the Child Dental Patient with

Oligontia:

Early implants therapy

Phenotypic and surgical aspects
Considerations linked to skeletal growth

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Isolated and syndromic oligodontia

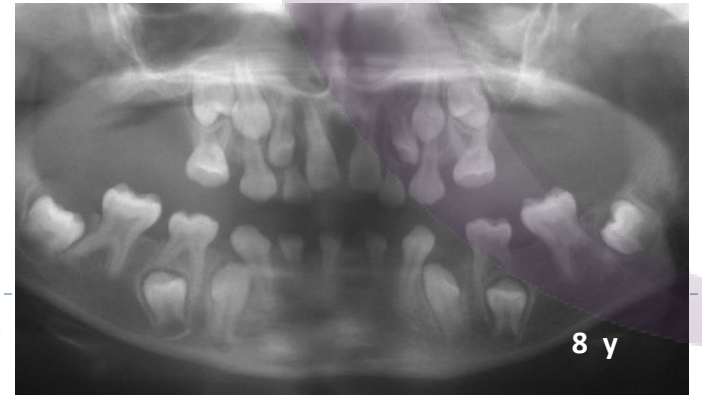
Dental phenotype defined by a minimum of 6 ageneses

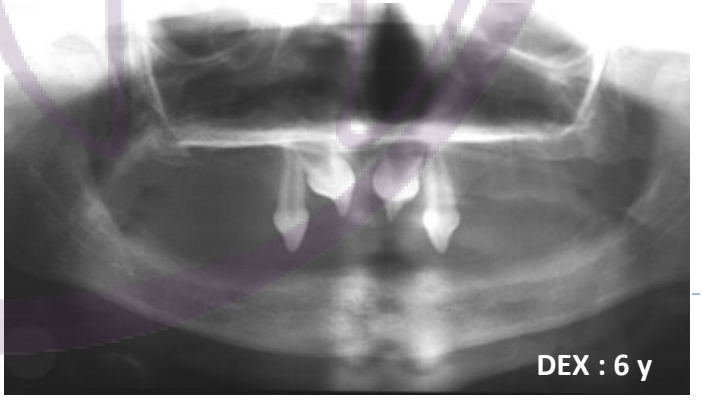
Isolated oligodontia: mutation in

- *MSX1*
- *PAX9*
- *AXIN2*
- *EDA-EDARADD-WNT10A*

Syndromic oligodontia

- Hypohidrotic Ectodermal Dysplasia (HED)
- Rieger, Wolff-Hirschorn, Van der Woude, Johanson-Blizzard syndromes, Craniosynostoses…





Early implants placements in oligodontia: history

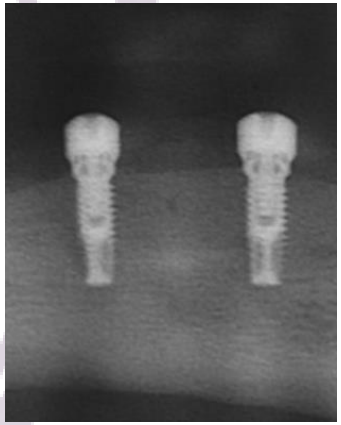
- First team (in Sweden): Bergendal et coll., 1991

*Bergendal T, Eckerdal O, Hallonsten AL, Koch G, Kurol J, Kvint S. Osseointegrated implants in the oral habilitation of a boy with **ectodermal dysplasia**: a case report. Int Dent J. 1991;41(3):149-56*

- Ectodermal dysplasia (ED) comprises a large group of clinical and genetically heterogeneous diseases affecting the ectoderm-derived structures, such as the hair, nails, sweat glands, and teeth.
- The prevalence is estimated between 1,6 and 22 per 100,000 persons
- The most common forms of ED are the X-linked hypohidrotic (XLHED)
- Historically, prosthetic treatment for ED patients involved removable partial dentures, removable partial or complete overlay dentures and fixed partial dentures.
- **The advent of dental implants has provided an additional treatment modality for restoration of the dentition in this group of patients.**

Early implants therapy : Questions

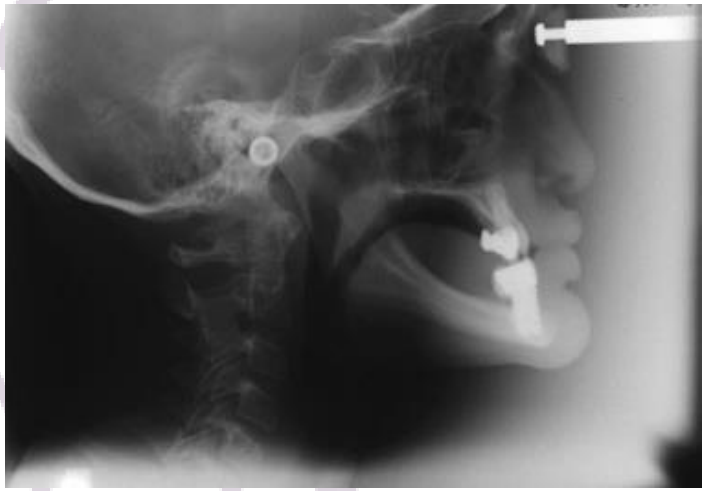
- Effects of early osteointegrated implants on maxillary and mandibular skeletal growth ?
- Effects of growth on osteointegration and implants axis ?
- Long term osteointegration prognosis ?
- Implants evolution at the end of skeletal growth ?



Extreme caution when placing implants during growth: skeletal changes and dentition

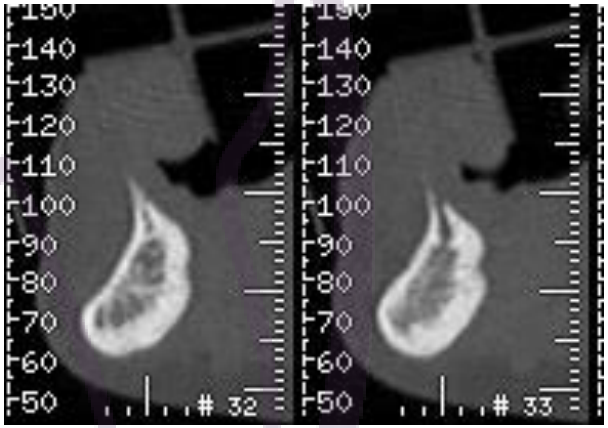
What is the ideal age for early implants therapy? diagnosis parameters to consider

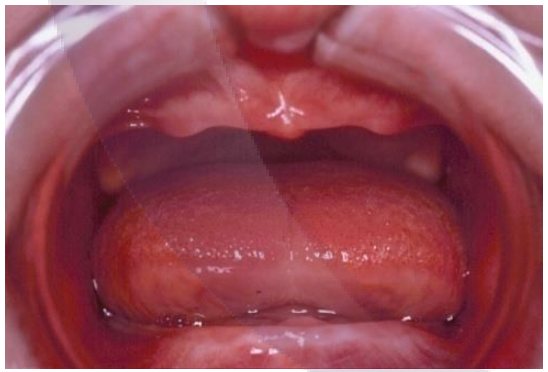
- Sex
- Skeletal maturity
  - X-ray of the hand and wrist
  - Cephalometry superposition
- Phenotypic severity
- Topographic distribution of dental ageneses and implants location



What is the ideal age for early implants therapy? diagnosis parameters to consider

- Anatomical characteristics of the implants sites:
  - Marked hypodevelopment of mandibular symphysis before 6 years-old
- Cognitive maturity and risks of psychological stress
- Oral function





Early implants placements during growth in oligodontia

- Importance of a comprehensive and systematic clinical protocol

- International Consensus about indications, surgical phases and prosthetic rehabilitation : *International Delphy Study*

Klineberg I, Cameron A, Whittle T, Hobkirk J, Bergendal B, Maniere MC, King N, Palmer R, Hobson R, Stanford C, Kurtz K, Sharma A, Guckes A. Rehabilitation of children with ectodermal dysplasia. Part 1: an international Delphi study. Int J Oral Maxillofac Implants. 2013; 28(4):1090-100

Klineberg I, Cameron A, Hobkirk J, Bergendal B, Maniere MC, King N, Watkins S, Hobson R, Stanford C, Kurtz K, Sharma A. Rehabilitation of children with ectodermal dysplasia. Part 2: an international consensus meeting. Int J Oral Maxillofac Implants. 2013 ;28(4):1101-9.

Early implants therapy of oligodontia: French policy

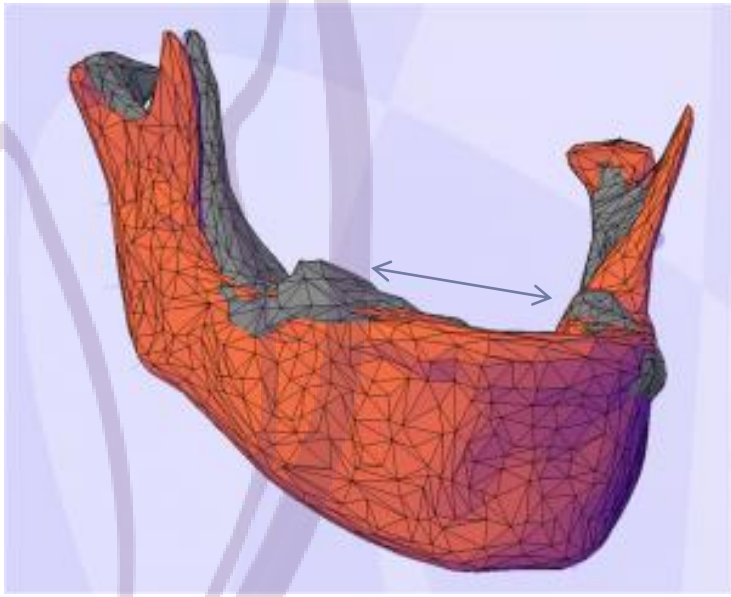
High Health Authority (2006): implants reimbursement

« Muliple dental ageneses treatment in the context of Ectodermal Dysplasia and other rare diseases in children with oligodontia : placements of 2 implants (maximum 4) in the mandibular symphysis from 6 years-old before the end of skeletal growth and after conventional prosthetic treatment failure »

- **Oligodontia** in permanent dentition
- Implants possible in the mandibular **symphyseal** area
- Previous prosthetic failure
- Treatment before the end of skeletal maturation (determined radiographically)

Skeletal mandibular growth specificities

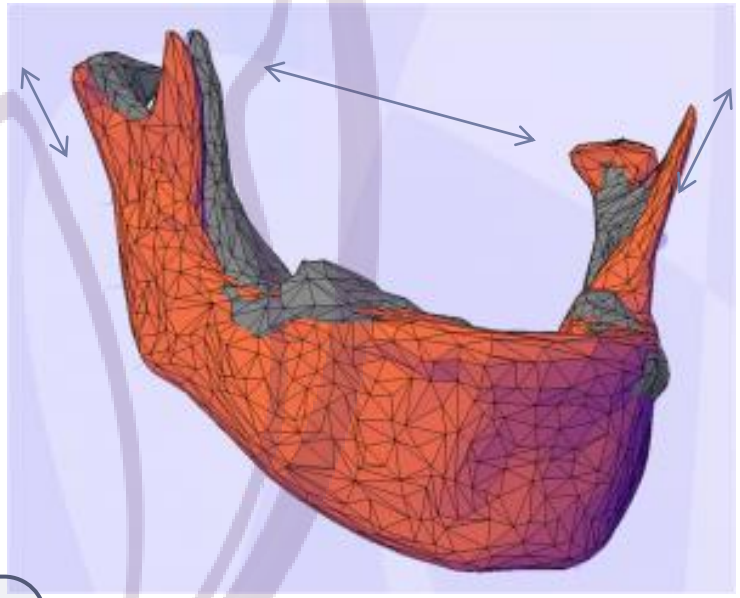
- Transverse stability of symphysis at 6 years-old
- Mandibular symphysis suture closure of at 2 years-old
- Lingual periosteal bone remodeling and apposition
- Dimensional bone changes in the vertical dimension of the symphyseal alveolar ridge



Singer SL, Henry PJ, Liddelow G, Rosenberg Long-term follow-up of implant treatment for oligodontia in an actively growing individual: a clinical report. J Prosthet Dent. 2012;108:279-85.

Skeletal mandibular growth specificities

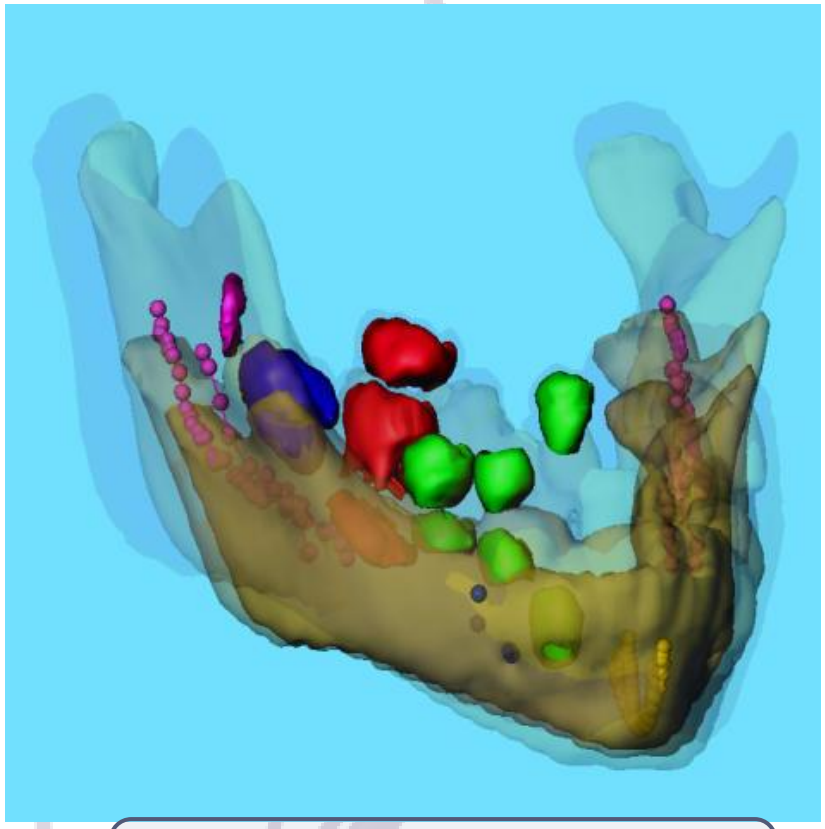
- Dynamic transverse and anteroposterior growth in the mandibular posterior area
- Rotational growth
- Subperiosteal transverse remodeling distally of mental foramina



Placement of implants in the posterior mandibular area has to be delayed untill skeletal maturation

Skeletal mandibular growth specificities

- Bone apposition at the condyle, coronoid process, alveolar process and posterior aspect of the ramus
- Bone resorption on the anterior aspect of the ramus and lingual side of the mandibular body



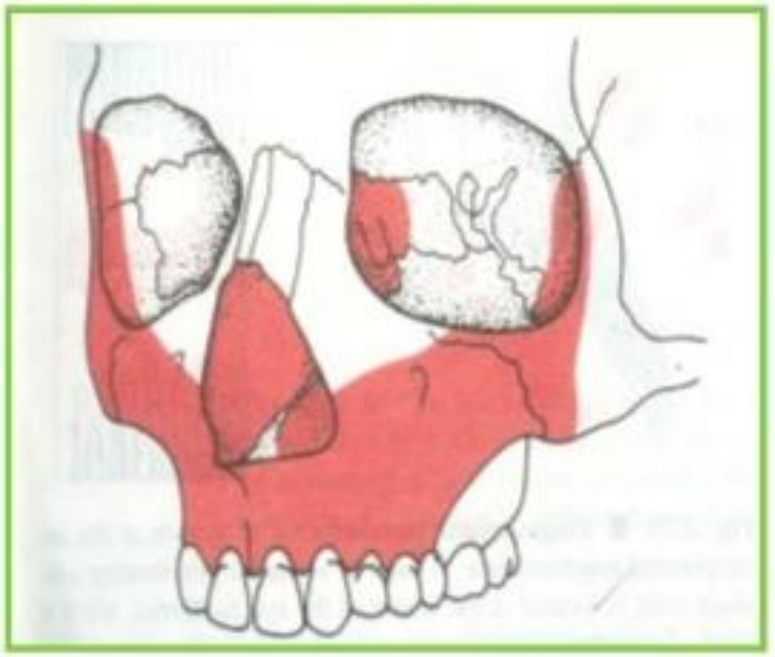
CT superimposition from 4 different ages (0, 1, 7 ans 10 years old)

Krarup et al., 2005

Skeletal maxillary growth specificities

- Resorption and remodeling of the external surface of the premaxilla

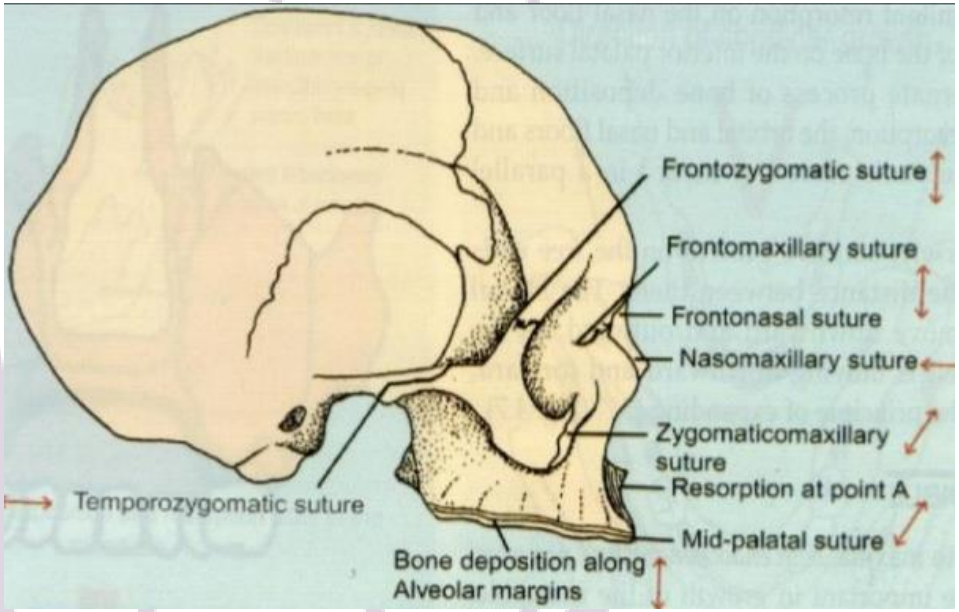
- Lateral surfaces of the alveolar process are resorptive



Risks of implants exposure and osteointegration complications

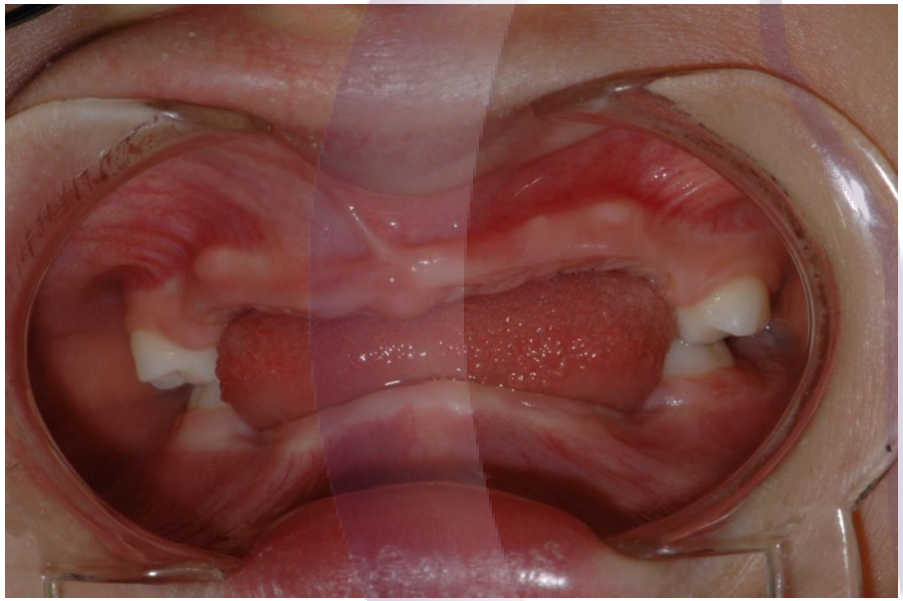
Skeletal maxillary growth specificities

- Marked dimensional changes
- Transverse maxillary growth at midpalatal suture
- Bone remodeling of the nasal and sinus cavities floors
- Displacement of nasomaxillary complex linked to the cranial base growth



Osteointegrated implants in the maxilla have to be delayed untill skeletal maturation

Prosthodontic rehabilitation: as a first step



Criteria to consider for prosthodontic rehabilitation

- Degree of cognitive maturity and cooperation
- Alveolar bone hypotrophy
- Cranio-facial dysmorphies
  - Class III skeletal relationships
  - Maxillary retrognathism
  - Reduced facial height

Johnson et *al.*, 2002

Complication risk factors in early implants placement

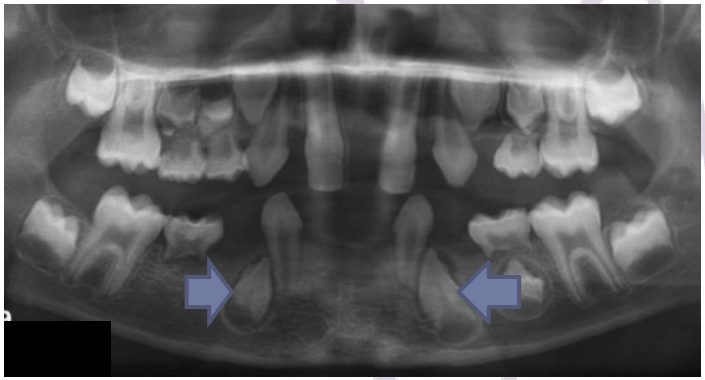
- Mandibular rotational growth : modifications of implants axis

- Vertical bone growth : implants submergence risks

Kearns G1, Sharma A, Perrott D, Schmidt B, Kaban L, Vargervik K. Placement of endosseous implants in children and adolescents with hereditary ectodermal dysplasia. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1999;88(1):5-10.

Complications risk factors in early implants placement

- Interferences with skeletal growth in all dimensions
- Traumatic lesions of the dental germs during the surgical phase

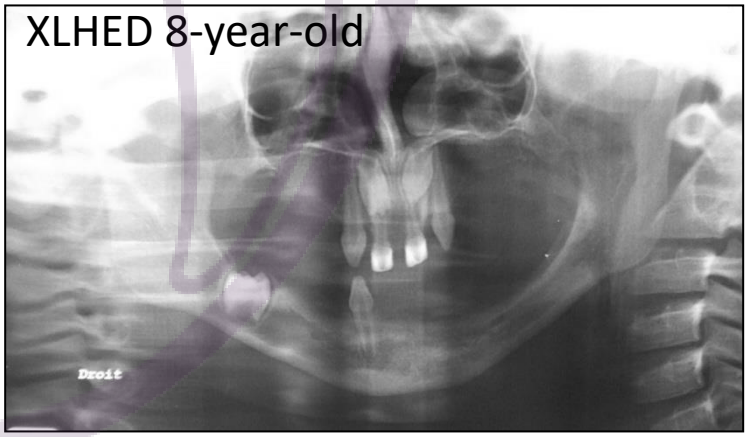


- Increased osteointegration complications in XLHED patients

Bergendal B, Ekman A, Nilsson P. Implant failure in young children with ectodermal dysplasia: a retrospective evaluation of use and outcome of dental implant treatment in children in Sweden. Int J Oral Maxillofac Implants. 2008;23(3):520-4.

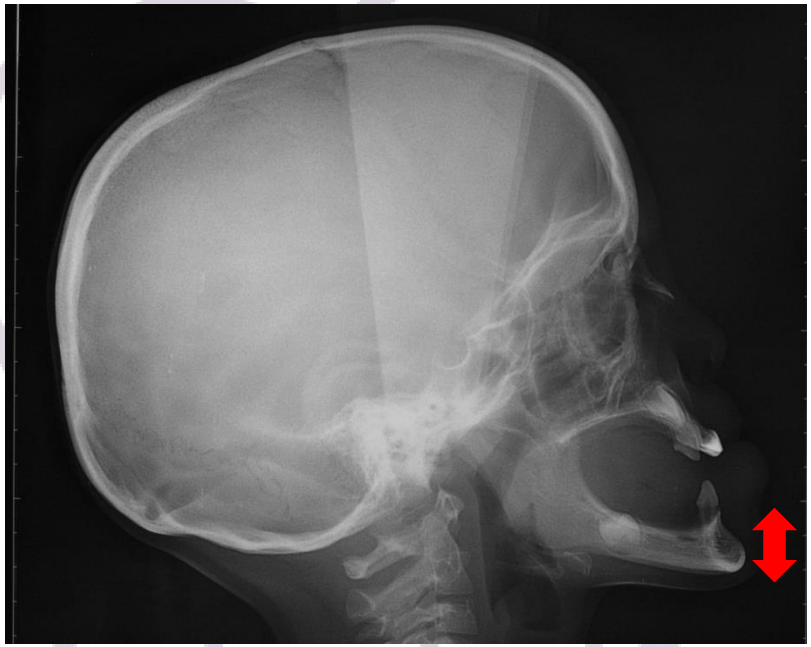
Pre-operative diagnosis : important parameters to consider

- Medical history
  - ➢ Immune, cardiac, neurological, skeletal defects
- Clinical signs of ectodermal defects
- Cleft lip-palate associated to oligodontia
- Dental anamnesis: previous prosthodontic rehabilitation
- Cognitive maturity

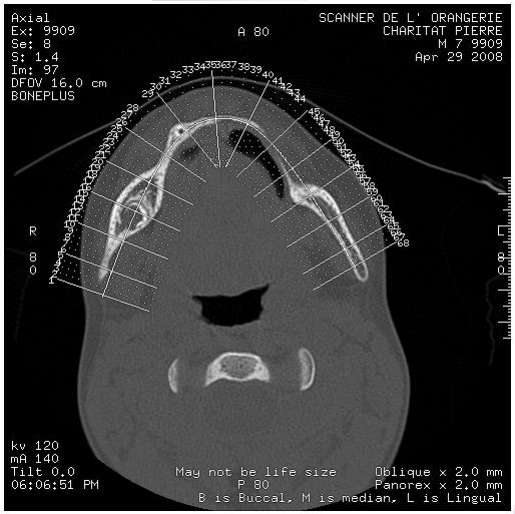


Pre-operative imaging

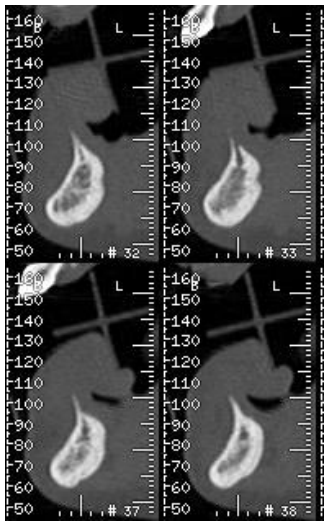
- Teleradiography and cephalometric analysis



- CT

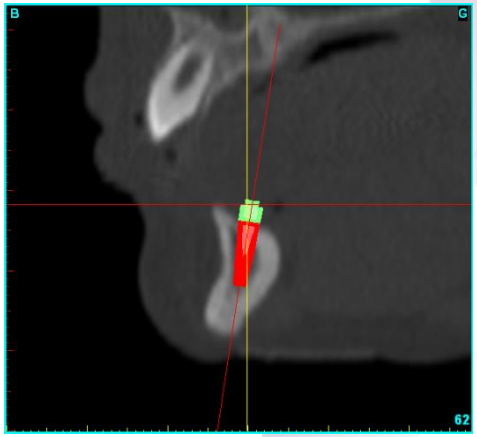


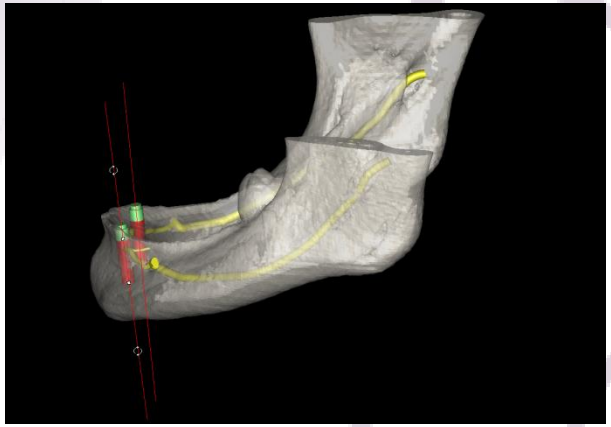
Pre-operative imaging: CBCT or CT with trimensional reconstructions

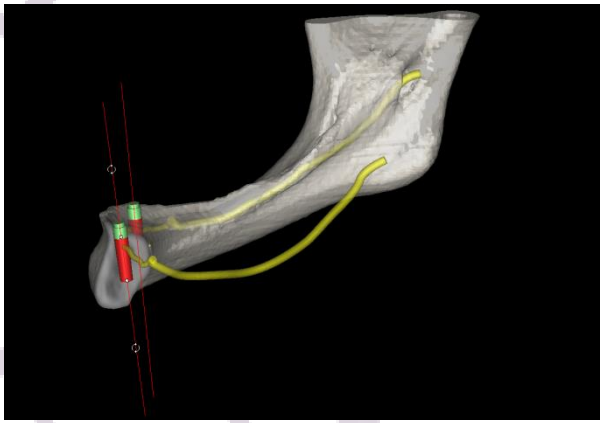


- Analysis of local anatomical conditions and bone phenotype for an optimal surgical planning
- Degree of bone hypotrophy
- Bone cortical thickness
- Increased medullary bone mineralization and hypercorticalization in XLHED
- Qualitative bone analysis (Lekholm et Zarb classification)

Computer-assisted preoperative implants simulation







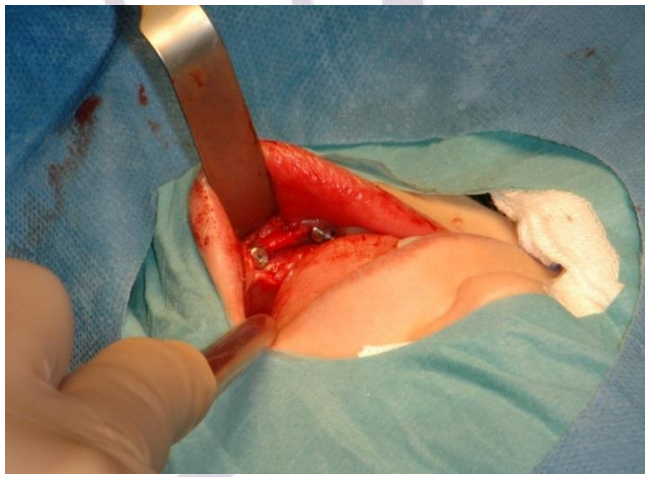
- Optimal surgical planning
- Implants length and diameter determination
- Anatomical risks identification
- Drilling axis

Surgical step

• Management under general anaesthesia could be indicated (young age)

• The most frequent solution: placement of 2 symphyseal implants

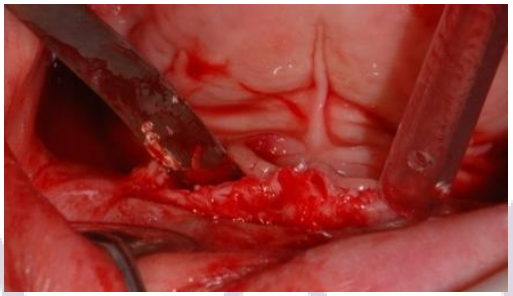
- Short length (ex: 8 mm)
- Short diameter (ex : 3 mm)

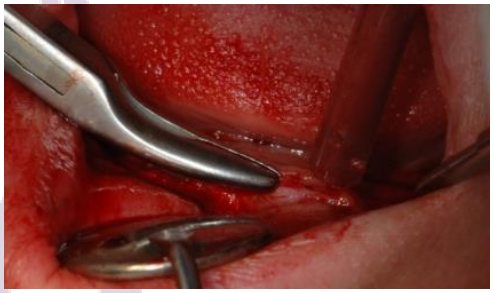


- Taking account of the alveolar crest hypotrophy
- Minimizing the surgical trauma
  - Low speed drilling
  - Under irrigation
- Two-surgical steps are prefered in syndromic contexts to improve osteointegration

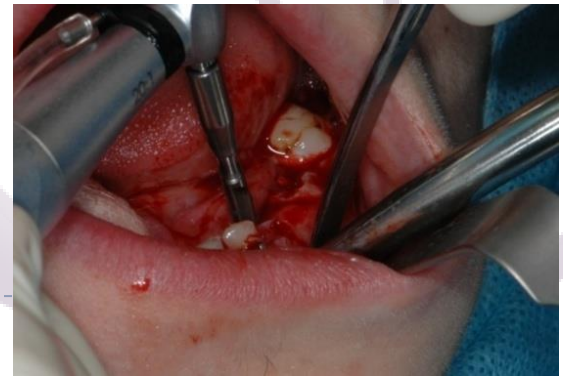
Surgical step

Adaptation of the surgical protocol to the anatomical context





- Osteotomy for sharp-edged alveolar bone
- Adaptation of the drilling axis to the mandibular crest
- Bone grafts in the symphyseal area are not indicated during growth



Indication of mini-dental implants

- Patients with severe alveolar bone hypotrophy
- When placement of conventionnal implant is impossible without bone grafting
- Reduced diameter : 1.8-2.4 mm
- One surgical step and stabilization of removable mandibular prosthesis

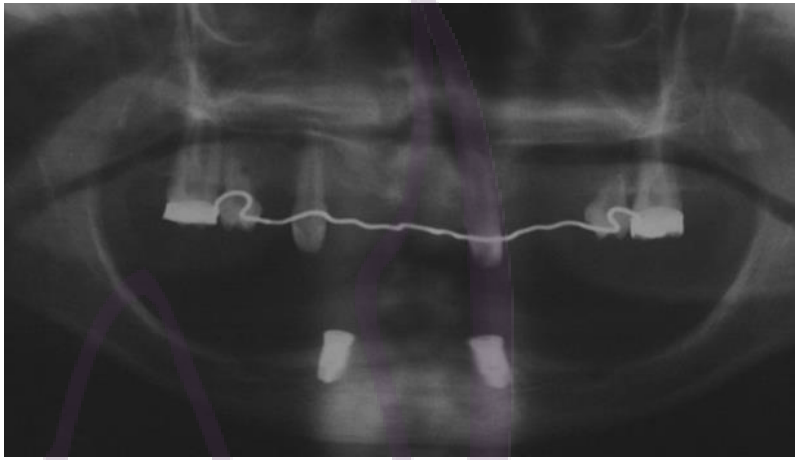
Sfeir E, Nassif N, Moukarzel C. Use of mini dental implants in ectodermal dysplasia children: follow-up of three cases. Eur J Paediatr Dent. 2014; 15; 207-12.

Prosthodontics rehabilitation

- Implant supported prosthesis
- Implants placed into the anterior mandible of younger patients are used to support overdentures using ball attachments
- The patient and his parents have to be instructed regarding prosthesis placement, removal, and hygiene
- Review appointments are usually arranged at 6 and 12 months post prosthesis insertion, then on an annual basis
- New adjustments in prosthesis are usually performed

Importance of post-operative follow-up

- Regular clinical and radiological follow-up
- Early detection of osteointegration complications
- Adaptation of the implants-supported denture to growth and dentition
- Other main complications: Infraocclusion positioning of dental implants in the maxillary arch and rotation of dental implants in the mandibular arch



Conclusions

• The decision to commence implant therapy early in a child's life is a complex decision. Both the financial and biological costs need to be evaluated.

• Prior to cessation of growth, implant placement in the symphyseal region of the anterior mandible may be performed with caution.

•In growing jaws, dental implants require positional modifications, and they should be considered only under special circumstances.

•Multi-disciplinary approach is needed: medical genetics, paediatric dentistry, prosthodontics, oral/ maxillo-facial surgery.

• Importance of pre-operative evaluation : clinical and genetics, CT, tridimensional reconstructions, implants simulation.

• Strong probabilty for bone gratfting procedures, sinus lifts, distraction osteogenesis at the end of skeletal growth.