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BRIEF COMMUNICATION

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Orthodontic Treatment with Rapid Maxillary Expansion for Treating a Boy with Severe Obstructive Sleep Apnea

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This case report shows that orthodontic treatment with rapid maxillary expansion (RME) is an effective treatment option for managing pediatric obstructive sleep apnea (OSA). An 11-year-old boy with severe pediatric OSA received comprehensive orthodontic treatment with RME. Four sleep studies were done: before orthodontic treatment, after RME, just after comprehensive orthodontic treatment and at the 2-year and 5-month follow-up. Polysomnographic findings showed that the orthodontic treatment with RME was successful for managing severe OSA in the patient. **Sleep Med Res 2014;5(1):33-36**

Key Words Rapid maxillary expansion, Orthodontic, Pediatric obstructive sleep apnea, Adenoid, Adenotonsllectomy.

INTRODUCTION

It is estimated that the prevalence of pediatric obstructive sleep apnea (OSA) patients is 0.4–4%.[1] Current available treatment options for pediatric OSA are adenotonsillectomy (T&A), nasal continuous positive airway pressure (CPAP), intranasal application of high-potency corticosteroids, leukotriene modifiers and rapid maxillary expansion (RME).[2] Enlarged adenoid and tonsils are a well-known pathophysiology for pediatric OSA, and T&A is the most popular treatment option.[3] However, recent publications revealed that not every child with pediatric OSA is cured with T&A.[4] We present a case report that RME improved the symptoms of a pediatric OSA child who did not respond to T&A.

CASE REPORT

An 11-year-old boy was referred from an otorhinolaryngologist. His mother said, "It seems that my son does not breathe while sleeping. I cannot sleep because I have to change his sleeping positions. Otherwise he may die while sleeping." The ENT surgeon said, "He appeared not to respond to T&A which was done 3 years ago. He still has severe OSA. Nasal CPAP is too harsh for an eleven-year-old boy; he has to use it for the rest of his life."

His body mass index was 22.4 (height: 145 cm, weight: 47.0 kg) and neck circumference was 31 cm. From the clinical evaluation, it was found that he had an orthognathic and slightly convex profile. His lips were closed at rest and lip balance as well as facial harmony were acceptable. His panoramic X-ray showed normal dentition without any pathology and cephalometric measurements showed normal vertical and anteroposterior relationships. The model analysis showed severe crowding, narrow maxilla and mandible with lingually tilted posterior teeth (Fig. 1).

Sleep architectures were as follows: total sleep time 398.0 minutes, sleep efficiency 82.5%, sleep latency 44.1 minutes, and REM latency 191 minutes. From the findings of polysomnogra-

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phy (PSG): apnea-hypopnea index was 18.9; respiratory disturbance index (RDI) was 19.8; minimum oxygen saturation during sleep (SaO_2 @ nadir) was 60%; RDI in a supine position was 22.0 & RDI in a lateral position was 13.4; arousal index was 19.6. He was diagnosed with "position dependent severe OAS with oxygen desaturation and CO_2 retention."

Banded RME was used to improve the quality of sleep and correct the narrow maxillary arch. The RME appliance was removed after 5-month maintenance and another sleep study was conducted. Brackets were then placed to align the teeth. Two

Fig. 1. Facial and intraoral photos before orthodontic treatment.

Table 1. PSG findings before RME treatment, just after removing RME appliance, just after conventional orthodontic treatment, and at the follow-up

	PSG before orthodontic treatment	PSG after RME	PSG just after orthodontic treatment	PSG @ 2 year 5 month follow–up
BMI	22.4	22.4	21.0	21.2
Neck circumference (cm)	31	31	36	35
TST (minutes)	398.0	379.5	312.5	293.0
Sleep efficiency (%)	82.5	91.3	85.8	79.0
Sleep latency (minutes)	44.1	26.2	13.0	57.6
REM latency (minutes)	191.0	162.0	134.5	113.5
REM/total recording time (%)	11.6	10.5	14.1	9.4
N1/total recording time (%)	12.4	4.6	5.6	8.5
N2/total recording time (%)	39.3	49.8	48.4	32.6
N3/total recording time (%)	19.2	26.4	17.6	28.5
Apnea index	1.7	1.7	0.4	0.6
Hypopnea index	17.2	2.2	4.0	0.4
Total snoring time/TST (%)	26.5	12.8	3.4	8.8
AHI	18.9	3.9	4.4	1.0
RDI	19.8	5.0	5.9	5.9
ArI	19.6	6.2	11.4	12.3
SaO_2 @ nadir	60	93	85	94
O_2 saturation below 90%/TST (%)	87.1	0.0	0.5	0.0
RDI in supine position	22.0	5.8	7.8	8.4
RDI in lateral position	13.4	2.7	0.7	0.0

PSG: polysomnography, RME: rapid maxillary expansion, BMI: body mass index, TST: total sleep time, AHI: apnea-hypopnea index, RDI: respiratory disturbance index, ArI: arousal index.

Fig. 2. Facial and intraoral photos just after orthodontic treatment.

additional sleep studies were done just after conventional orthodontic treatment with brackets and after 2 years and 5 month of debonding brackets. The PSG findings are summarized in Table 1.

Facial and intraoral photos were taken after orthodontic treatment (Fig. 2). His profile and lip balance were maintained; extended head and neck seemed improved; teeth were well aligned.

DISCUSSION

Rapid maxillary expansion is a popular treatment for correcting narrow maxilla in growing children. Haas[5] at the Department of Orthodontics, University of Illinois is a pioneer in establishing an academic basis and popularizing RME in the world. We still follow Haas's recommendations in 1970s to design an individual RME appliance for each patient. Premolars and molars are incorporated in the RME appliance to ensure sufficient anchorage for skeletal expansion. A jackscrew in the RME appliance is activated at 0.5 mm to 1.0 mm per day for a few weeks, which increases the force up to 10 to 20 pounds. The patients rarely experience pain, but midpalatal sutures open and diastema appears between the upper front teeth. The space created at the midpalatal suture is filled initially with tissue fluids and hemorrhage. The RME appliance is maintained for 3–4 months, and new bone eventually fills the suture. If RME is properly used for young children, it can separate the two halves of whole maxilla as well as the midpalatal suture. It can increase the width of the roof of the mouth and the floor of the nose. As a result, intranasal capacity is increased structurally. Age is an important factor in obtaining separation of the suture, because the midpalatal suture becomes more tortuous and interdigitated with age. Opening the suture for patients in their twenties is unlikely but not impossible. Even though the midpalatal suture can be separated in patients in their twenties, the effect of RME on adult OSA patients is questionable. The mechanism behind the improvement of OSA with RME is not fully understood. Some believe that the resting tongue position is moved upward and forward after RME. Others believe that RME reduces nasal resistance, which could activate mechanosensory receptors at the nose responsible for maintaining the upper airway.[6] If the sensory functions for maintaining the upper airway during sleep are impaired with age, the symptoms of OSA would not be resolved by true skeletal expansion, which is implemented by surgical assisted RME. The age factor could be important for good results with RME on OSA. To achieve more reliable results with RME for older ages, further research on the pathophysiology of OSA is necessary.

The causal effect of a high palatal arch on pediatric OSA is unclear, even though one pathophysiology of OSA is an anatomic feature including high palatal arch. However, many papers have been published since 1996 showing the effect of RME on pediatric OSA. No treatment options for pediatric OSA (T&A, nasal CPAP, topical intranasal application of high-potency corticosteroids, leukotriene modifiers, and RME) produces perfect results. Hence, interdisplinary approaches are important. Properly applied, RME could be a strong tool to help pe-diatric OSA patients with serious health problems.[7]

Conflicts of Interest

The author has no financial conflicts of interest.

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