SleepArchiTx™

WHITE PAPER

CBCT & SLEEP DISORDERS

Proper Use of Cone Beam Imaging for Upper Airway Analysis and Management of Sleep-related Breathing Disorders

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ABOUT THE AUTHOR

Sal Rodas is the Chief Product Officer for SleepArchiTx and the Executive Director for the Foundation for Airway Health. He is a published author, speaker, dental and medical technology evaluator. Sal has presented hundreds of continuing education courses to dental and medical professionals, nationally and internationally, in the areas of sleep medicine, airway management, 3D technology and practice growth. Mr. Rodas has over 15 years of professional senior level executive experience.

Throughout his career, Sal has been innovating solutions and leading companies in the medical and dental sleep industry designed to help practices grow. His most recent assignment was as the Chief Strategic Officer of a sleep diagnostics company. Previously, he led operations, sales, marketing and service efforts as the Chief Operations Officer for Space Maintainers Lab, an international organization with offices in the U.S. and abroad that serve the needs of dentists and orthodontists worldwide. At Space Maintainers Lab, Sal presided over the SMILE Foundation – the educational division of the company – organizing seminars nationwide with leading lecturers in the dental community. Sal earned his MBA from Babson College, holds a Bachelor of Information Technology and served as a US Marine.

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EXECUTIVE SUMMARY

Recently, there has been an increased awareness and desire to understand how we sleep at night, to such extent that in 2016, Arianna Huffington published a New York Times Bestseller on the subject: *The Sleep Revolution*.[1] In fact, the global sleep apnea devices market is expected to generate more than $6 billion in annual revenue by 2023.[2]

More importantly, however, in 2014, the Centers for Disease Control and Prevention categorized insufficient sleep as "a public health epidemic."[3]

In October 2017, the American Dental Association adopted an 11-point policy addressing the role of the dental practitioner in identifying and treating patients that suffer from sleep-related breathing disorders.[4]

With much attention on the topic of sleep and how dentistry plays a role in this arena, Cone Beam Computed Tomography (CBCT) manufacturers have rushed to develop software and manufacture machines that can accurately document the condition of the upper airway and the adjunct structures. With more than 20 years in the market, CBCT has been found to be an invaluable tool to evaluate the maxillofacial area. The more recent CBCT devices are low cost and produce a lower radiation dose when compared to computed tomography (CT).[5]

Although various peer-reviewed articles have been published showing the accuracy and reliability of upper airway analysis using CBCT,[6,7] the purpose of this white paper is to help the dental clinician consider the most ideal field of view when selecting what CBCT to purchase or what type of CBCT scan to order from an imaging center.

The ideal field of view should provide the clinician with enough data to properly identify, treat and manage patients with sleep-related breathing disorders (SRBD).

REFERENCES

1. The Sleep Revolution by Arianna Huffington | PenguinRandomHouse.com: Books. https://www.penguinrandomhouse.com/books/253098/the-sleep-revolution-by-arianna-huffington/. Accessed January 12, 2019.

2. Global Sleep Apnea Devices Market 2016-2018 & 2023 - Growing Adoption of Wearable Sleep Trackers. Yahoo! Finance. https://finance.yahoo.com/news/global-sleep-apnea-devices-market-180000359.html. Published January 16, 2019. Accessed February 10, 2019.

3. Liu Y, Wheaton AG, Chapman DP, Cunningham TJ, Lu H, Croft. "Prevalence of Healthy Sleep Duration Among Adults -United States, 2014 ." MMWR Morb Mortal Wkly Rep. 2016;65(6):137–141.

4. American Dental Association. "ADA Adopts Policy on Dentistry's Role in Treating Obstructive Sleep Apnea, Similar Disorders." https://www.ada.org/en/press-room/news-releases/2017-archives/october/ada-adopts-policy-on-dentistry-role-in-treating-obstructive-sleep-apnea. Published October 23, 2017. Accessed January 18, 2019.

5. El H, Palomo MJ. "Measuring the airway in 3 dimensions: a reliability and accuracy study." Am J Orthod Dentofacial Orthop. 2010; 137 (4): S50.e1-9.

6. Ghoneima A, Kula K. "Accuracy and reliability of cone-beam computed tomography for airway volume analysis." In Eur J Orthod. 2013; 35 (2): 256–261.

7. Vizzotto MB, Liedke GS, Delamare EL, Silveira HD, Dutra V. "A comparative study of lateral cephalograms and cone-beam computed tomographic images in upper airway assessment." Eur J Orthod 2012: 34 (3): 390–393.

PROPER FIELD OF VIEW

One of the various options to consider when selecting a new CBCT or obtaining an image from an independent imaging center is the Field of View (FOV). The FOV is the area of interest that will be captured during the CBCT scan. When identifying, treating and managing patients that may suffer from sleep-related breathing disorders, doctors are encouraged to perform an appropriate upper airway analysis of the patient using a CBCT by capturing – at minimum – all of the following landmarks: **Temporomandibular joints and the entire upper airway**[8] (nasal cavity, oral cavity, pharynx, and larynx).
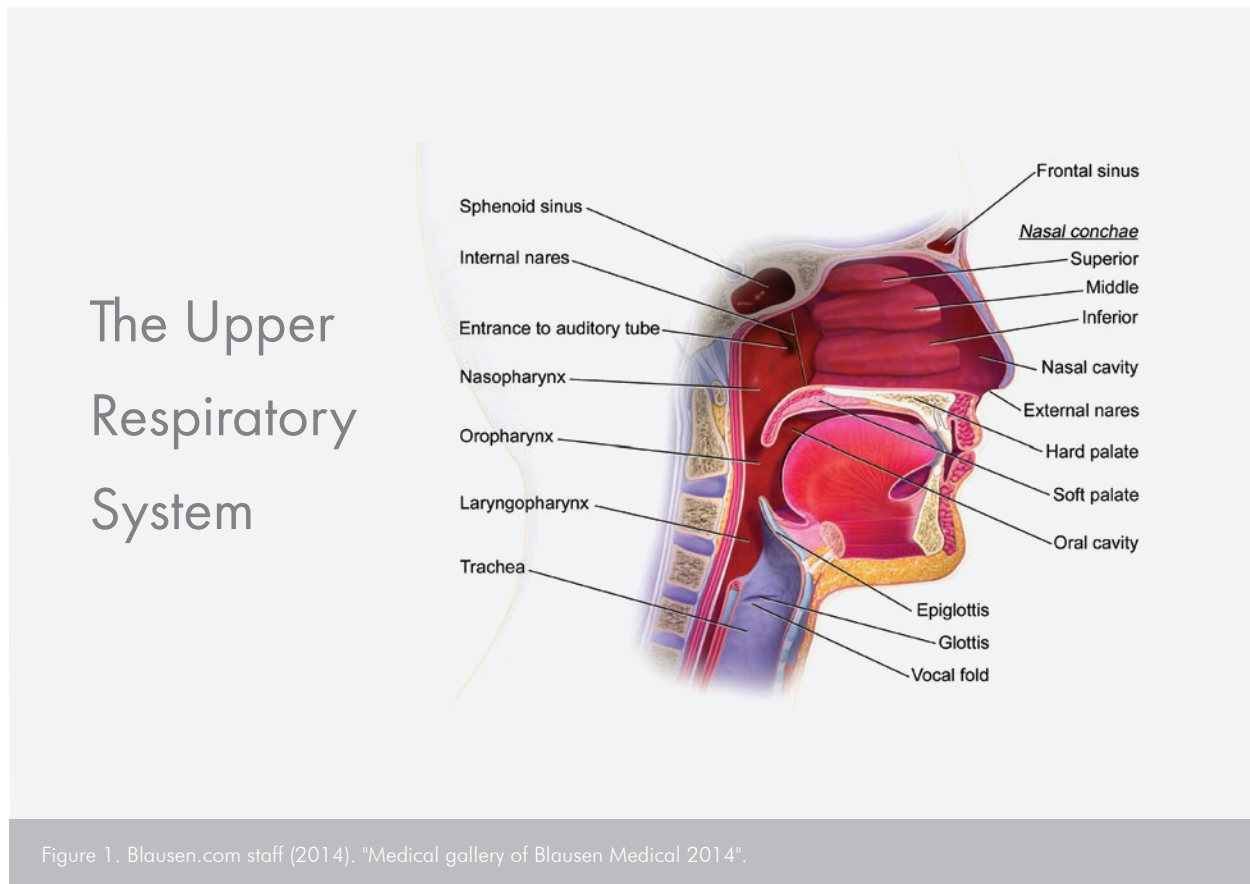

The Upper Respiratory System

Figure 1. Blausen.com staff (2014). "Medical gallery of Blausen Medical 2014".

The evaluation of the entire upper airway is necessary for patients with sleep-related breathing disorders because the airway may be compromised at one or many points, depending on the patient's anatomic abnormalities.[9,10]

REFERENCES

8. Functional Anatomy and Physiology of Airway.”; http://dx.doi.org/10.5772/intechopen.77037

9. Guijarro-Martinez R, Swennen GR. “Cone-beam computerized tomography imaging and analysis of the upper airway: a systematic review of the literature.” Int J Oral Maxillofac Surg. 2011;40(11):1227-1237.

10. Yucel A, Unlu M, Haktanir A, et al. “Evaluation of the upper airway cross-sectional area changes in different degrees of severity of obstructive sleep apnea syndrome: cephalometric and dynamic CT study.” AJNR Am J Neuroradiol.2005;26(10):2624-2629.

CASE IN POINT

To highlight the necessity to evaluate the entire upper airway and adjunct structures, consider the current dental sleep medicine model to treat patients with sleep apnea. Most courses today teach dental sleep medicine practitioners to take bite registrations at 60-70% of maximum protrusion[11]. This method of placing the patient's bite has been found to be experimental at best and, in many cases, labeled as a "guesstimate".[12]

The reason this method to treat patients with obstructive sleep apnea is still promoted might be due to the absence of a comprehensive review of the entire upper airway. The overarching thought is that sleep apnea patients typically have collapsibility of the tongue and/or soft-tissue that blocks the airway, causing these patients to suffer episodes where they get no oxygen for 10 seconds or more. Since the tongue is the primary culprit, then, protruding the mandible forward will achieve airway patency.[13]

However, there is one segment of the population that suffers from sleep-related breathing disorders for a different reason. These are patients who have narrow arches that prevent the tongue from fitting properly in the oral cavity and cause the floor of the nasal cavity to be compromised. These patients are not your typical obstructive sleep apnea patients. In fact, most are thin, suffer from allergies, have a long face and are mouth breathers (Figure 2). Moving the mandible forward on these patients, as explained above, may be contra-indicated.
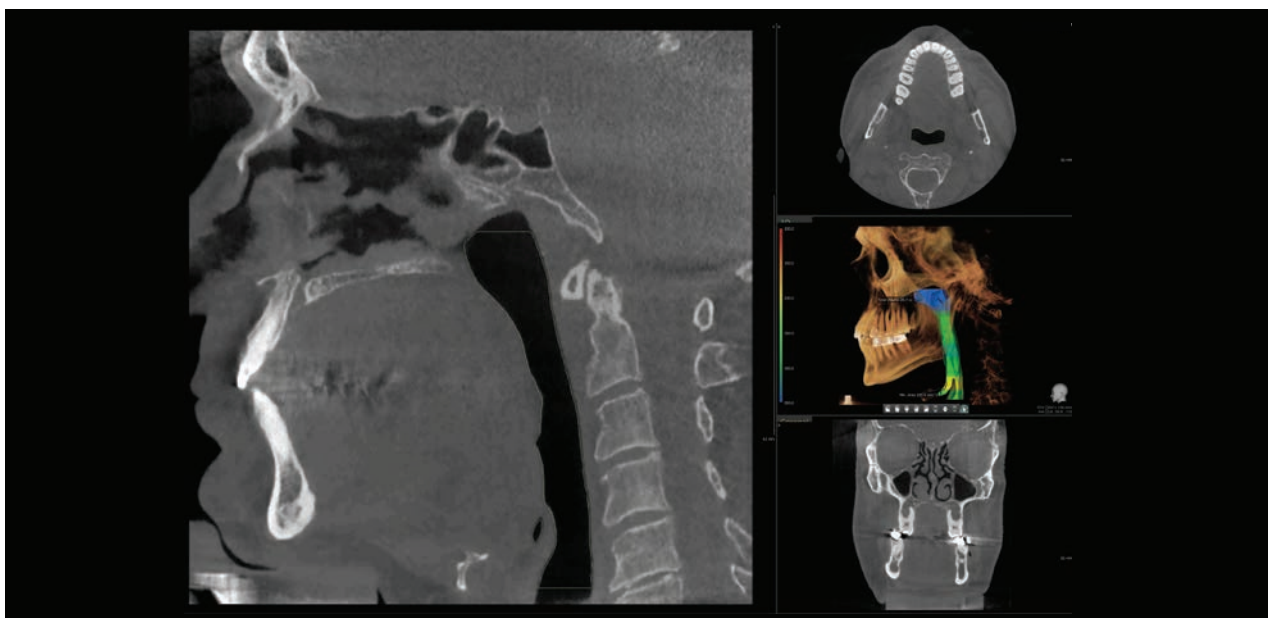

Figure 2. Patient with compromised nasal cavity; high-vaulted palate.

Therefore, identifying patients that may suffer from other upper airway disorders is imperative (Figure 2) because the traditional mandibular advancement protocol will not improve their sleep disorder. In fact, it may even injure them (i.e., trigger TMJD, cervical spine issues, etc.). Recent studies have shown that at least 27% to 54% of children are mouth breathers.[14] This segment of the population may not be able to tolerate an appliance in the mouth that moves the mandible forward because most of these patients are not breathing through their nose. Furthermore, most nasally compromised patients may have an open oropharynx that does not require further opening (Figure 3).
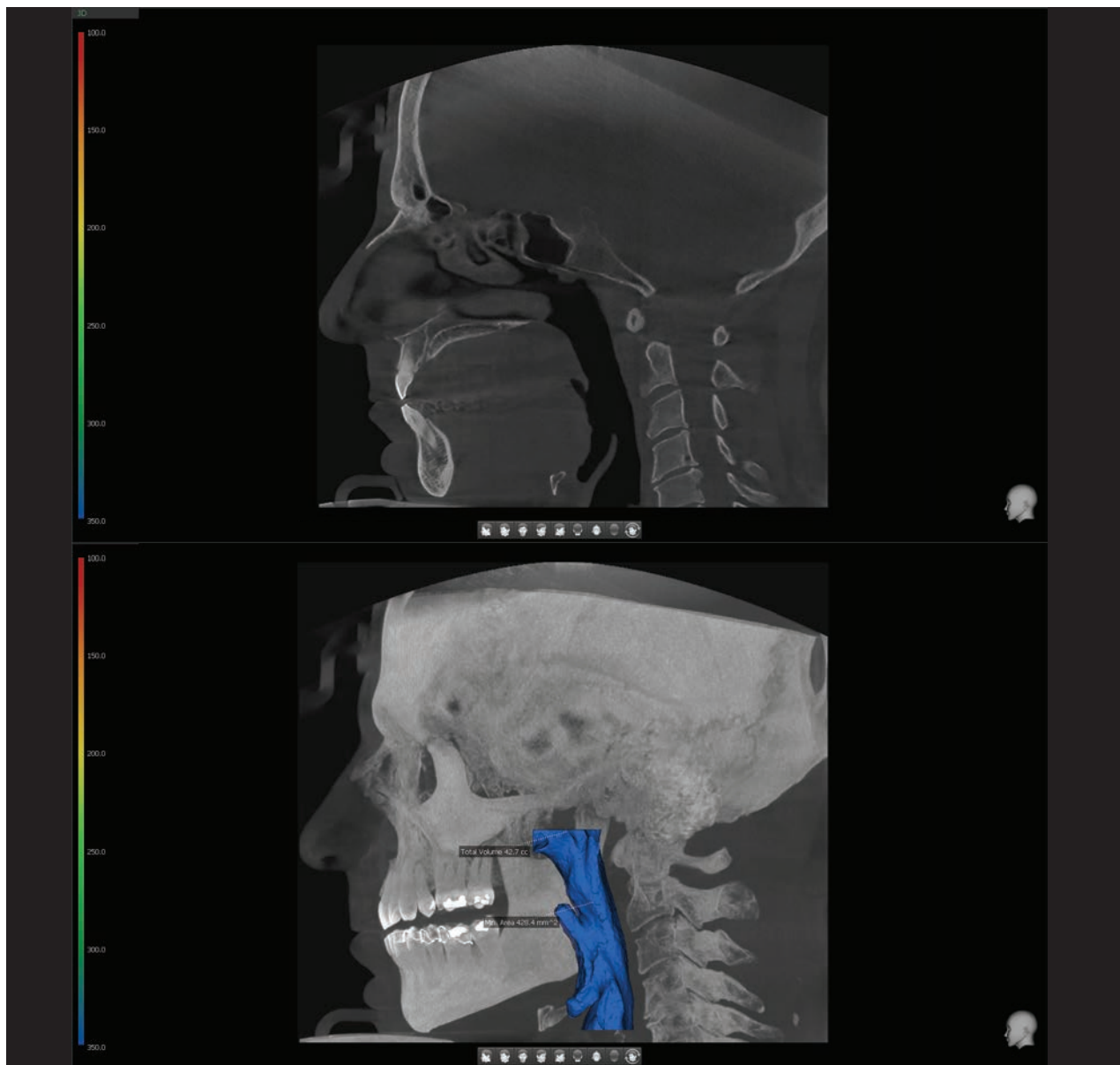

Figure 3. Oropharynx within normal limits. Courtesy: Vatech America, Inc.

REFERENCES

11.   Williams RC. "Where Do We Start?" Dental Sleep Practice. https://dentalsleeppractice.com/physi-cians-perspective/where-do-we-start/. Published June 8, 2015. Accessed January 12, 2019.

12.   Elliott, E. "Getting It in Their Hands: The Delivery Appointment." Dental Sleep Practice. 2017 June 20; 8. https://dentalsleeppractice.com/articles/getting-it-in-their-hands-the-delivery-appointment/

13.   Ferguson KA, Love LL, Ryan CF. "Effect of mandibular and tongue protrusion on upper airway size during wakefulness." Am J Respir Crit Care Med. 1997 May;155(5):1748-54.

14.   Abreu RR, Rocha RL, Lamounier JA, Guerra AF. "Prevalence of mouth breathing among children." J Pediatr (Rio J). 2008 Sep-Oct;84(5):467-70. doi:10.2223/JPED.1806. Epub 2008 Sep 29. English, Portu-guese. PubMed PMID: 18830512.PubMed PMID: 18830512.

FIELD OF VIEW SIZE

To properly evaluate the upper airway, all of the necessary structures must be successfully captured. These include the adjunct structures and cranio-facial complex. We strongly recommend that offices consider CBCT equipment that can achieve a Field of View (FOV) size of 15 cm x 13 cm, or greater. Figures 4, 5 and 6 highlight the different FOV sizes for your consideration.
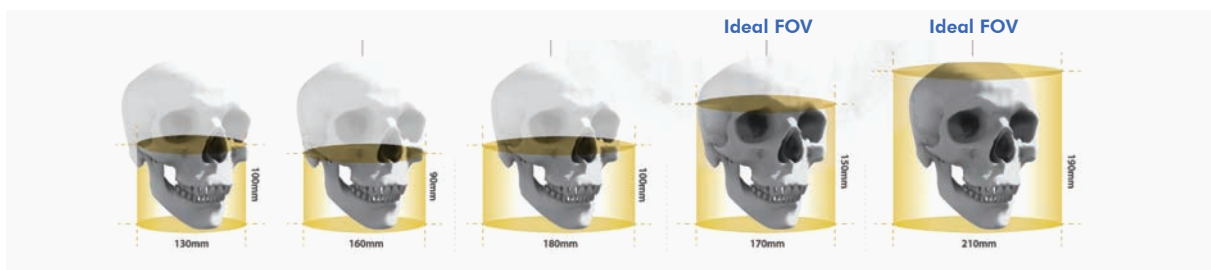

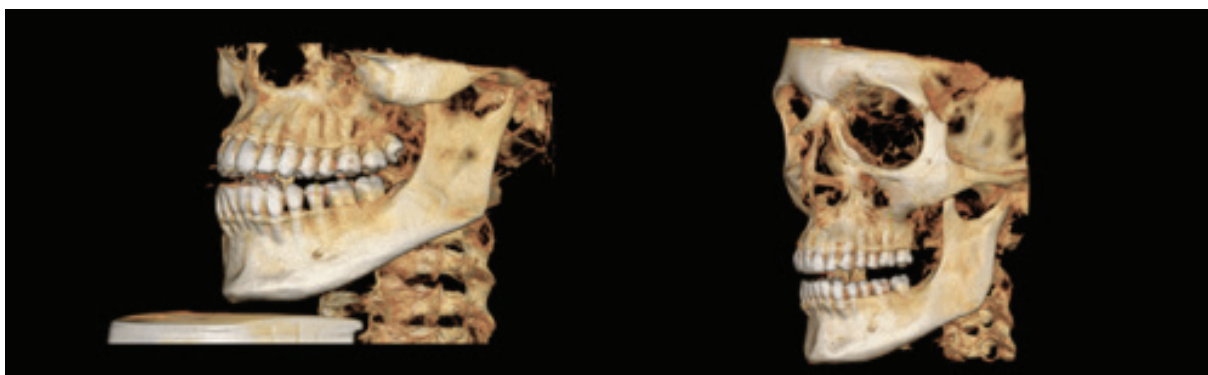Figure 4. FOV Sizes. Courtesy: Vatech America, Inc.

Figure 5. Comparison of 16 x 10 vs 15 x 15 FOV. Courtesy: Vatech America, Inc.
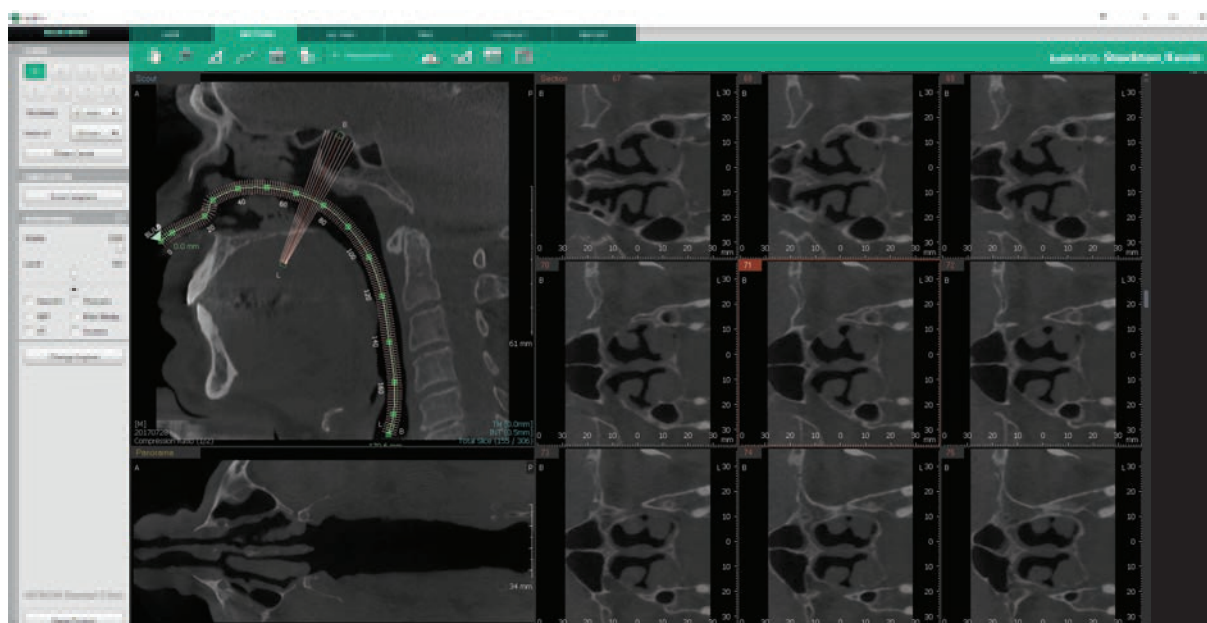

Figure 6. Evaluation of entire upper airway. Courtesy: Vatech America, Inc.

CONCLUSION

As dental offices become more involved in screening, treating and managing patients with sleep disorders, clinicians must consider the condition of the entire upper airway to provide the most proficient analysis of the patient's condition and determine the most ideal treatment protocol.

Currently, the most efficient tool to help you evaluate the entire upper airway is the Cone Beam Computed Tomography (CBCT) machine due to their comparative low cost and low dose exposure to the patient.

When considering what machine to purchase or what image to request from an imaging center, clinicians should take caution in selecting CBCT machines that are unable to minimally achieve field of view (FOV) sizes of 15 cm x 13 cm or greater to capture all the necessary anatomical deformities the patient may present during the consultation.

Dental clinicians should avoid the use of two scans to achieve one larger image. For instance, using a CBCT machine that captures an FOV of 10 x 10 and then scanning the patient again to achieve what might be equivalent to an FOV of 10 x 20 is not recommended. This protocol increases the amount of radiation the patient may be exposed to unnecessarily in overlapping areas.