

CASE STUDY—VALLONE

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Physical Examination

Observation of the child at play showed an obvious retraction of the chest, recruitment of the secondary muscles of respiration and anterior head carriage. He demonstrated upper extremity weakness (underdevelopment), never "pushing up" when asked to lie prone or to perform the "wheelbarrow". His mother related that he had never been put on his stomach as an infant or toddler due to his extreme breathing difficulties and to the best of her memory, he never crawled, simply learned how to sit up from a supine position, pull to stand, then walk. He had difficulty demonstrating lower extremity coordination when asked to hop holding one foot. Hypervigilance was apparent as demonstrated by resistance to requests to perform certain activities ("No!", "I can't", "I don't want to!"), excessive startle response to loud noises or quick movements and violent physical resistance to any position that would put him into hyperextension.

When asked to sit from a supine or even 45 degree elevated position, he could not recruit his rectus abdominus or his abdominal obliques to flex the first 30 degrees. To comply with the directive, he had to roll to his side and recruit his lateral flexors (specifically the iliocostalis and latissimus dorsi muscles) to reach a position of flexion where he could effectively engage his iliopsoas and complete movement to the seated posture, thereby demonstrating a lack of core abdominal stability. When asked to lie supine over a Bozu (a stable sphere filled with air), a look of terror overcame his face due to the perceived threat to his airway as he hyperextended over the sphere. The same look of terror came over him when asked to sit on a glider and pull the handles towards him to make it swing back and forth. The exertion resulted in tachypnea and hyperventilation.

Auscultation of the lungs revealed a wheeze in the inspiratory phase (which is sometimes indicative of an obstruction in the upper airways). Thoracic excursion was non-existent. Lower rib cage was flared and there was a large volume of residual air in his lungs that was not exchanged with normal inspiration and expiration. His respiratory diaphragm was taut. He breathed through his mouth rather than through his nose but his mandibular excursion was limited and his hyoid was retracted. His voice was high pitched. Despite the recruitment of his secondary muscles of respiration and restricted thoracic excursion, his diaphragm efficiently produced an expiratory wave sufficient to make sound, but the restriction in the movement of the head (particularly the jaw) and neck did not allow for clear enunciation or formation of many consonant sounds.

All other physical exam findings (auscultation, percussion, neurologic and orthopedic examinations) were within normal limits.

Motion palpation revealed hypertonic occipital muscles with C01 restriction in extension (occiput moving anterior and superior on atlas). He was unable to flex the occiput on atlas and all cervical flexion was performed from the lower cervicals and, again, was violently resisted when performed passively due to constriction of his airway. All other cervical, thoracic

and lumbar vertebrae demonstrated normal movement although the sacrum was fixed in nutation.

Treatment and Results

Initial treatment consisted of lying the child supine with the head of the table at a 30 degree angle and fingertips placed under the C01 junction to release tension of the occipital fibers and suboccipital triangle bilaterally. A gentle dural unwinding from occiput to sacrum was performed. Small toys were used to distract the child during this process which took approximately 5 minutes. At the end of the soft tissue release, SOT cervical stair stepping maneuver was employed to gently encourage occipito-atlantal range of motion. No other osseous manipulation was performed at the first visit but it was suggested he return in two days to be adjusted again and to be shown some vestibular exercises that could be performed during his visits as well as at home. His treatment plan included weekly visits for 4-6 weeks accompanied by 1 hour sessions of adaptive play therapy to incorporate upper extremity strengthening, coordination and balance training into playful activities of daily living that could be easily reproduced at home by his parents.

Upon returning to the office in two days, his mother reported that his enunciation seemed slightly clearer and he was talking more frequently, although still in short sentences or bursts of short commands. She also noticed, for the first time, that he was occasionally closing his lips and making the "M" sound much more clearly. He had one hour of work with the adaptive play therapist before his adjustment. It was observed that his hypervigilance was a "program" or conditioning to feel that any use of his airway beyond normal resting respiration required him to recruit his secondary muscles of respiration as if he was under excessive exertion. The therapist worked gently and slowly with him encouraging him to experiment with non stressful activities like blowing bubbles through a wand or blowing a variety of whistles. She demonstrated the difference for his

mother between blowing a whistle and what he needed to do to protect himself if put in a compromising position like he had been when lying in hyperextension over the Bozu sphere on his previous visit.

His adjustment consisted of myofascial unwinding of the hyoid and release of the submandibular muscles and a repeat of the soft tissue release of the suboccipital muscles and dural unwinding followed by a diversified osseous adjustment utilizing a pediatric drop head piece to adjust the occiput into flexion (moving it posteriorly and superiorly). The sacrum was adjusted, also on a drop lumbar piece, into counter nutation. Active flexion and extension of the occipital atlantal junction did not elicit respiratory distress.

After his adjustment and returning to the therapist, he was able and willing to ride on a glider without recruiting his secondary muscles of respiration or hyperventilating.

His remaining treatment consisted of three additional visits over the course of three weeks, performing the same treatment, in conjunction with regular vestibular and balance activities (swinging, glider, balance beam, physioball, balance pads) both in the office, at home and on the playground at school. His activities were enthusiastically reinforced by the therapists and teachers working with him at school as they saw his progress.

After one month his mother reported a complete change in the boy's attitude about life. He was eating more of a variety of foods and handling many new textures comfortably. He was interested in eating more frequently. His enunciation was clearer and he was consistently and frequently talking in multiple sentences. He was cooperative and rarely balked at requests to perform tasks or activities that previously would alarm him or make him belligerent. Teachers noted increased attention span and that he was willing to take risks with his classmates he had never tolerated before. It was observed when at play, even when challenged on the balance

beam or standing on the Bozu sphere requiring attention to balance, he no longer recruited the secondary muscles of respiration and his breathing stayed even and within normal limits.

He continued working with his therapists for several months "catching up" with his peers. He returns for chiropractic evaluations every 2-3 months and is adjusted as necessary.

Discussion

The pathophysiology of obstructive sleep apnea and central sleep apnea overlap considerably. During normal inspiration, neuronal discharge to the diaphragm and dilator muscles of the pharynx increases. Failure to achieve pharyngeal dilatation in the presence of diaphragmatic contraction results in an obstructive apnea. If the diaphragmatic contractions are diminished, a central sleep apnea occurs. The hypopharynx may or may not be open during a central apnea. Studies have shown considerable narrowing of the hypopharynx during a central apneic event. If the hypopharynx is closed during central apnea and diaphragmatic activity resumes before pharyngeal dilator muscle tone is restored, a mixed apnea results.⁴ Based on his presentation, this patient may have experienced both a mechanical obstruction to the passage of air as well as diminished or disorganized neuronal discharge to the diaphragm as well as the dilator muscles of the pharynx/hypopharynx.

Chronic elevated sympathetic tone also is known to be the precursor of atopic disorders like asthma. Alveolar macrophages (AMs) play an important role in the regulation of the local immune reactivity in the lung. AM activity can be influenced by the neuroendocrine system, implying that stress may contribute to the onset or severity of pulmonary inflammatory processes.⁵

These factors, along with the debilitating inappropriate muscular recruitment that effectively dysregulated swallowing and breathing mechanics as well as potentially added to the respiratory obstruction, resulted in the complex pic-

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Extra-strong double-pull elastic

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