Autumn meeting OMFS

TOWARDS A NEW CEPHALOMETRY FOR SLEEP APNOEA SYNDROMES ?

Jaumotte M, Raskin S, Le Clercq M, Poirrrier R, Gilon Y.

Coordinating supervisor: Pr. Gilon Y.

SUMMARY

01
Introduction:

- 1931: Broadbent (United States) and Hofrath (Germany)
- Riley & Powell (1981–1983) conducted the first systematic cephalometric studies on OSAS patients.
- Proposal of the concept of ‘obstructive skeletal phenotype’.
- Surgical application to cephalometry.

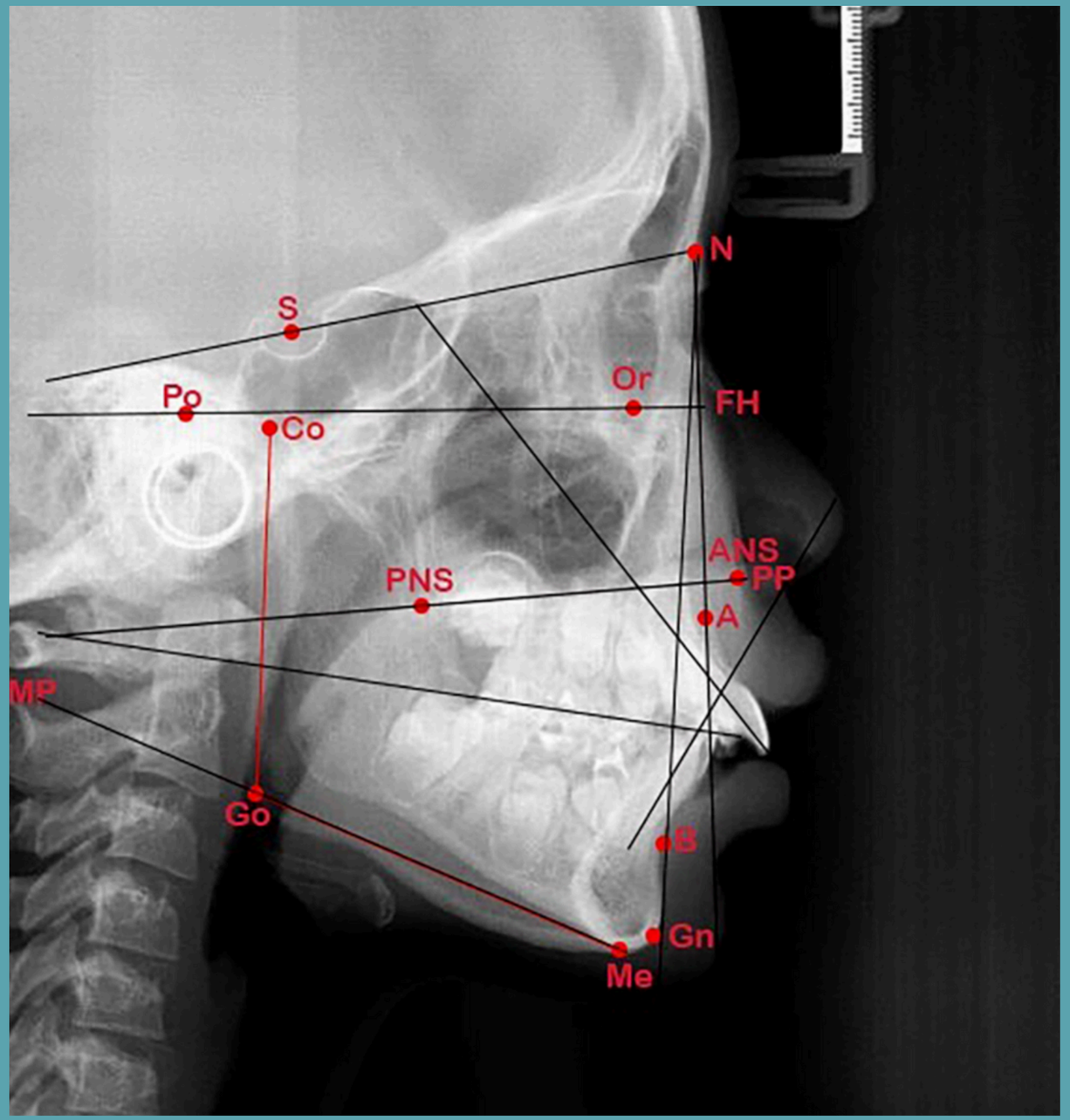
02
Review 2D

a. Posterior mandibular position
Key measurement:
↓ SNB → receded mandible.

OSA patients often have a lower than normal SNB (< 78°).
Consequence: reduction in retroglossal space and lowering of the oral floor.

b. Posterior maxillary position
Measurement:
↓ SNA → receded maxilla.

May coexist with mandibular recession (overall retrognathic profile).
Consequence: reduction in anterior support of the pharyngeal soft tissues.



02
Review 2D

Controlled Clinical Trial > Laryngoscope. 2012 Oct;122(10):2350-4. doi: 10.1002/lary.23458. Epub 2012 Jul 9.

Contribution of postero-anterior cephalometry in obstructive sleep apnea

Anne-Lise Poirrier [1], Sylvie Pire, Sylviane Raskin, Michel Limme, Robert Poirrier

Raskin, S., & Bruwier, A. (2022). *Importance du sens transversal maxillaire et mandibulaire dans le SAOS (syndrome d'apnées et hypopnées du sommeil) pédiatrique et adulte* [Paper presentation]. 65ème réunion du club international de morphologie crânio-faciale (CIMF), Bruxelles, Belgium. https://hdl.handle.net/2268/295907

Extensive expertise in cephalometry in Liège for many years. The work of Prof. Raskin, Bruwier, Poirrier A-L and Limme is among the most relevant and recognised today.

Jaumotte, M., Grobet, P., PEPINSTER, F., THONNART, F., NIZET, J.-L., & GILON, Y. (2020). Apport de la technologie 3D en chirurgie maxillo-faciale. *Revue Médicale de Liège, 75* (4), 240-242.
https://hdl.handle.net/2268/256981
Peer reviewed

LA MANDIBULE DES RONCHOPATHES ET DES APNÉIQUES.
Raskin S, Limme M, Poirrier R. L'orthodontie française, vol 66, tome II, 1995.

BILAN CÉPHALOMÉTRIQUE DANS LE SYNDROME DES APNÉES ET HYPOPNÉES OBSTRUCTIVES DU SOMMEIL.
Raskin S, Gilon Y, Limme M. Rev Stomatolo.Chir.maxillofac., 103(3):158-163, 2002.

It is therefore in the wave of these innovations that we are questioning ourselves!

03
Review 3D

- Purpose: 3D cephalometry aims to:
  Precisely measure bone morphology and air volumes,
  Identify areas of obstruction (retropalatal, retroglossal, hypopharyngeal),
  Assess post-treatment changes, particularly after orthognathic surgery or mandibular advancement orthosis.

  3D technology enables volumetric, surface and directional (x, y, z) analysis.

Three-dimensional analysis of craniofacial bones and soft tissues in obstructive sleep apnea using cone beam computed tomography

Analyse tridimensionnelle des os craniofaciaux et des tissus mous dans l'apnée obstructive du sommeil utilisant la tomographie volumétrique à faisceau conique

Annick BRUWIER[a,*], Robert POIRRIER[b], Adelin ALBERT[c], Nathalie MAES[d], Michel LIMME[a], Carole CHARAVET[a], Mladen MILICEVIC[e], Sylvianne RASKIN[a], Anne-Lise POIRRIER[f]

This article confirms that airway volume is determined by maxillary volume: 3D is essential!

03
Review 3D

- Volumetric studies (Li, Schwab, Ogawa, 2010–2023) show that:

3D Parameters	In relation to IAH
↓ Retroglossal volume	AHI ↑
↓ CSAmin (minimal surface)	AHI ↑
↑ Pharyngyal lenght	AHI ↑
↓ SNB 3D / ↑ MP–H 3D	AHI ↑
↑ Lingual volume ↓ pharyngyal volule	AHI ↑

04
New cephalometry ?

- Numerous articles have focused on the limitations of 2D cephalometry for orthognathic surgery planning.
  Some even claim that it is no longer necessary.
  - What about our approach to sleep? Should we establish a new cephalometry?

- Hernández-Alfaro F, Valls-Otaegui C, Guijarro-Martínez R. Three-dimensional virtual planning in orthognathic surgery. Clin Oral Investig. 2024;28(5):1-15.
- Lee YJ, Choi JW, Park GY, Kim MJ, Kim JW. Redefining precision and efficiency in orthognathic surgery with three-dimensional virtual planning. J Korean Assoc Maxillofac Plast Reconstr Surg. 2023;45(2):75-87.
- Ho CT, Lin HH, Lo LJ. Intraoperative navigation and three-dimensional surgical simulation in orthognathic surgery: A literature review. J Clin Med. 2019;8(6):878.
- Awad D, Kluba S, Reinert S. Accuracy of three-dimensional soft tissue prediction in orthognathic surgery using CBCT-based planning: A prospective study. J Pers Med. 2022;12(9):1379.
- Ho CT, Ho CH, Lo LJ. Three-dimensional surgical simulation improves the accuracy of orthognathic surgery. Sci Rep. 2017;7:46542.
- Meikle MC. The clinical significance of cephalometric radiography. Br J Orthod. 1985;12(4):195-201.
- Schendel SA, Jacobson R, Khalessi S. 3D facial simulation in orthognathic surgery: Current practice and future directions. J Oral Maxillofac Surg. 2014;72(12):2429-2441.
- Swennen GRJ, Mollemans W, Schutyser F. Three-dimensional treatment planning of orthognathic surgery in the era of virtual imaging. J Oral Maxillofac Surg. 2009;67(10):2080-2092.
- Xia JJ, Gateno J, Teichgraeber JF. Three-dimensional computer-assisted planning in orthognathic surgery. Oral Maxillofac Surg Clin North Am. 2007;19(4):613-622.

04
New cephalometry ?

So, who should we believe?

04
New cephalometry ?

- Fábio José Fabrício de Barros Souza, Cervical computed tomography in patients with obstructive sleep apnea: influence of head elevation on the assessment of upper airway volume, J. bras. pneumol. 42 (1) • Jan-Feb 2016

- report an average volume of ≈ 23.4 ± 8.7 cm^3 of the ‘pharyngeal airway’ (comparable segmentation, CBCT) for healthy adults.
- explains a 20 to 40% decrease in this volume in patients with OSAHS (14,04 - 18,72cm^3)
- Hypothesis: does bimaxillary advancement surgery allow this difference in volume to be regained?

04
New cephalometry ?

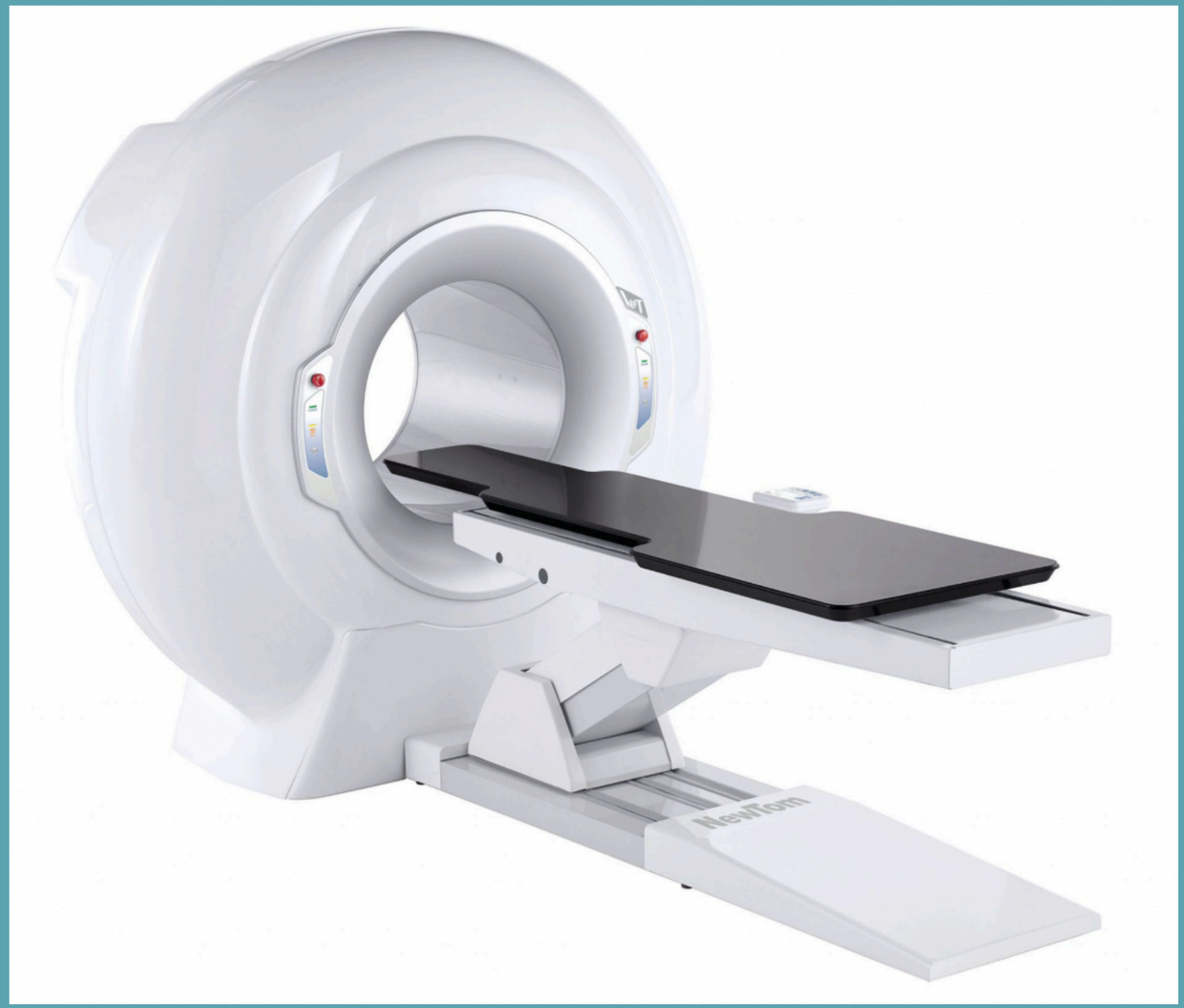
- We performed 27 3D cephalometric analyses on patients with SAHOS who underwent bimaxillary advancement surgery.

Time : 10 - 20 years after surgery

New tom 5G Verona CBCT

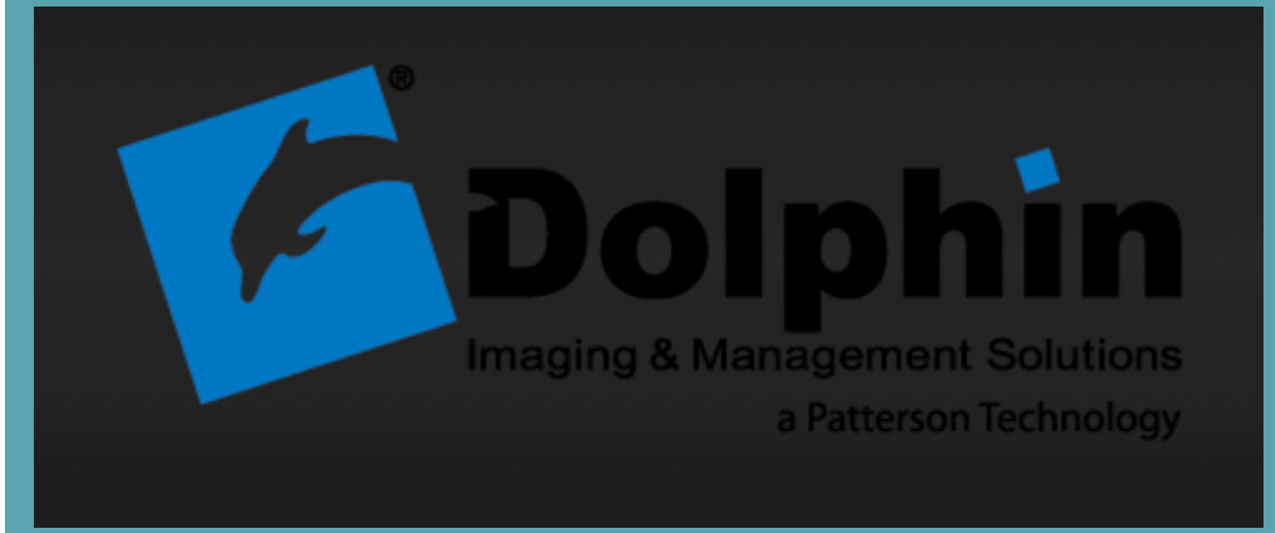
Dolphin imaging 11.9

16x 18 cm

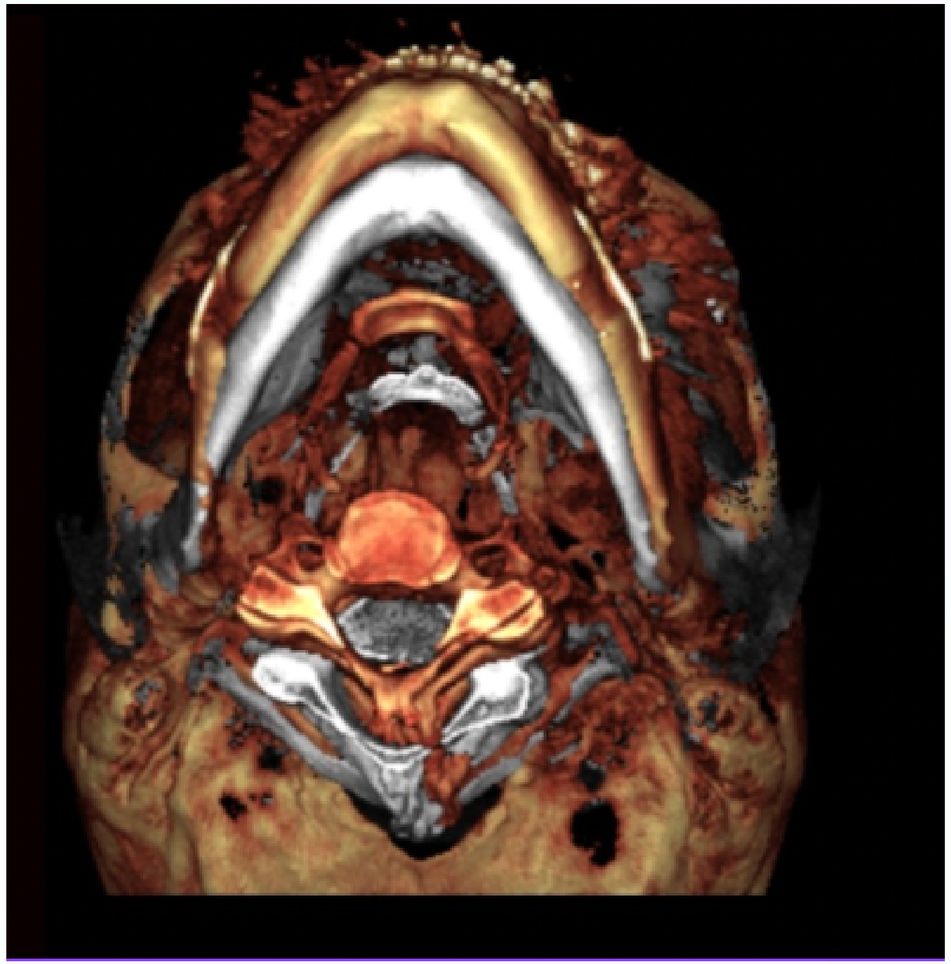


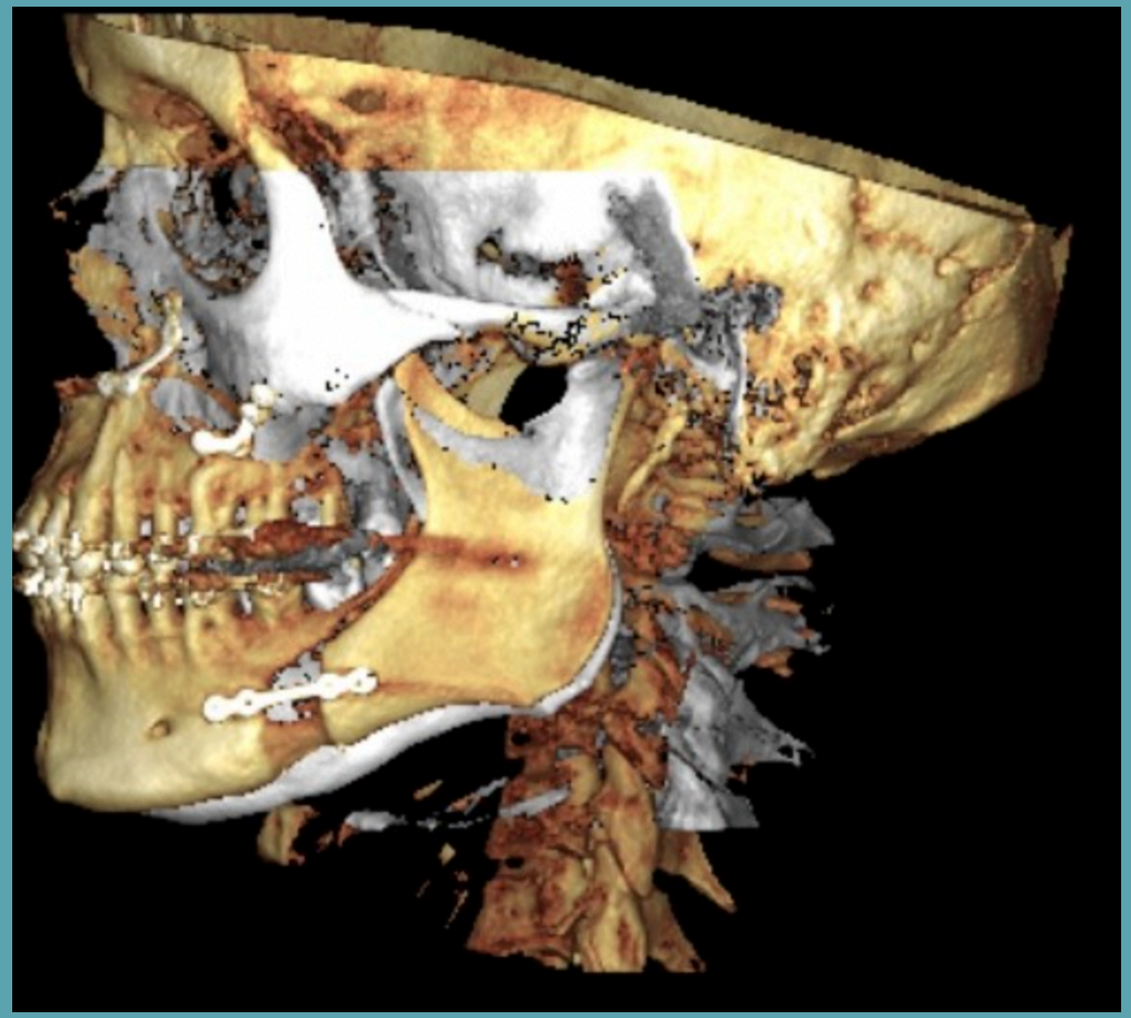
04
New cephalometry ?

- In the series, all patients underwent maxilla first surgery with a minimum maxillary advancement of 11 mm.
- The average post-operative volume in this 10-20 year old group was 21.2 ± 7.8 cm^3, which is very close to the volume of a healthy patient (23.4 ± 8.7 cm^3).
- The eleven patients who experienced a relapse are those with the smallest airway volumes, averaging 15.82 cm^3.

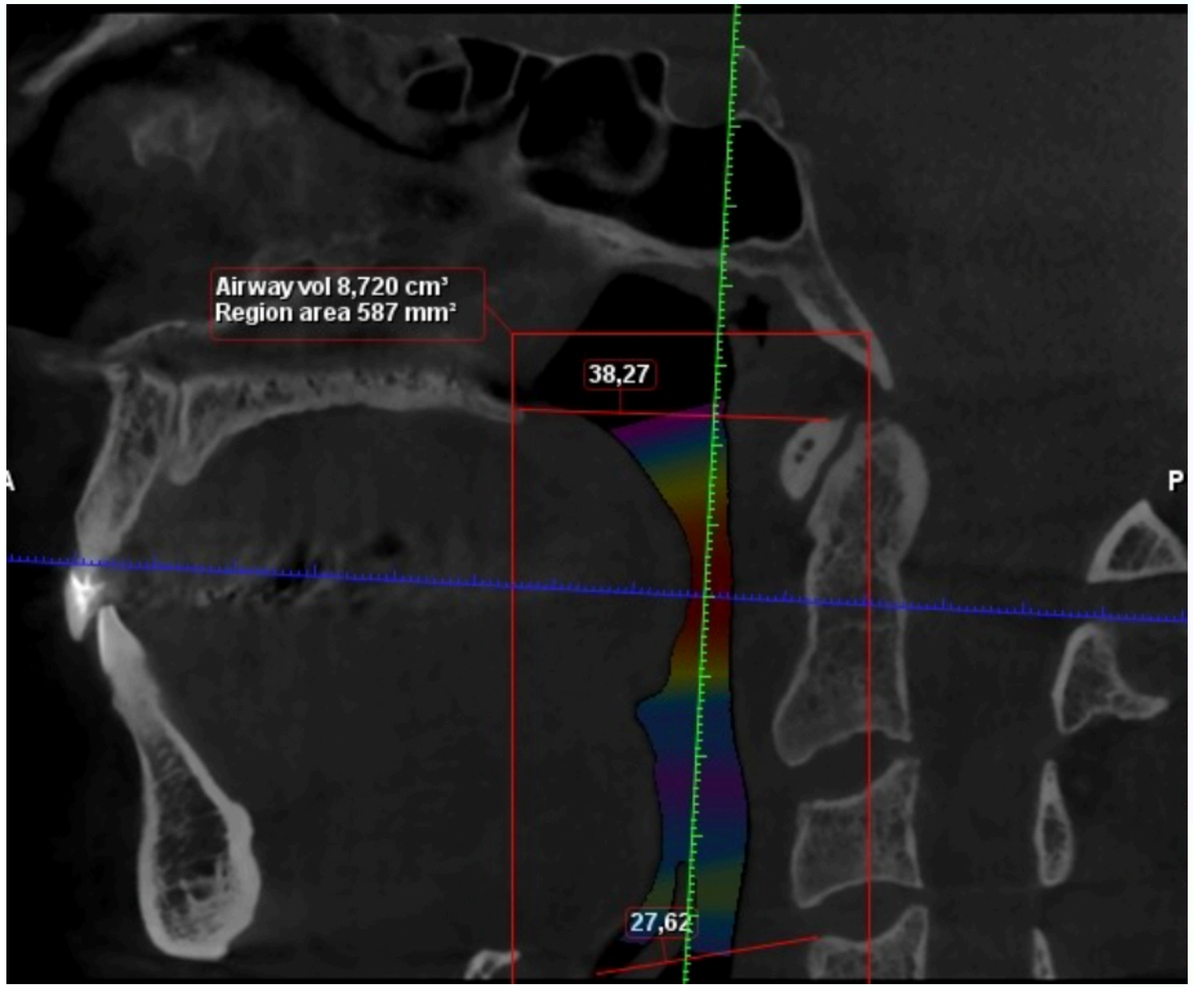


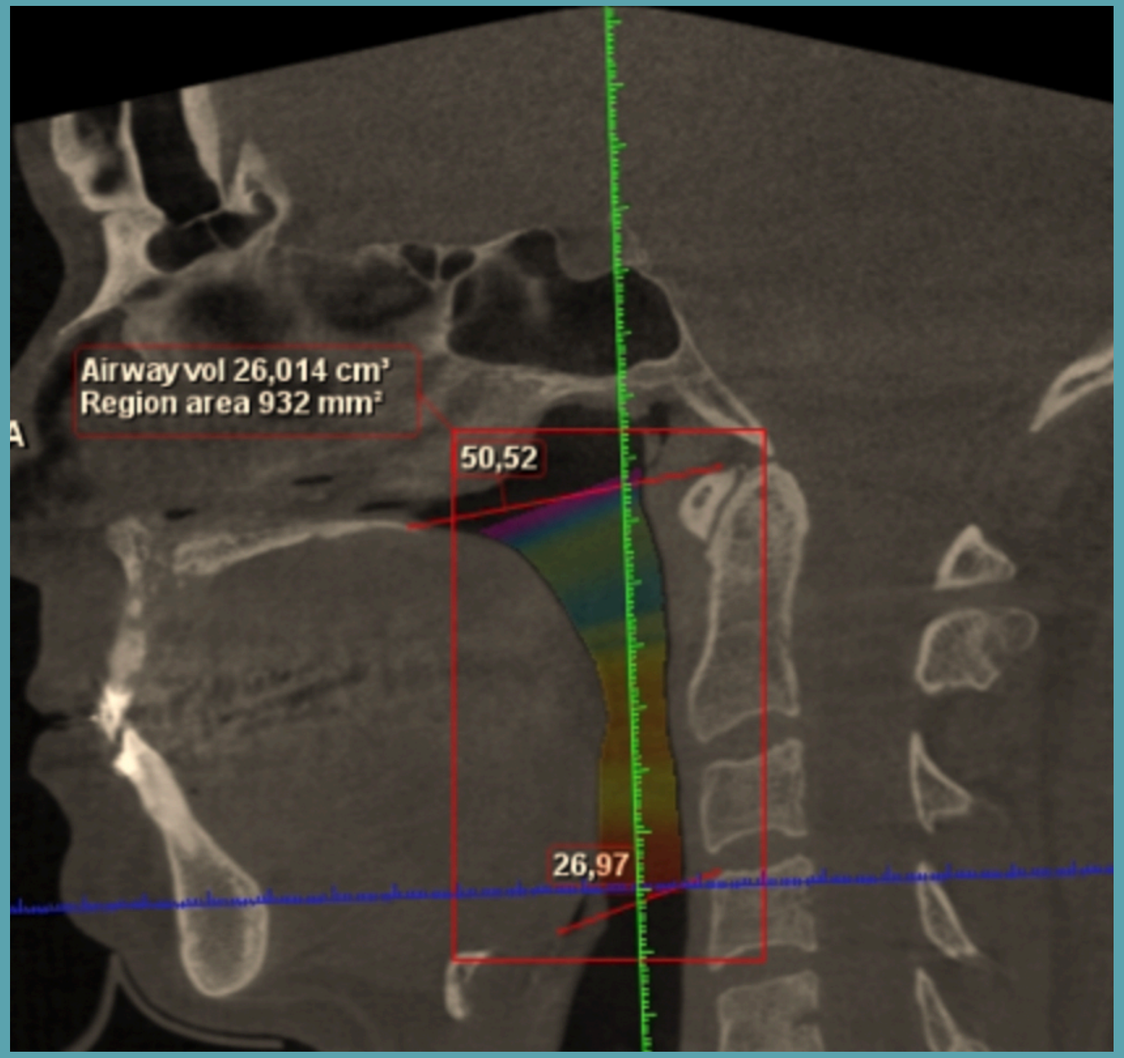
04
New cephalometry ?





04New cephalometry ?

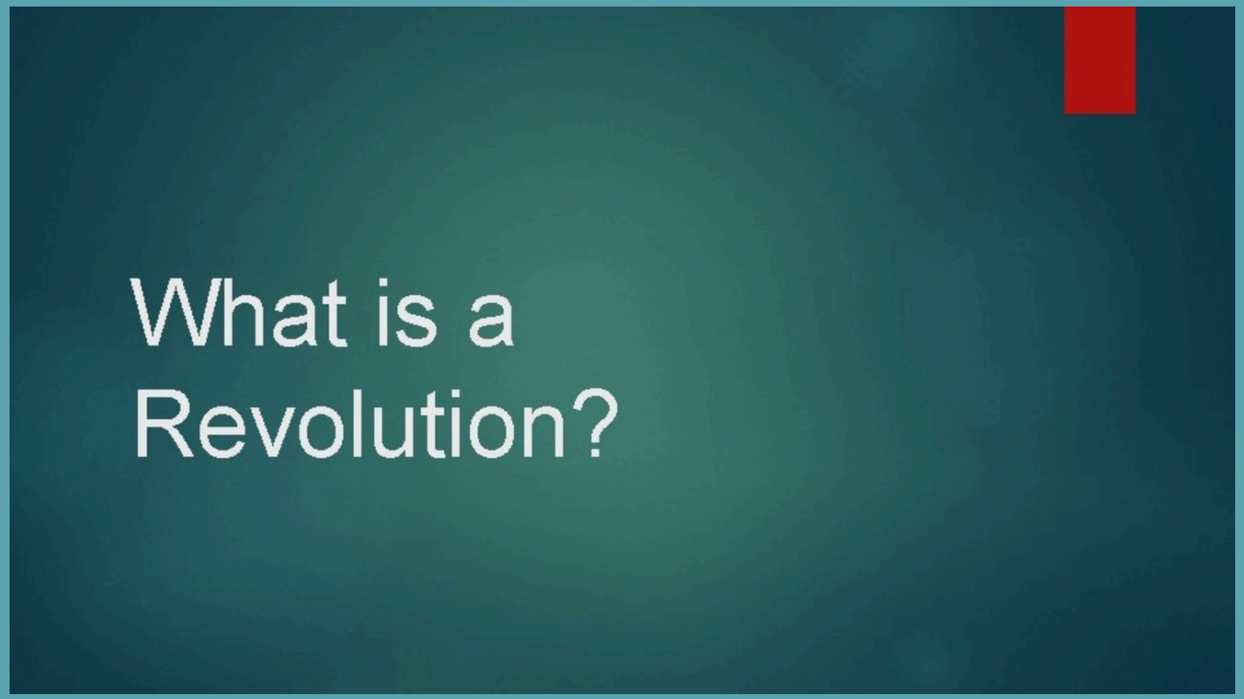




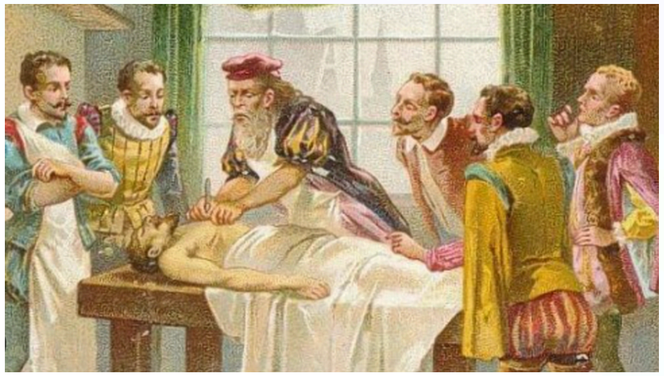
8,7cm3 => 26,014 cm3

04
New cephalometry ?

- The pre-operative volume is therefore extremely low in this patient, below the volume standards for SAHOS patients.
- The bimaxillary advancement,combined in this case with maxillary and mandibular distraction, allows him to reach the volumes of healthy patients, at the upper end of the average value.
- The patient is completely cured of his apnoea (AIH < 15).
  IAH pre-operative = 53/h



05 Conclusion

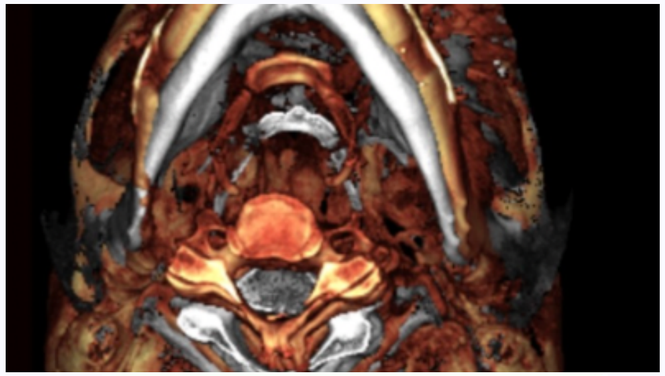


Continued interest in cephalometry

- 3D cephalometry provides indisputable pre- and post-operative measurements and arguments for discussion with the patient and therapeutic guidance.

Growing interest in 3D

- A new cephalometry adapted to the needs of the Sahos is under study and would fill the gaps in conventional 2D/3D imaging.



Encouraging results !

- In my next presentation, we will combine our knowledge of cephalometry and surgery to offer you a comprehensive study from Liège covering more than 20 years of sleep surgery!