance without the respiratory tube.

But two months later he experienced cyanosis and cardiac arrest, and the respirator was connected again. After that the respirator was always connected, but sixteen months later (when he was two years and six months old) his condition took a sudden turn for the worse and he died of pneumonia.

DISCUSSION

Insertion of oropharyngeal or nasopharyngeal tube has been the generally accepted method to improve the upper airway obstruction for Pierre-Robin syndrome and other craniofacial anomalies. But in almost all cases the tubes were solely inserted without any modification. Galvis *et al.*² and Masters *et al.*⁸ devised modified nasopharyngeal tubes and relived upper airway obstruction in Pierre-Robin syndrome and other causes. The

tube was split at the outer part of the nostril like wings and the wings fixed by cords or adhesive tape to the face. We suppose that these tubes had rigid fixation, but the nasoharyngeal tube is not easy to insert for non-medical staff and the fine adjustment of the tip of tube was difficult after splitting the tube. Mucositis may be caused during a long insertion period.

The palatal appliance is a relatively easy method to secure oropharyngeal tubes that have been placed as part of management of upper airway obstruction. Hotz *et al.*⁵ and Stellzig *et al.*¹⁰ reduced the airway obstruction in cases of Pierre Robin syndrome and other anomalies using the palatal appliance. Hotz *et al.*⁵ described how the upper airway obstruction was improved by placement of this appliance because the tongue mechanically moved forward resulting from detachment from the posterior wall of the pharynx and the soft palate.

Kondo *et al.*⁷ made good use of the palatal appliance as an anchor of the oropharyngeal tube at the same time for a patient of Crouzon disease. When the palatal appliance was used as a fixed apparatus of the respiratory tube, there was no need to measure the precise tube length from the right position, just from the superior position to the epiglottis, because to some extent the respiratory tube was able to move inside the outer guide tube.

In our case, as the outer guide tube caught hold of the oropharyngeal tube sufficiently, the respiratory tube could be held without adhesive tape. The extra outer guide tube was useful to suck the secretion easily.

The complication was that, because the palatal appliance with respiratory tube was a custom-made, it needed time and some laboratory processes to construct the appliance. The precise fitting was not known until it was placed, so we made two different appliances and used the tighter one. Convenience and usefulness were adequate enough when this appliance was placed.

The laboratory method used the heat-curing resin to minimize the residual monomer. The soft type resin was not used because of the difficulty of cleaning the surface of the resin.

For the management of this appliance, the appearance of cyanosis and increase of secretion is the obvious result of pulling off the tube or breakdown of the appliance. As the palatal appliance and the respiratory tube attaches to the oral and respiration tract mucosa, a mucositis may occur. Kondo *et al.*⁷ stated that endoscopic examination was useful to watch mucositis. Actually there has been no report to describe the mucositis from wearing the appliance for a long period.⁷ If the setting period is prolonged, the appliance needs not only a minor repair, but also a reconstruction according to the growth of the patient.

The palatal appliance with respiratory tube contributes to the improvement of an upper airway obstruction without hurting the growth of the infant and there is no need to use adhesive tape or cord to fix

the tube. We understand that the kind of tube or appliance is preferred should be chosen on a case by case basis, but suggest that this appliance can be applied to upper airway obstruction caused by various craniofacial disorders and anomalies.

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