A novel method to approach a hipoplasic mid face diagnosis

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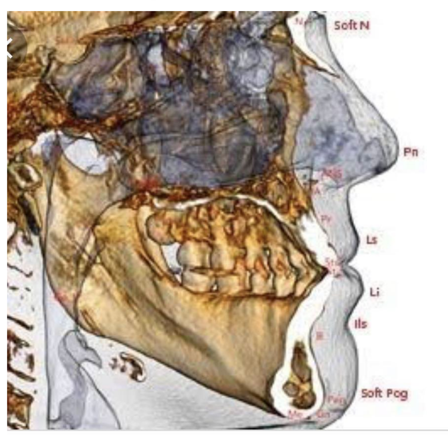
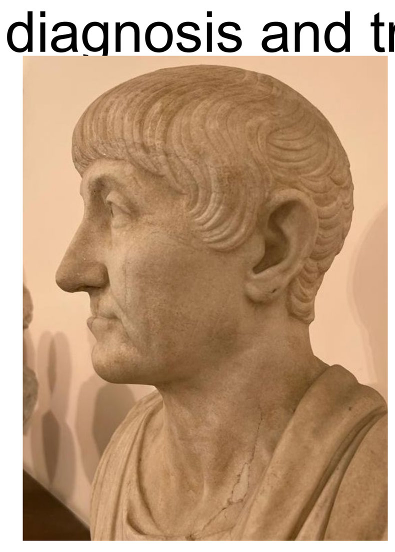
INTRODUCTION

Class III skeletal malocclusion is one of the less frequent but aesthetically impactful misalignments. It can be caused by maxillary hypoplasia or retrognathia, mandibular hyperplasia, or a combination of both. Its frequency varies between 2-11% of the global population, depending on the ethnic group.

Diagnosis and treatment planning traditionally is determined by two-dimensional anteroposterior position using cephalometric analysis on lateral radiographs, with few studies analyzing bone volume rather than position, being of great importance for diagnosis and treatment planning.


CBCT / IMAGE SEGMENTATION

Understanding the true underlying cause of the aesthetic impairment of the profile can greatly benefit from the volumetric analysis of the maxilla. The introduction of cone-beam computed tomography (CBCT) for imaging the maxillofacial region has shifted the approach from 2D to 3D for data acquisition and image reconstruction. CBCT allows for more comprehensive and detailed visualization of the maxillofacial structures, providing valuable information for diagnosis, treatment planning, and assessment of various conditions.

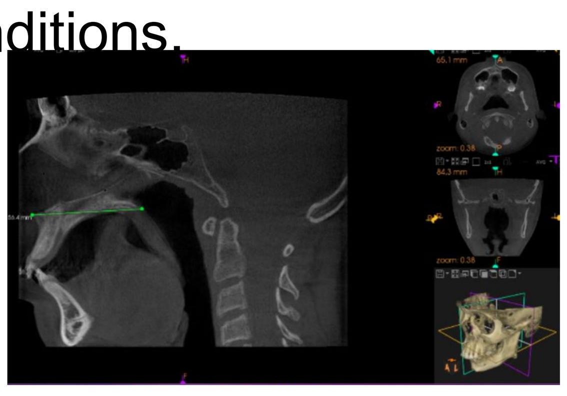
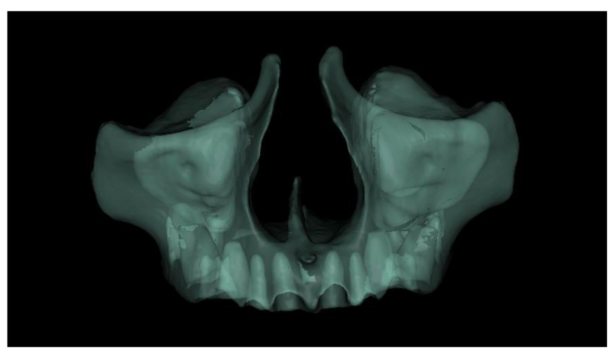



Image segmentation is the process of separating specific regions within an image to delineate structures or areas of interest. It enables measurements of volume, surface area, shape properties, 3D printing, and other analyses.

METHODS & MATERIAL

CBCT records of patients of the Orthodontics Department of the Universidad Autónoma de Baja California were use under the following criteria: Patients with no previous orthodontic treatment, no history of maxillofacial surgery and no active upper airway diseases (sinusitis, allergies, adenoids, tonsillitis).

Exclusion Criteria was: patients with previous or ongoing orthodontic treatment, patients with a history of maxillofacial surgery (orthognathic surgeries, facial reconstruction surgeries, accidents with impact on craniofacial structures, etc.) patients with active upper airway diseases (sinusitis, allergies, adenoids, tonsillitis).

The measurement of maxillary bone volume was performed using Cone-Beam tomography scans of skeletal Class I, Class II, and Class III patients and the DIAGNOCAT (*Copyright © 2023 Diagnocat LLC. All rights reserved)* software was used to segment the maxillary bone and calculate the average volumetric values and those were established for both men and women.

REFERENCES

METHODS & MATERIAL

Using the CareStream (*© 2023 Carestream Dental LLC. All Rights Reserved*) software linear measurements on the CBCT were made following the Trujillo´s analysis.

The Trujillo analysis for the maxilla stablishes measurements as follows:

1. Anteroposterior position of the middle maxillary portion Mx-Vpt:
Average maxillary position (anteroposterior): Distance between the maxillary point (Mx - midpoint between ANS and PNS) and the pterygoid vertical (VPt). Standard: Women: 26 mm. Men: 30 mm. Standard Deviation: +/- 3 mm.

2. Anteroposterior Maxillary Dimension (Ena-Enp):
Indicates the distance between the anterior nasal spine and the posterior nasal spine.
Standard: Women: 52 mm. Men: 59 mm. Standard Deviation: +/- 3 mm.
Determines the degree of horizontal or anteroposterior growth of the maxilla.

RESULTS

A total of 43 patients were selected, 20 male and 23 female. 85% of the patients age was between 21 to 30 years old. We found lower average values compared to the reference values established by Trujillo for both the mean and anteroposterior position of the maxilla, as well as for the length of the maxillary bone.
Comparison between maxillary bone volume, anteroposterior projection, and length in Class III patients vs. Class I and Class II was made as well as the comparation between the maxillary bone volume, anteroposterior projection, and length between Class III patients and Class I and Class II patients. *Minitab 14* was used to analyze the data and convert it into statistics. A statistical hypothesis test for the difference in means was conducted on small samples using the Student's t-distribution. A significance level of 95% (alpha = 5%) was used.
Results showed that Class III patients exhibited significantly lower maxillary bone volume (56,039 mm^3) compared to Class I (72,341 $mm^{3)}$ and Class II (72,833 mm^3) patients (Fig. 7). The mean for maxillary bone volume measurements were 75, 979.75 mm^3 for men and 59, 979.73 mm^3 for women.
These findings suggest that Class III patients have distinct characteristics in terms of maxillary bone volume, anteroposterior projection, and length compared to Class I and Class II patients, highlighting the significance of these variables in understanding the skeletal differences observed among different malocclusion classes.

CONCLUSION

Analyzing the maxilla volumetrically can be helpful in identifying the true cause of aesthetic profile impairments, so we can consider patient's volume evaluation as a routine, specially at a growing phase, to find the main etiology to develop this lack of maxillary growth and treat it at an earlier age as possible.
The measurement of maxillary volume has not been considered as an important factor in treatment decision-making in current assessment and diagnosis studies.

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