# Aetiology.
# Hereditary and acquired anomalies.
# Functional anomalies.

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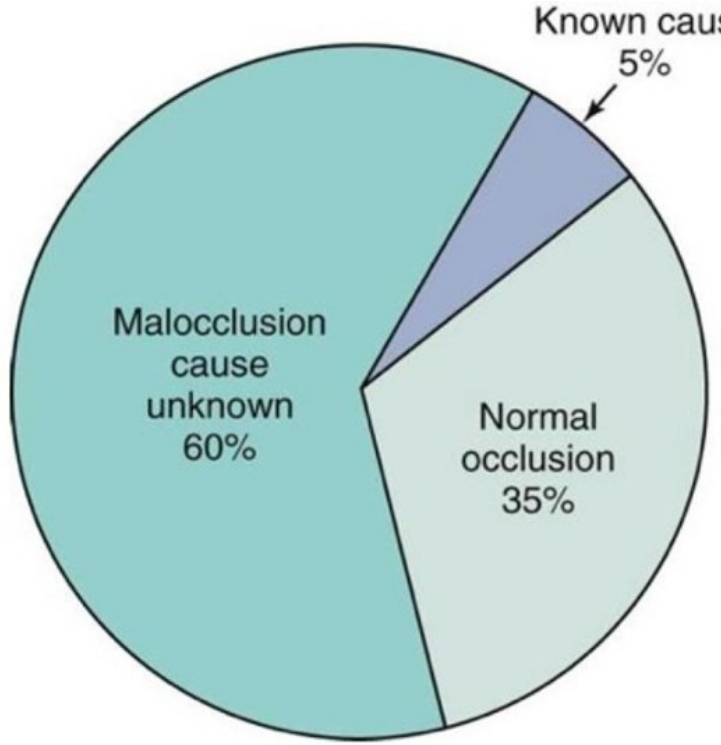
# Introduction

1. **Malocclusion is a developmental condition**. In most instances, malocclusion and dentofacial deformity are caused, not by some pathologic process, but by **moderate (occasionally severe) distortions of normal developmen**t
2. **Occasionally, a single specific cause** is apparent, for example, in mandibular deficiency secondary to a childhood **fracture** of the jaw or the characteristic malocclusion that accompanies some **genetic syndromes**.
3. More often, these problems result from a **complex interaction** among multiple factors that influence growth and development, and it is impossible to describe a specific etiologic factor




Contemporary Orthodontics, 5th ed William R. Proffit, Henry W. Fields, Jr, David M. Sarver; Elsevier-Mosby; www.elsevier.com;

# Overview

- Specific causes
  1. Hereditary influences
  2. Disturbances during embryonic development
  3. Disturbances of dental development
- Environmental influences
  1. Equilibrium considerations
  2. Masticatory function
  3. Habits
  4. Respiratory pattern

# Specific causes

# Embryonic development

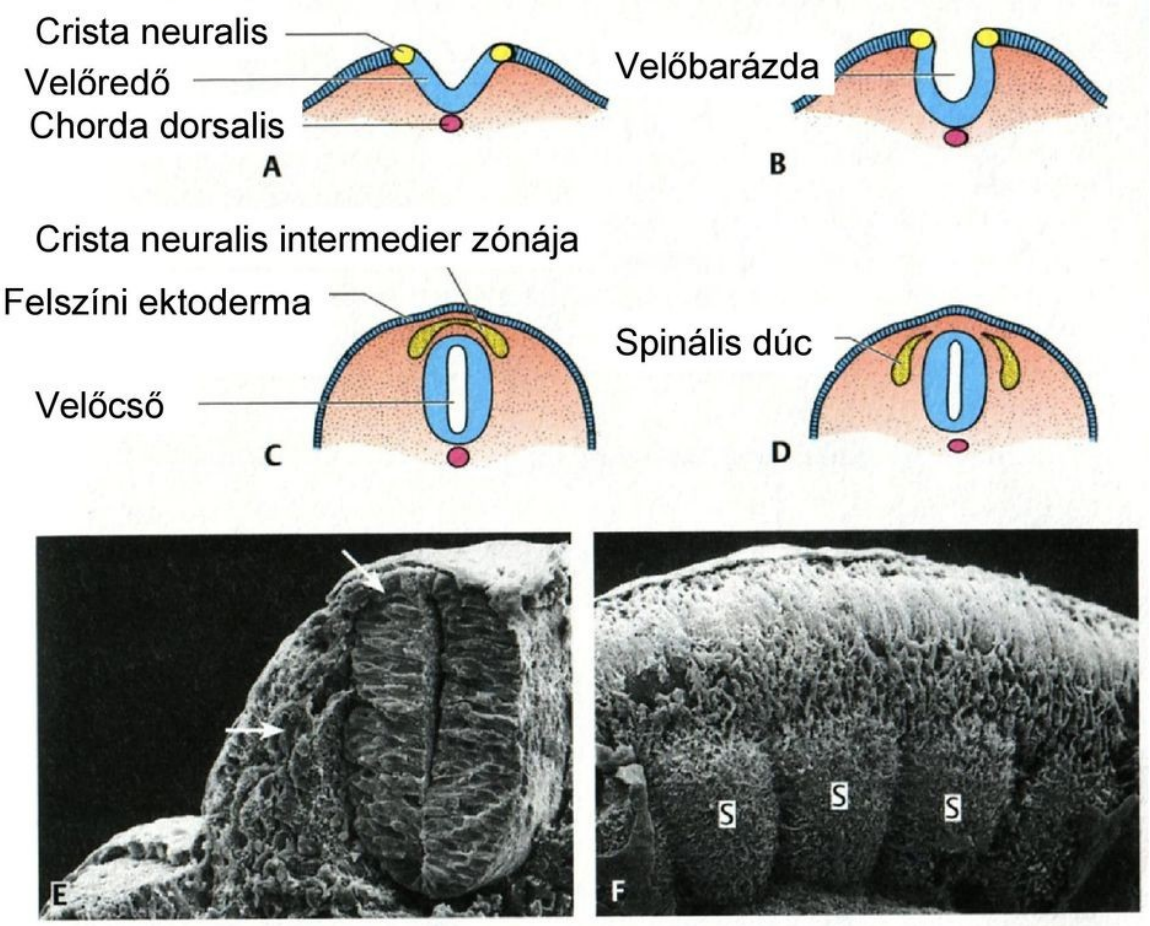
- Defects usually end in the death of the embryo
- Genetical or environmental origin
- Teratogens

| Teratogens | Effect |
|---|---|
| Aminopterin | Anencephaly |
| Aspirin | Cleft lip and palate |
| Cigarette smoke (hypoxia) | Cleft lip and palate |
| Cytomegalovirus | Microcephaly, hydrocephaly, microphthalmia |
| Dilantin | Cleft lip and palate |
| Ethyl alcohol | Central midface deficiency |
| 6-Mercaptopurine | Cleft palate |
| 13-cis Retinoic acid (Accutane) | Similar to craniofacial microsomia and Treacher Collins syndrome |
| Rubella virus | Microphthalmia, cataracts, deafness |
| Thalidomide | Malformations similar to craniofacial microsomia, Treacher Collins synd |
| Toxoplasma | Microcephaly, hydrocephaly, microphthalmia |
| X-radiation | Microcephaly |
| Valium | Similar to craniofacial microsomia and Treacher Collins syndrome |
| Vitamin D excess | Premature suture closure |

# Neural crest cells

- Most structures of the face are derived from neural crest cells
- Their migration ends by the 4th week of pregnancy
- They from all the loose mesenchymal tissue in the facial regions
- Later differentiate into skeletal and connective tissue forming the jaws and teeth

Migration of neural crest cells



# Hereditary anomalies

- Skeletal tendencies tend to run in families
- Dental parameters show big variation within families

https://medium.com/@TheHistoryAndScienceNerd/how-inbred-were-the-habsburgs-1f8c2fde57aa

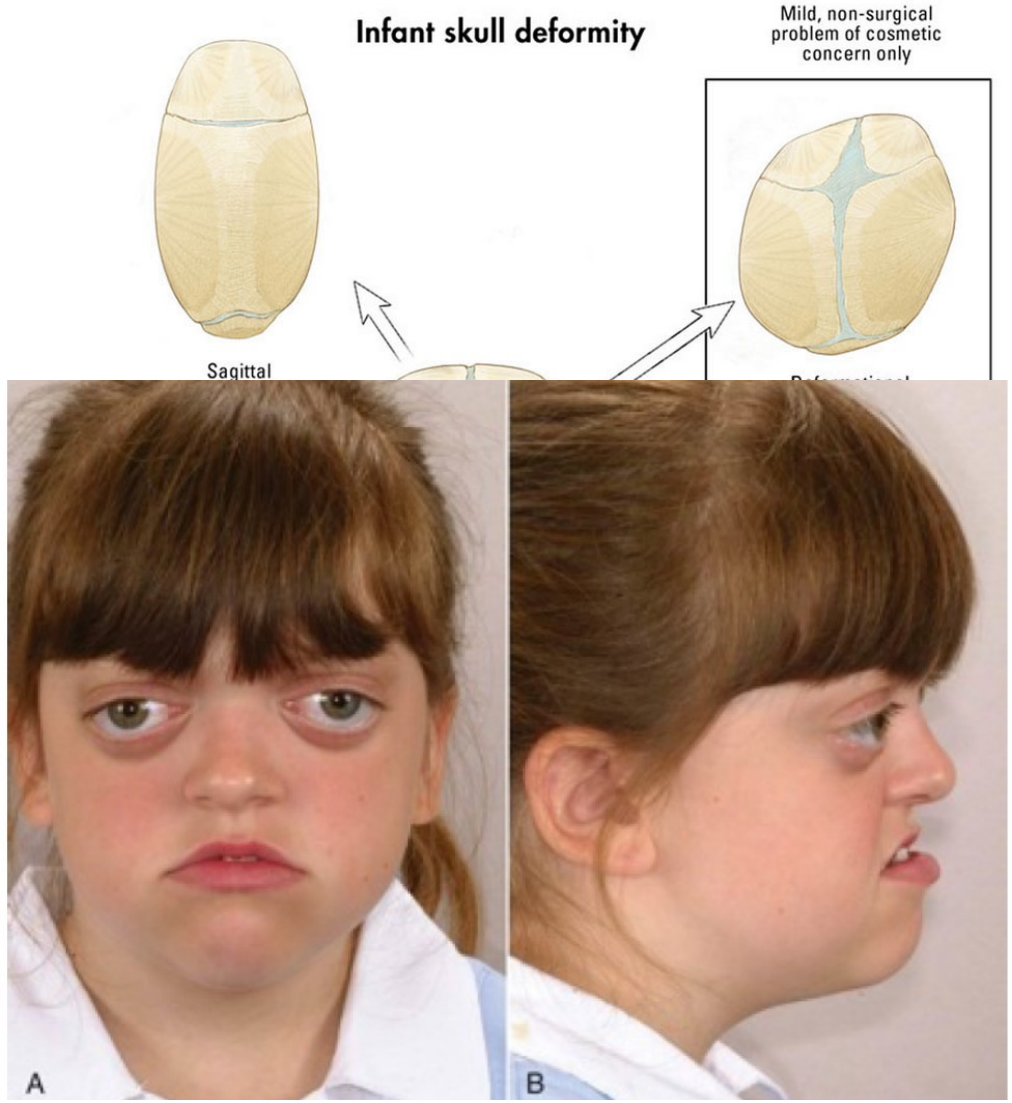
# Treacher- Collins syndrome

- Affected migration of neural cells → Generalized lack of mesenchymal tissue in the lateral parts of the face

https://www.adelaidenow.com.au/lifestyle/parenting/born-with-rare-treacher-collins-syndrome-zackary-walton-4-starts-kindy-and-gives-it-the-thumbs-up/news-story/5fb25ee904d8622f1b8375e93cbff276

# Craniosynostosis problems

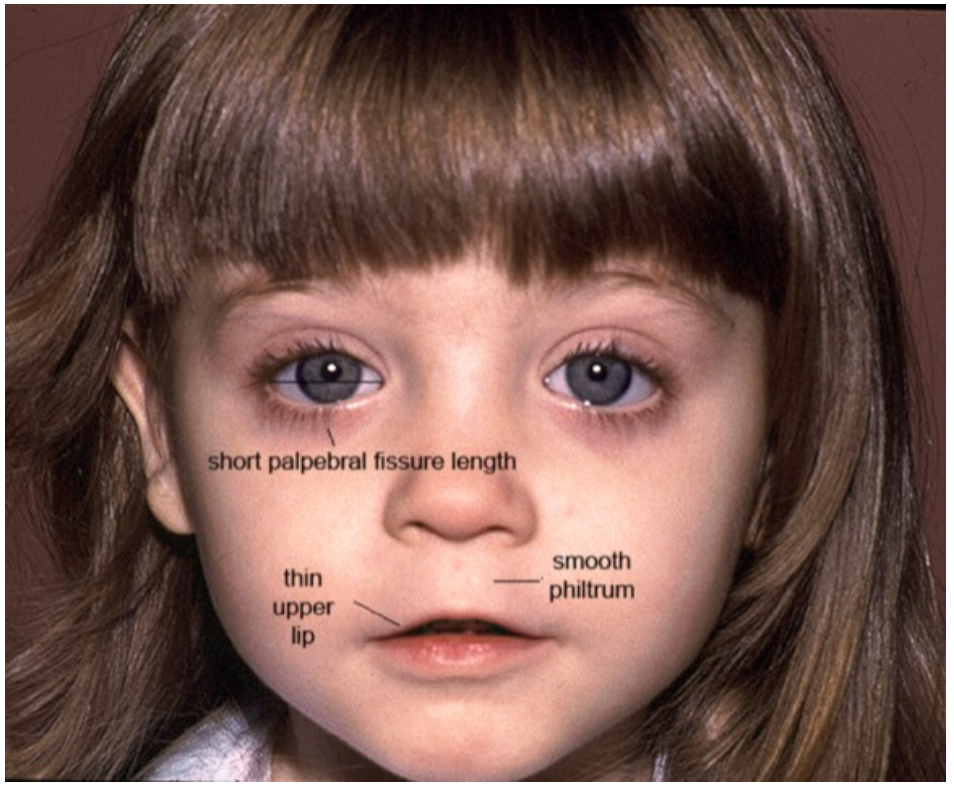
- Early closure of sutures between cranial and facial bones
- Depending where the early fusion is, characteristic distortion occurs
- Crouzon’s syndrome




https://www.craniofacialteamtexas.com/craniofacial-conditions-we-treat/craniosynostosis-diagnosis-and-treatment/

# Fetal alcohol syndrome (FAS)

- Deficiencies of midline tissue of the neural plate
- Caused by exposure to very high levels of ethanol



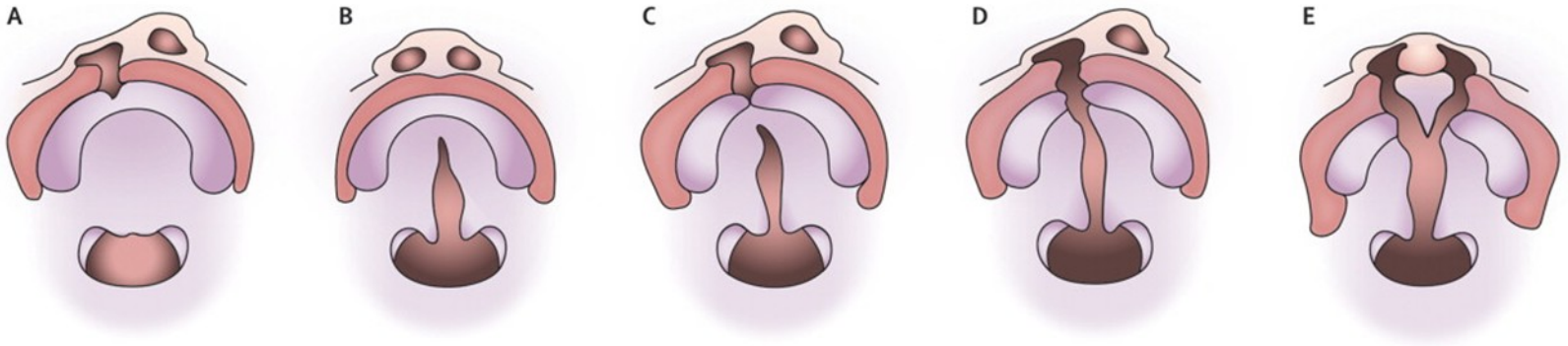

https://shaap.org.uk/blog/383-fetal-alcohol-spectrum-disorder-it-s-not-all-about-the-face.html

# Cleft lip and palate

- Most frequent maxifacial anomaly
- Incidens: 1,4-1,7/1000 birth
- Gender:
  - CLCP  boy dominant
  - CP girl dominant

# Etiology

- Chromosome discrepancies
- Exogen factors:
  - phase specificity of the exogen factors
  - CL: 5-7 iu. week
  - CP: 8-12 iu.week
  - ,,lack of fusion”




http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(09)60695-4/fulltext

# Interdisciplinary teamwork

- Maxillofacial surgeon
- ENT doctor
- Speech therapist
- Orthodontist
- Pszichiatrist

https://br.freepik.com/vetores-gratis/projeto-equipe-medica_1023371.htm

# Orthodontic treatment of cleft patients

- **Newborn:** PNAM
- **7-10 years:** Transversal expansion and sagittal mesialization of the maxilla
- **11-12 years:** Orthodontic treatment
- **18 years +** Orthognath surgery)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# PNAM

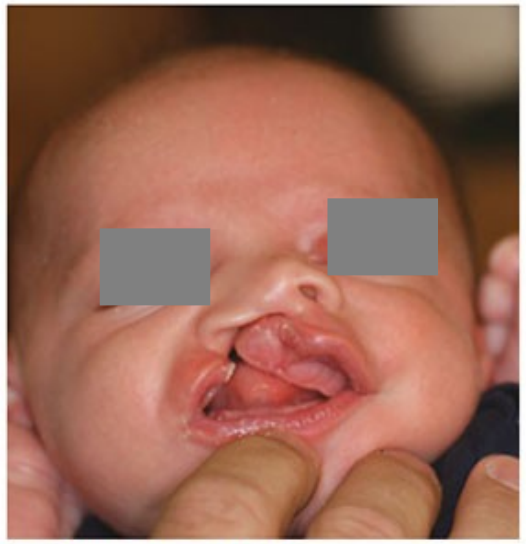
Preoperative Nasoalveolar Molding has three main aspects:

1. **Guiding the growth of the alveolar segments**
2. **Decreasing the gap between the lip segments**
3. **Shaping of the nose**

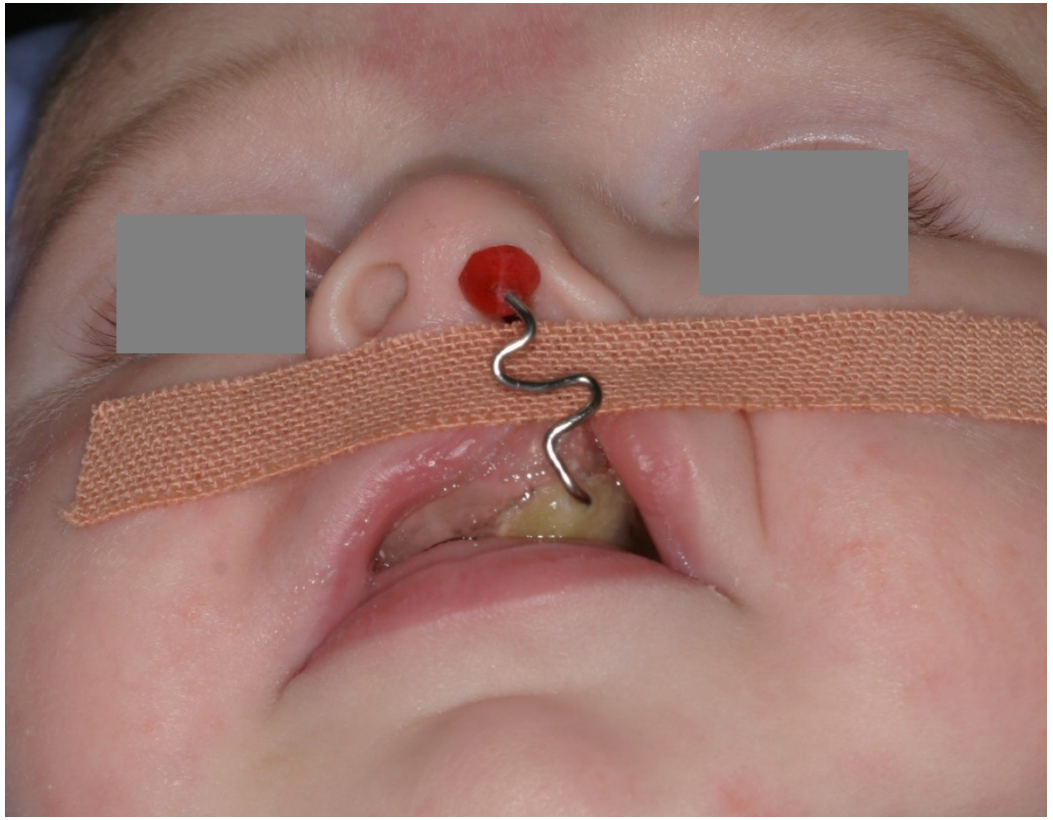
http://blogs.jpmsonline.com/2016/07/05/one-begets-the-other-the-importance-of-a-childs-self-esteem-for-good-mental-health/

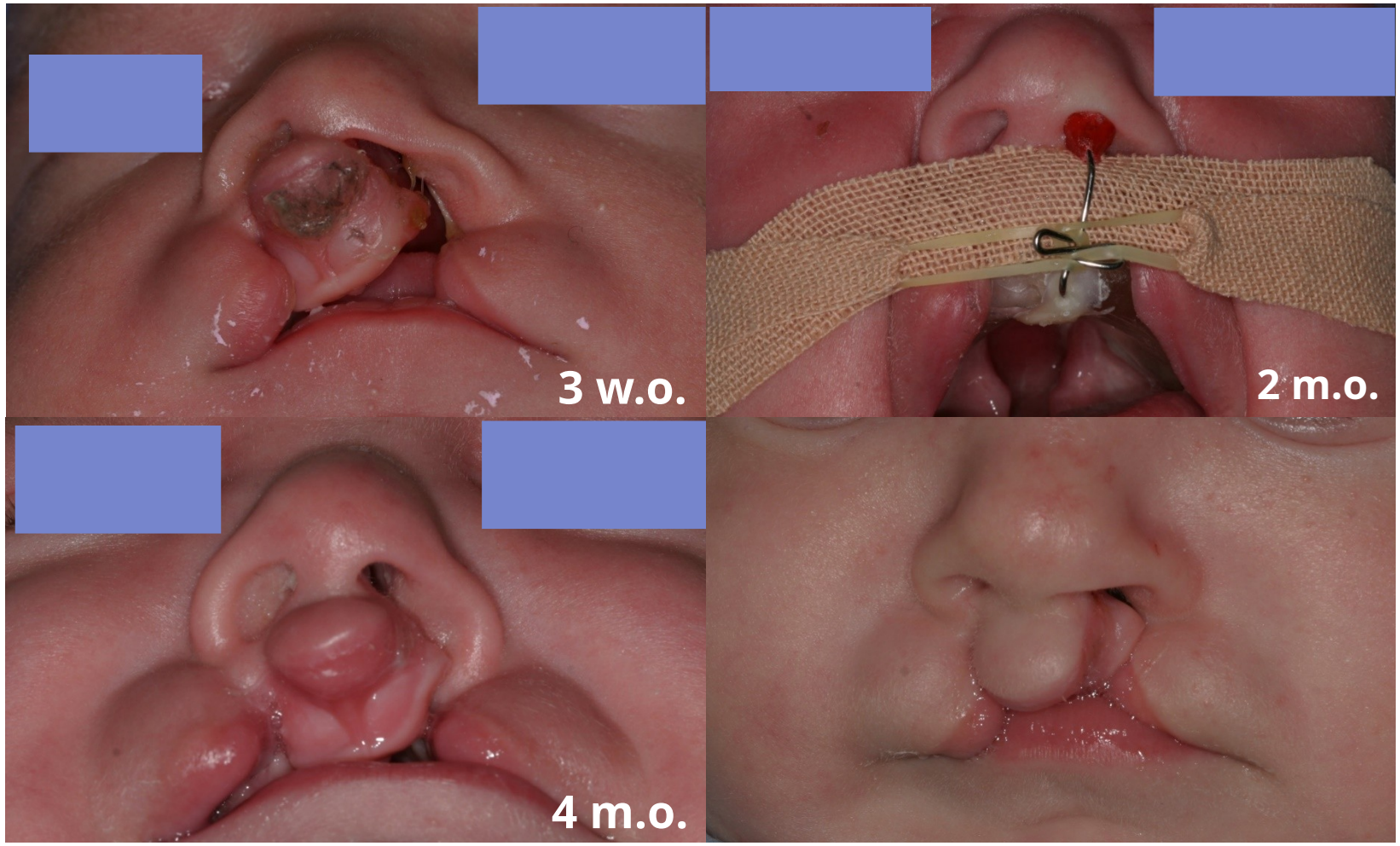
# Forming of processus alveolaris

# Shaping of nose



https://www.orthopracticeus.com/ce-articles/treating-cleft-palate-presurgical-nasoalveolar-molding-pnam




3 w.o.
2 m.o.
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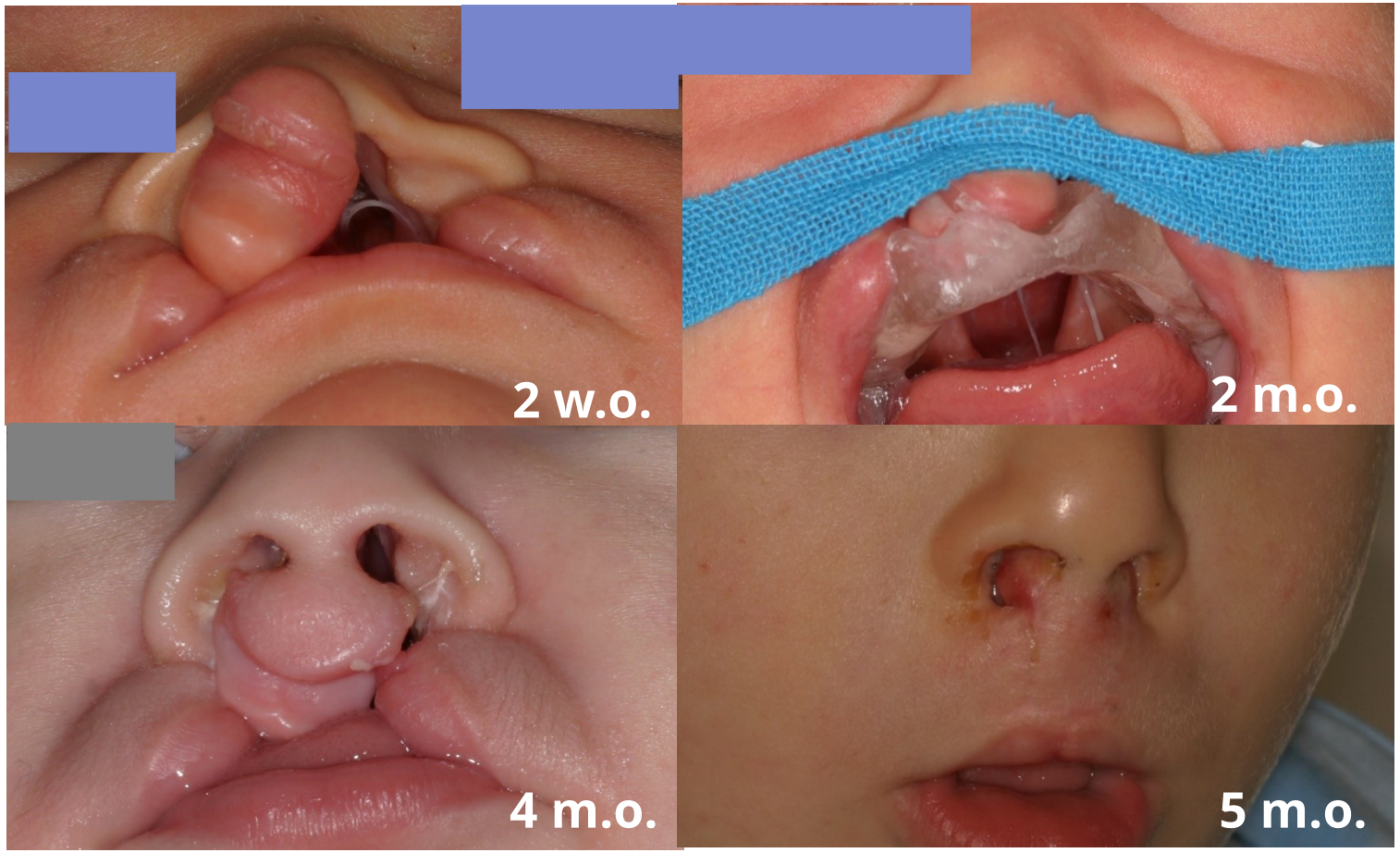
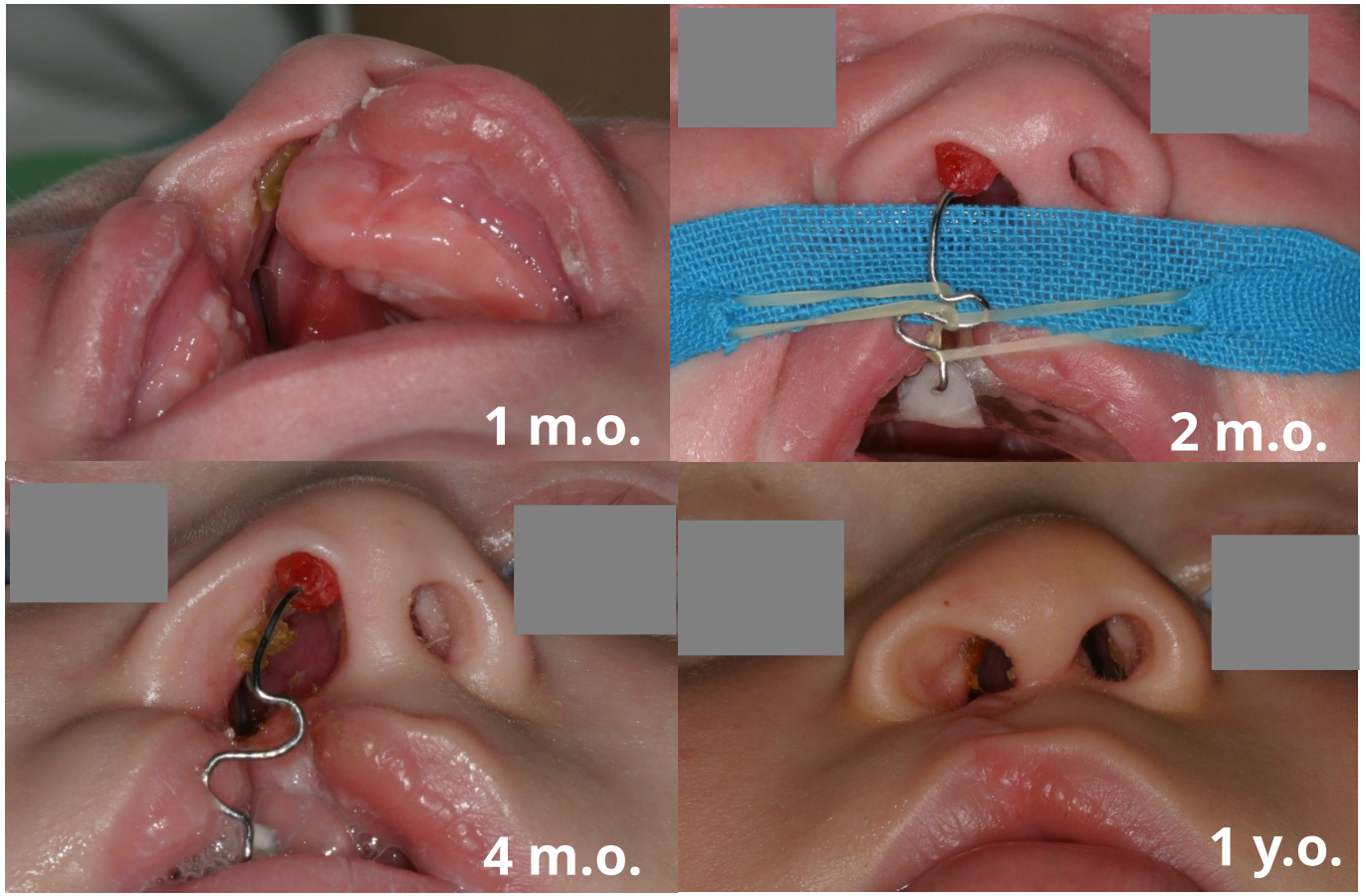
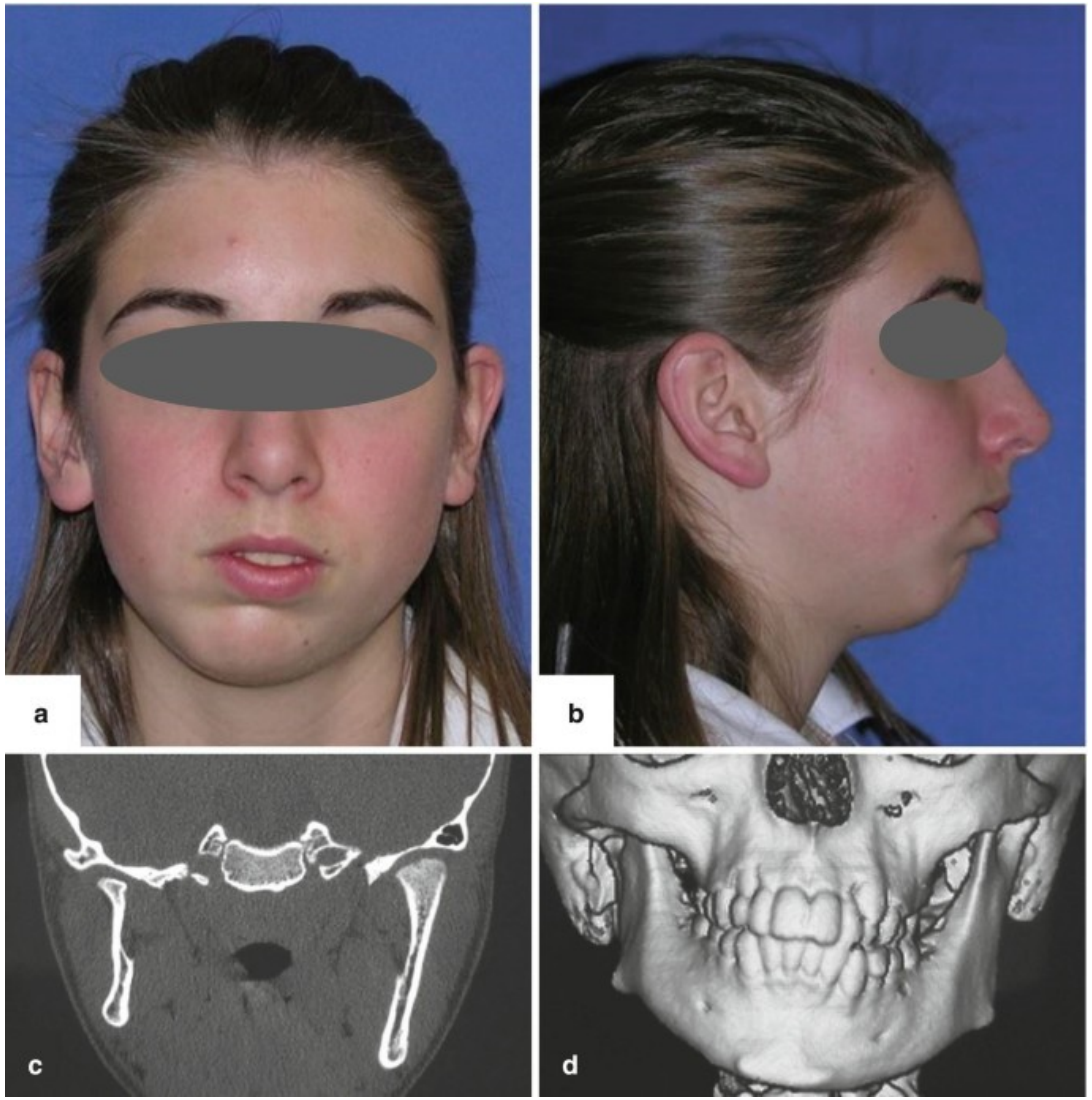

2 w.o.
2 m.o.
4 m.o.
5 m.o.


1 m.o.
2 m.o.
4 m.o.
1 y.o.

# Jawfracture

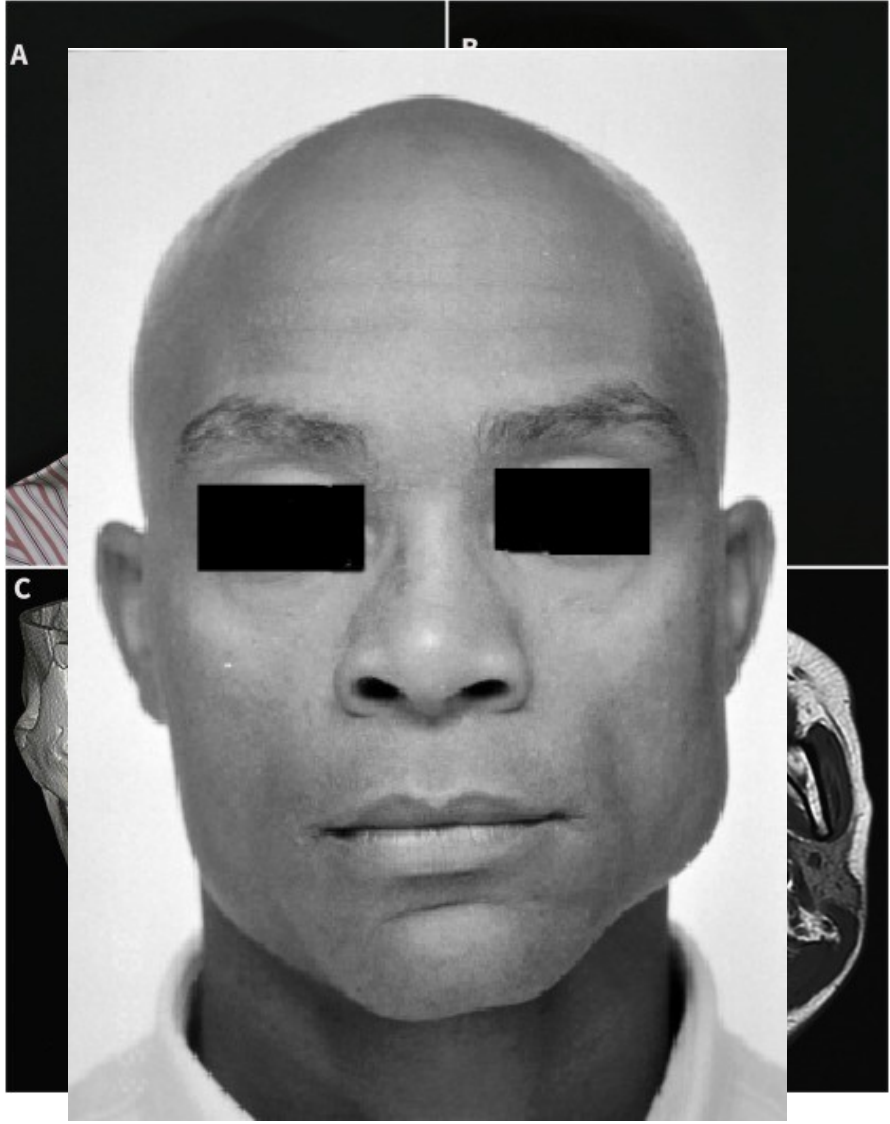
- Condylar fracture
- Asymmetric growth tendency




Gerbino, G., Chianca, V., Ramieri, G. (2020). Developmental Disorders. In: Robba, T., Tanteri, C., Tanteri, G. (eds) MRI of the Temporomandibular Joint. Springer, Cham. https://doi.org/10.1007/978-3-030-25421-6_5

# Muscle dysfunction

- Formation of bone at muscle attachment
- Soft tissue matrix
- Excessive muscle contractions restricts growth like scar tissue
- Lengthening of the lower face and open bite can accompany muscle dystrophy



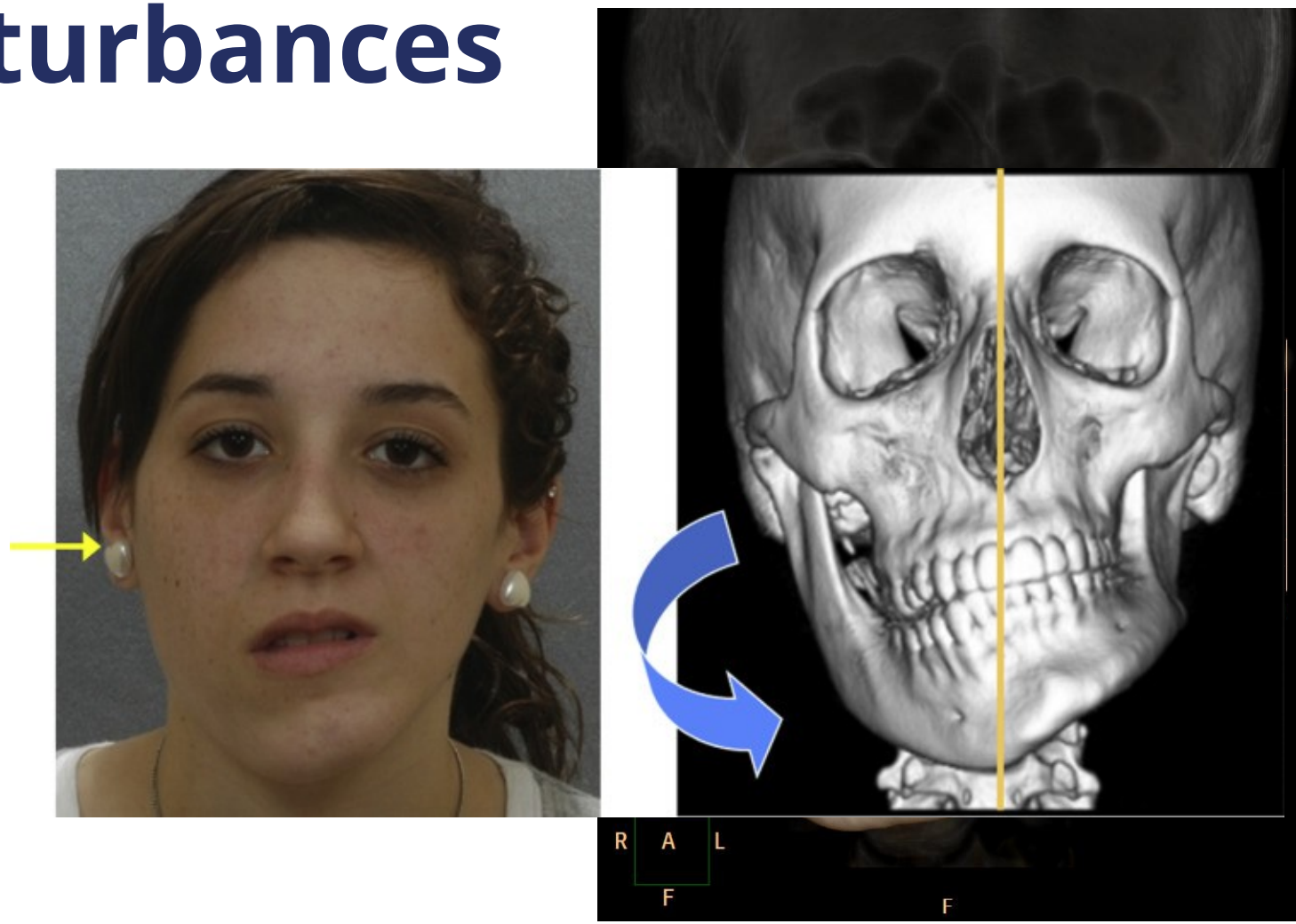

Masayuki Tsuneki, Satoshi Maruyama, Manabu Yamazaki, Kanae Niimi, Tadaharu Kobayashi, Hideyoshi Nishiyama, Takafumi Hayshi, Jun-ichi Tanuma.Masseter muscle hypertrophy: A case report,.Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology, 2019,Volume 31, Issue 6,

https://doi.org/10.1590/S0103-64402006000400015

# Later growth disturbances

- Condylar hyperplasia
  (hemimandibular hypertrophy)

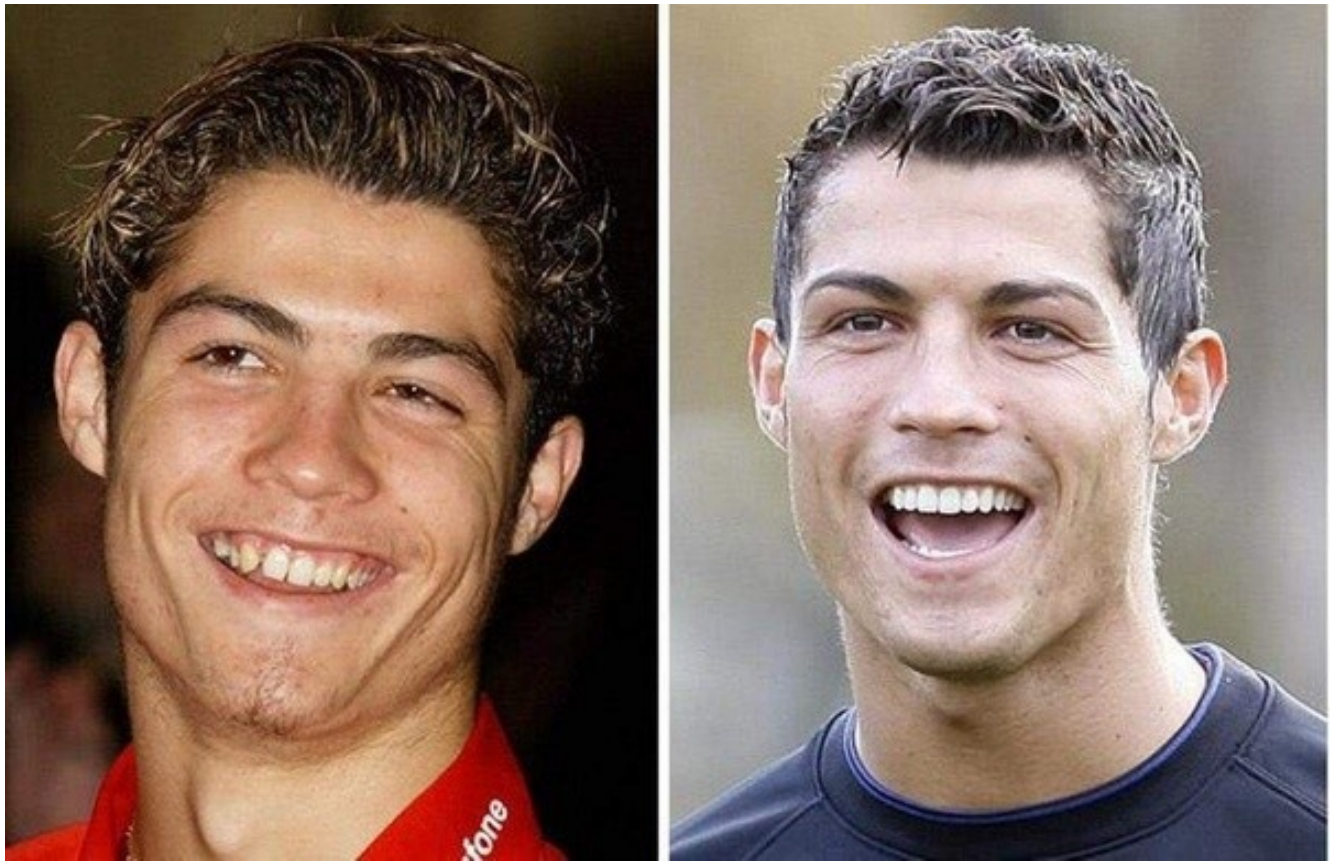
- Acromegaly




Jeffrey C. Posnick, Jorge Perez, Anish Chavda. Hemimandibular Elongation: Is the Corrected Occlusion Maintained Long-Term? Does the Mandible Continue to Grow? Journa
Oral and Maxillofacial Surgery, 2017,Volume 75, Issue 2.

# Congenitally missing teeth

- Anodontia, oligodontia→ ectodermal dysplasia
- Hypodontia – relatively common

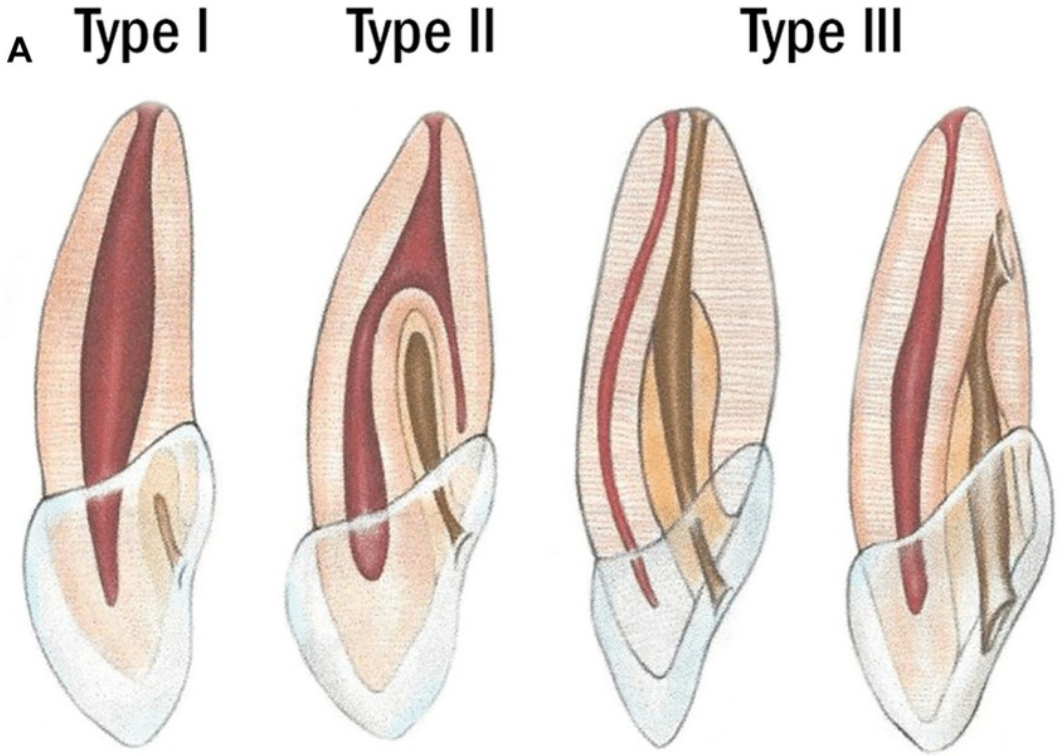


Chen, H. (2016). Hypohidrotic Ectodermal Dysplasia. In: Atlas of Genetic Diagnosis and Counseling. Springer, New York, NY. https://doi.org/10.1007/978-1-4614-6430-3_127-2

# Malformed and supernumerary teeth

https://www.kids-dentist.com.au/extra-teeth-in-gums/
https://www.meetdandy.com/learning-center/articles/charting-supernumerary-teeth/

# Malformed teeth




https://onlinelibrary.wiley.com/doi/10.1155/2013/634052
https://www.dental-update.co.uk/content/restorative-dentistry/dens-evaginatus-addition-beats-subtraction/
https://www.researchgate.net/figure/a-Classification-of-dens-invaginatus-Oehlers-17-A-schematic-drawing-showing-the_fig1_350215529

# Effect of primary teeth-related dental trauma

https://www.juniordentist.com/dilaceration.html



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# Early loss of deciduous teeth

- Trauma or caries
- Early loss by definition is when the permanent tooth is not expected to erupt within a year
- Midline deviation, reduction of arch length (primary molar and canine loss)
- Esthetic and speech effects (primary incisors)

https://minalidental.com/services/space-maintenance/

# Early loss of first permanent molars

- Patient and parents are often not aware of it
- Spontaneous space closure – timing is essential
- Can cause skeletal and dental asymmetry

b

Ashley, P., Noar, J. Interceptive extractions for first permanent molars: a clinical protocol. *Br Dent J* **227**, 192–195 (2019). https://doi.org/10.1038/s41415-019-0561-7

# Environmental factors


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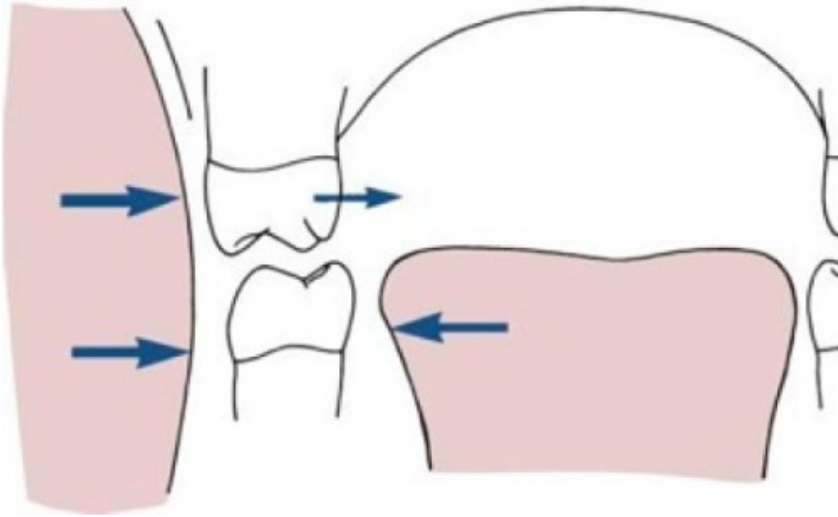
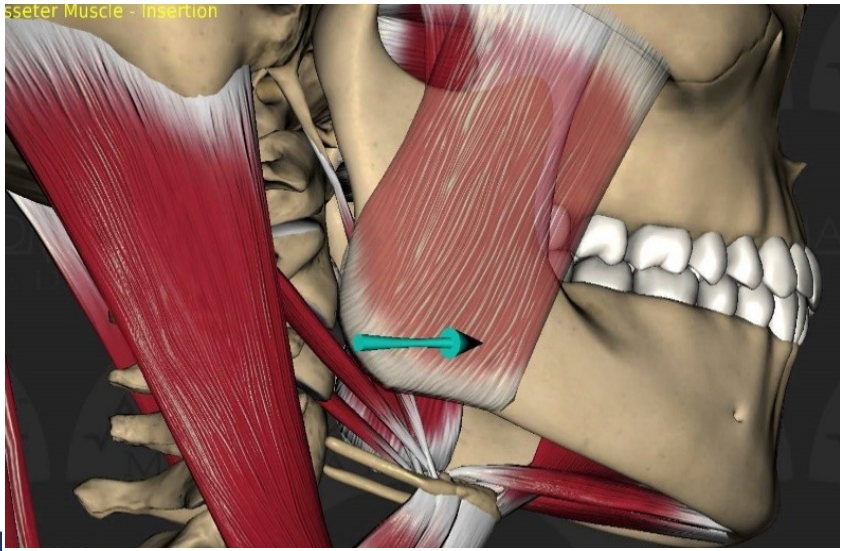
# Environmental effects-Equilibrium

- If any object is ***subjected to a set of forces but remains in the same position***, the forces must be in balance or ***equilibrium***.
- Force magnitude
- Duration of application/exposure
- Light forces for a prolonged period of time (min. 6h/day) produce changes in equilibrium and cause alterations in tooth positions



# Masticatory function

Heavy, intermittent forces, short exposure




Hyopthesis:

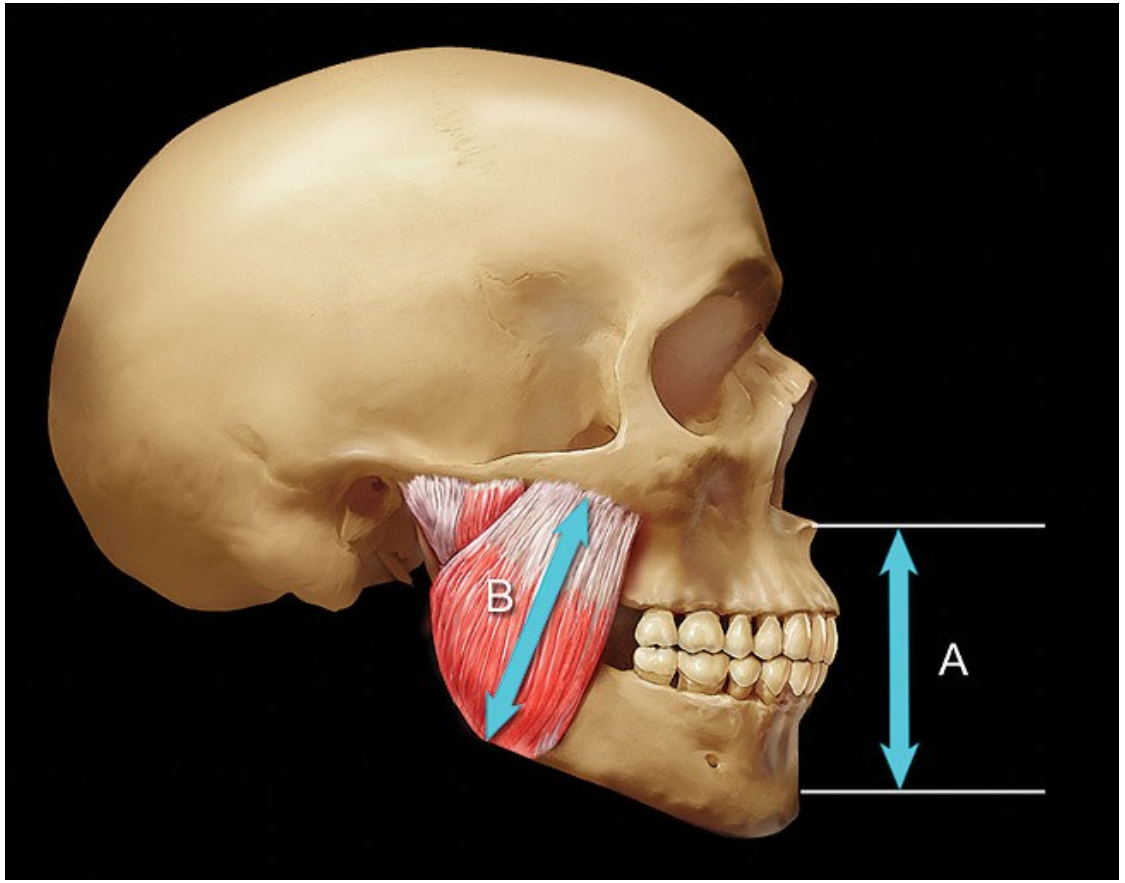
- greater use of the jaws, with higher and/or more prolonged biting force, could increase the dimensions of the jaws and dental arches or
- less use of the jaws might lead to underdeveloped dental arches and crowded and irregular teeth and the resulting
- decreased biting force could affect how much the teeth erupt → lower face height and overbite/open bite relationships.

# Bite force and eruption

Face height and bite force connection:

Face height ↑ →bite force ↓

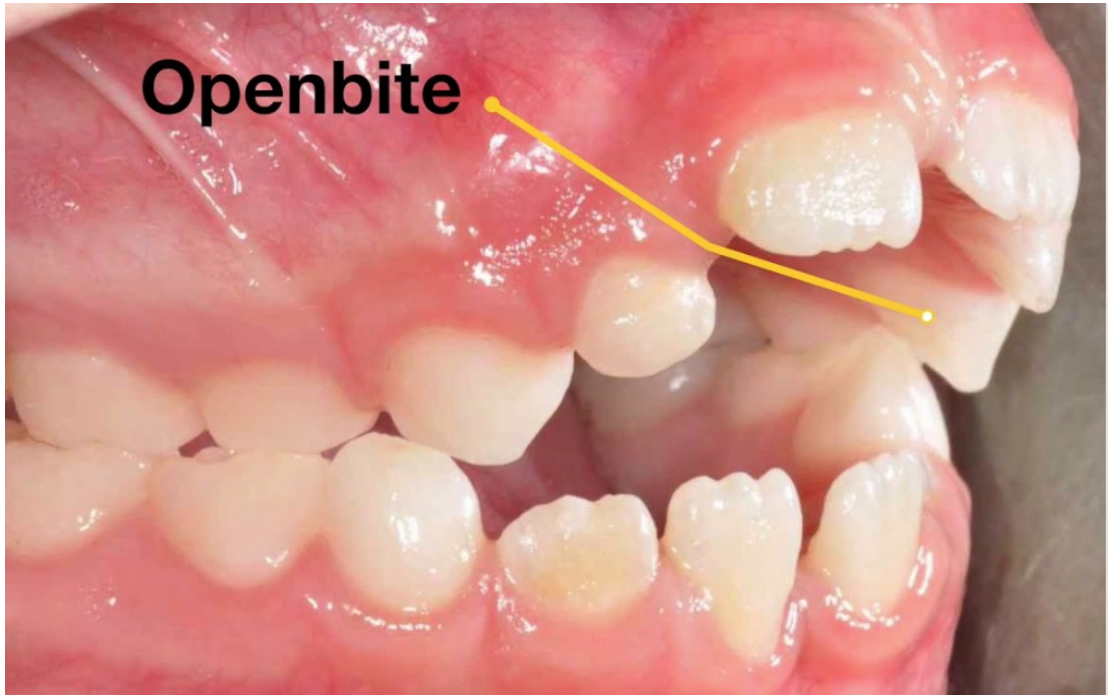
*EB: more likely that the different biting force is an effect rather than a cause of the malocclusion!*




https://cdeworld.com/courses/4827-changing-vertical-dimension-a-solution-or-problem

# Thumb sucking and other habits

- Almost all children engage in some form of *non nutritive sucking* (thumb or pacifier)
- Only during primary dentition → usually no long-term effect
- Time-factor
- Persisting during and after eruption of permanent teeth → characteristic malocclusion




Characteristics:
1. Open bite
2. Protruded, flared upper incisors
3. Retroclined lower incisors
4. Upper arch constriction

# Swallowing pattern

Tongue thrusting

- Primary seen in 2 situations:
  - Transitional stage in maturation (seen at earlier ages in children with normal occlusion)
  - Functional adaptation to an anterior open bite
- Time factor → habitual tongue position seems to be more important

# Respiration, airways

- Respiratory needs are the primary determinant of the posture of the jaws and tongue
- During **mouth-breathing** mandible and tongue is lowered→ equilibrium changes → changes in morphology of teeth and jaws
- Adenoid facies or long face syndrome:
  - Narrow width
  - Protruding teeth
  - Incomplete lip seal
  - Elevated lower facial height

https://www.researchgate.net/figure/Adenoid-face-with-orofacial-dysfunction-myofunctional-syndrome-with-reduced-orofacial_fig16_288827829

# Summary

- We know from research, that malocclusion **isn't** caused by independent inheritance of dental and facial characteristics
- Oral function
  - there are no simple explanations for malocclusion in terms of oral function
  - Mouth breathing, tongue thrusting, soft diet, sleeping posture—none of these can be regarded as the sole or even the major reason for most malocclusions
- Heredity
  - relatively **high** heritability of craniofacial dimensions
  - relatively **low** heritability of dental arch variations
- At least, at this point we are more aware of how much we really do not yet know about the etiology of orthodontic problems

# Thank you for your kind attention!

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