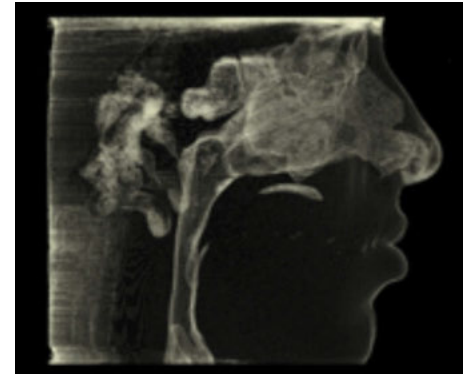
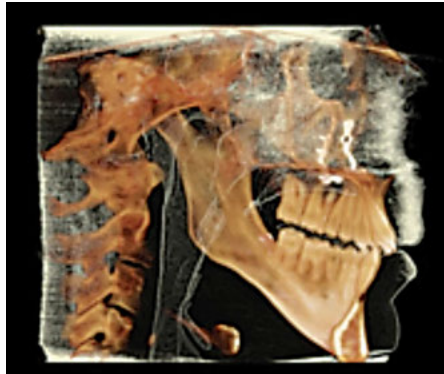


# CBCT in the evaluation of airway — minimizing orthodontic relapse

Dr. Steven Olmos discusses the four points of breathing obstruction

For those of us who treat obstructive sleep apnea (OSA) or those who have tried but run into problems that make you want to throw up your hands, think about the four points of breathing obstruction. Each patient has a different set of obstructions, so decisions on how to choose between the hundreds of appliances to treat breathing disorders are based upon multiple points of obstruction. The best treatment may be combination therapy (hybrid): oral appliance therapy, nasal positive pressure, and nasal surgery. The optimal result is one in which the four points of obstruction are best managed. Triage of options is dependent on a good clinical exam of the tongue and its posture and cone beam computed tomography (CBCT).

So much of the literature and techniques to treat OSA for oral appliance therapy centers on moving the mandible forward for



**Educational aims and objectives**  
This article aims to discuss the four points of breathing obstruction.

**Expected outcomes**  
*Orthodontic Practice US* subscribers can answer the CE questions on page 45 to earn 2 hours of CE from reading this article. Correctly answering the questions will demonstrate the reader can:

- Identify the four points of breathing obstruction.
- Realize various techniques to treat OSA for oral appliance therapy.
- Recognize that CBCT may be an effective imaging modality for viewing OSA-related anatomy.
- See how nasal obstruction influences OSA.
- Realize that failure to evaluate all four points of obstruction and failure to establish a patent airway will affect the longevity of any dental treatment being rendered.


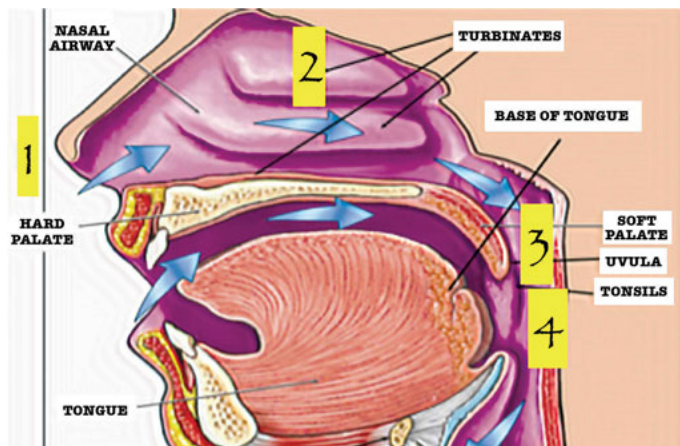



Figure 1

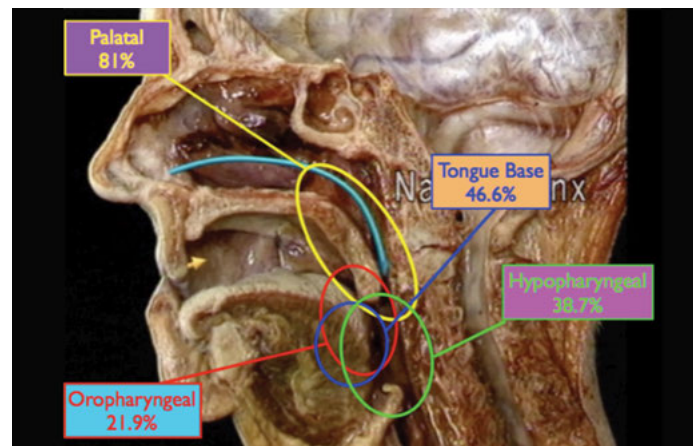


Figure 2

Steven Olmos, DDS, DABCP, DABCDMS, DABDSM, DAAPM, FAAOP, FAACP, FICCMO, FADI, FIAO, has been in private practice for more than 30 years with the last 20 years devoted to research and treatment of craniofacial pain, temporomandibular disorder (TMD), and sleep-disordered breathing. He obtained his DDS from the University of Southern California School of Dentistry and has continued his postgraduate education with over 4,000 hours and board certifications in the fields of mandibular orthopedic dysfunction and sleep-disordered breathing. Dr. Olmos is the founder of TMJ & Sleep Therapy Centres International with 28 licensed Centres in 5 countries dedicated exclusively to the diagnosis and treatment of these disorders. His protocols are an assimilation of his knowledge base, which is reflected by certifications in all philosophies of treatment both medical and dental. Dr. Olmos is an adjunct professor at the University of Tennessee School of Dentistry, where his system of diagnosis and treatment are utilized at the school's Craniofacial Pain Center. This effort is focused to establish protocols between dentistry and medicine for optimal treatment outcomes.

the beneficial effect of increasing the velopharynx and genioglossus tension to open the oropharynx. There is no one mandibular advancement device design that works for all patients with OSA.<sup>1</sup> The percentages of the frequency of these obstructions<sup>2</sup> are shown in Figure 2.

A patient whose tongue retracts on opening will have limited success with an oral



Figure 3: Tongue retracting on opening

appliance that does not address this condition. Tongue pillows designed to move the tongue forward are indicated, as mandibular forward titration alone will not address this condition. Scalloping of the tongue is 70% predictive of OSA as shown in Figure 3.

Normal breathing is through the nose. Air drawn through the nose is filtered, moistened, heated, and combined with nitric oxide (a gas concentrated primarily in the maxillary sinuses that has antibiotic and antifungal properties). Proper nasal breathing helps prevent upper respiratory infections.<sup>4</sup>

Literature demonstrates that the two biggest factors in success with oral appliance therapy for OSA are body mass index (BMI) and nasal airway resistance.<sup>5</sup> Diet and exercise are most often addressed, but the second biggest factor is often overlooked.

Nasal obstruction can be as simple as narrow or collapsed nares. The Clinical consensus statement, published in the *Journal of Otolaryngology-Head and Neck Surgery* in 2010, established Nasal Valve Collapse as a diagnosable condition with specific treatment options for it.<sup>6</sup> Obstructions of the flow of air through the internal nose can be as simple as soft tissue hypertrophy from food sensitivity or allergies. This is because the nasal structures are lined with erectile tissue and, therefore, are directly sensitized by irritants.<sup>7</sup>

Nasal obstruction can be due to underdevelopment of the skeletal structures or excessive development such as conchae bullosa, which can compress the uncinate process thus blocking maxillary sinus drainage (Figure 5). Nasal obstruction contributes to OSA and needs proper diagnosis for appropriate surgery.<sup>8</sup>

Lymphatic tissue obstruction such as adenoids and tonsils is a major airway obstruction in children and adults. A study published in the October 2014 edition of the *American Journal of Orthodontics and Dentofacial Orthopedics (AJO-DO)* demonstrated that CBCT was as accurate

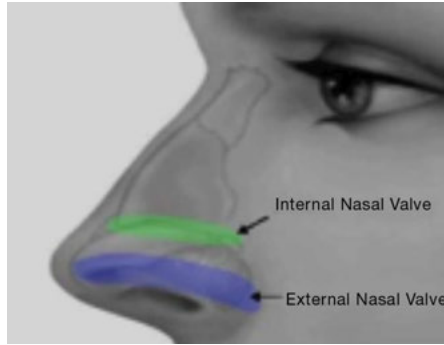


Figure 4A

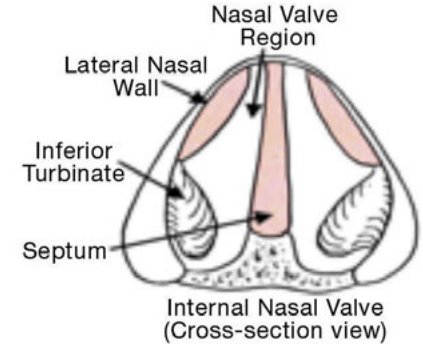


Figure 4B

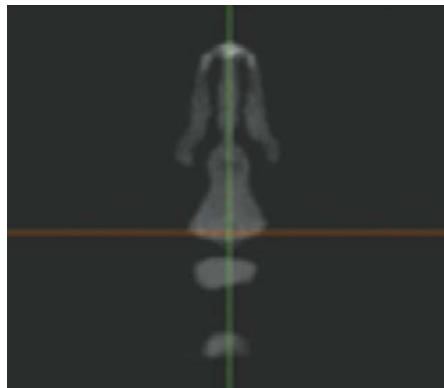


Figure 4C

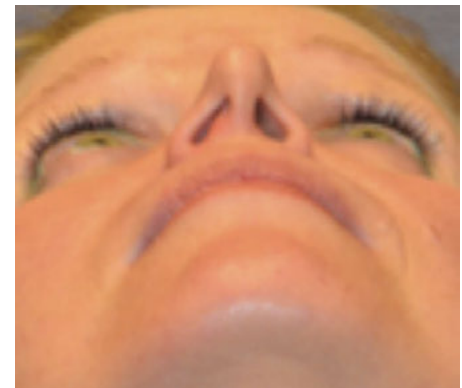


Figure 4D

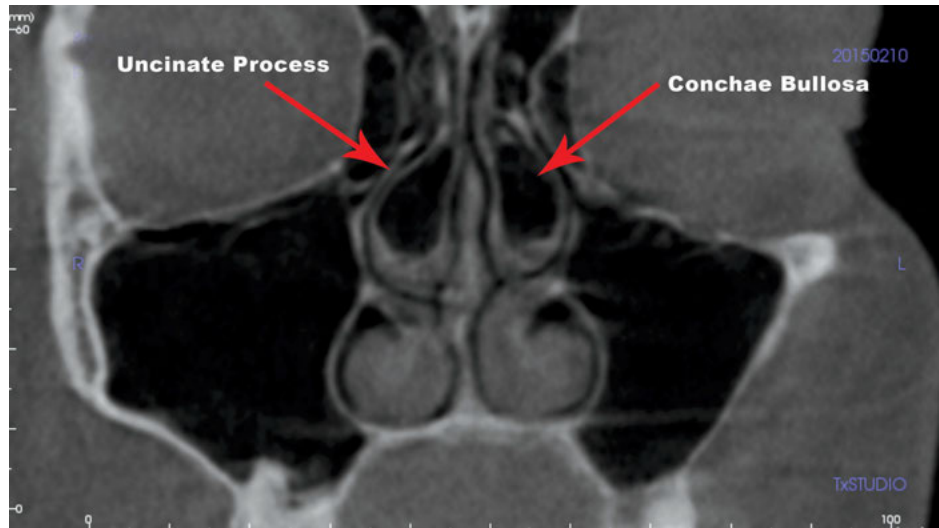


Figure 5

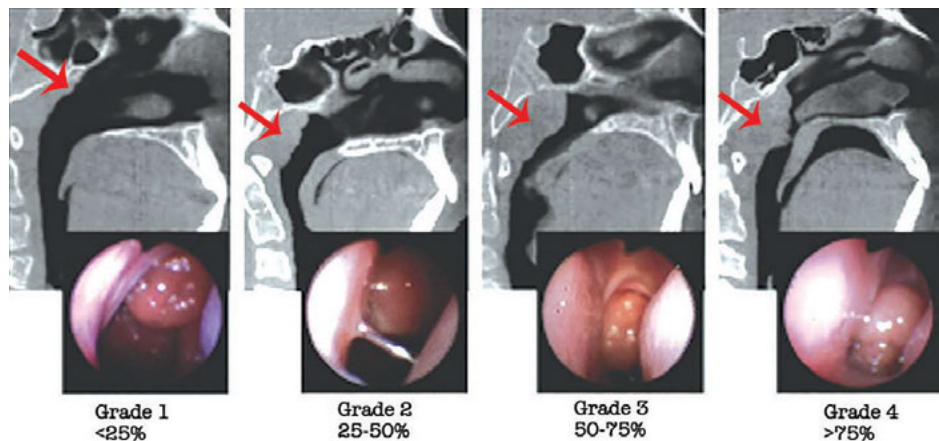


Figure 6



as nasoendoscopy for adenoid and tonsil evaluation.<sup>9</sup>

CBCT has the answers to identifying these problems and when we, as dentists, need to work with other specialists for optimal treatment success. The American Dental Association (ADA) recently published a recommendation that when CBCT is utilized, that the entire head be imaged to prevent missing incidental findings.<sup>10</sup> The most frequent incidental findings are nasal and sinus related. This is extremely important as CBCT is used for TMD, implant, and orthodontic therapy without review of breathing disorders that likely affect the therapy and can be the origin. The Oro-facial Pain Prospective Evaluation and Risk Assessment (OPPERA) study (NIH funded)

compared two large groups of TMD and OSA patients and determined that OSA symptoms preceded first-onset TMD.<sup>11</sup> Research in addition to Dr. Harvold demonstrated in the orthodontic literature 30 years ago that blocking nasal breathing results in open bite as the tongue pushes forward to

maintain an airway.<sup>12, 13, 14</sup> Current research demonstrates a continued need to understand why we see relapse even with our surgical patients.<sup>15</sup>

This is demonstrated in Figures 7-11 below in a 19-year-old male post-orthodontic therapy with retention.



Figure 7

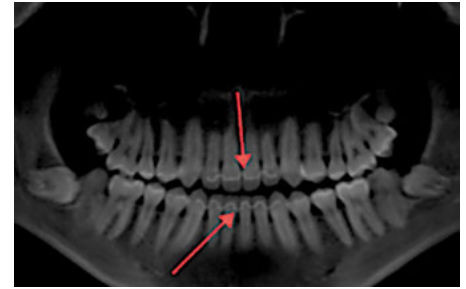


Figure 8

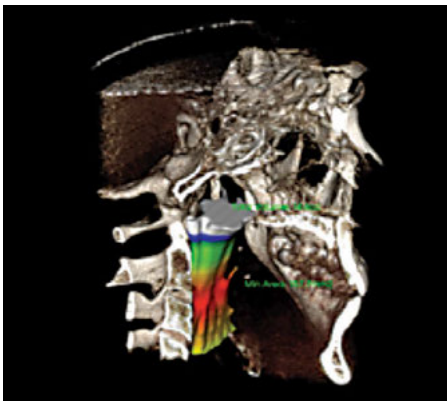


Figure 9: Narrow oro-pharyngeal airway

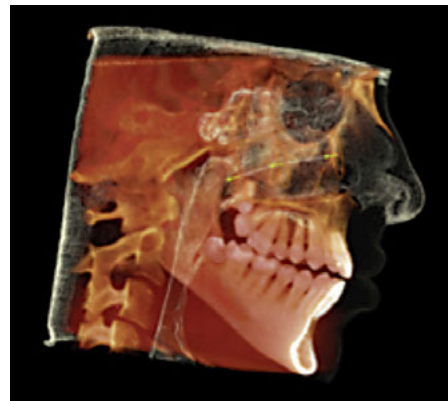


Figure 10: Tx STUDIO™ (i-CAT, Imaging Sciences International) software allows for quantifying nasal volume

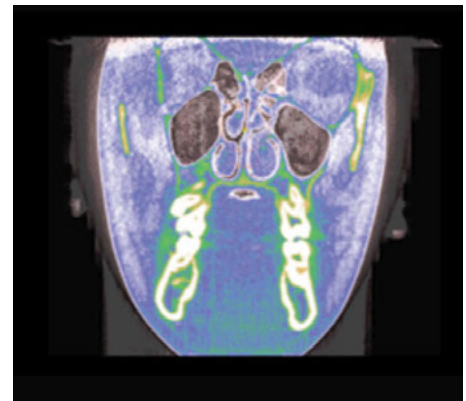


Figure 11: Total nasal obstruction soft tissue hypertrophy of middle and inferior turbinates



Figure 12: Diastemas developed as the tongue pushed the retained anteriors

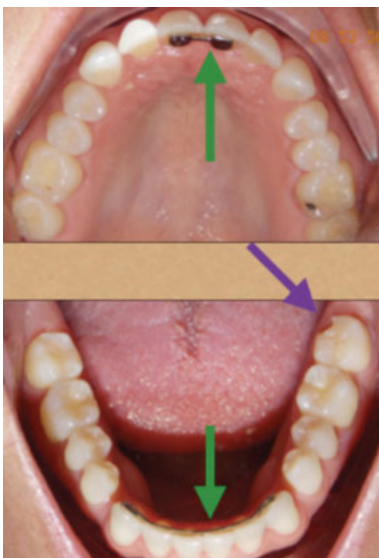


Figure 13: Notice fractured molar due to bruxism

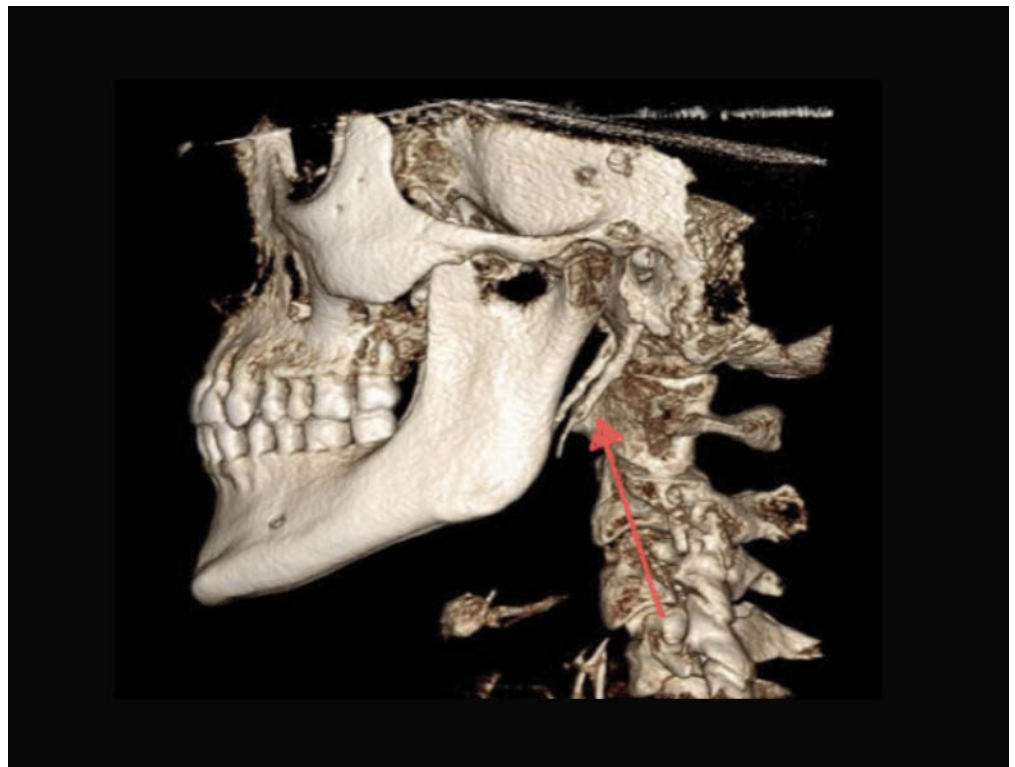


Figure 14: Elongated styloid processes (i-CAT image) demonstrating a long-standing motor activity of the mandible, likely the result of maintaining a patent airway<sup>16,17,18</sup>

This also explains diastemas that develop as we age with the development of OSA as demonstrated with a 45-year-old female with mild OSA (AHI 7.4), 20 years post-ortho with retention (Figures 12-14).

Implant failures may be related to the patient having bruxism secondary to OSA. Nightguards are frequently produced after implant restoration. Recent research has shown that if the patient has OSA, nightguards can worsen the suffocating events by 50%.<sup>19,20</sup> The latest research demonstrates the relationship between OSA and periodontal disease (PD).<sup>21,22,23</sup> Mouth breathing resulting in dry mouth increases the risk of caries and periodontal plaque.<sup>24,25</sup>

Every aspect of dentistry is affected by a blocked airway. Dental and medical problems overlap so frequently and manifest as symptoms in the head and neck. It is imperative to evaluate breathing from the tip of the nose to the epiglottis. Failure to evaluate all four points of obstruction and failure to establish a patent airway will affect the longevity of any dental treatment being rendered. Whether the treatment is orthodontic, prosthodontic, periodontal, or in the treatment and management of OSA, the use of CBCT imaging is a necessity. **OP**

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