Neonatal Distraction Osteogenesis: Converting Virtual Surgical Planning Into Operative Reality

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- Participating Institutions
  - Montefiore Medical Center
  - Albert Einstein College of Medicine

- Disclosures:
  - ES Garfein MD: Consultant 3D Systems - Medical Modeling
  - OM Tepper MD: Consultant for Stryker CMF

Background

- Mandibular Distraction Osteogenesis (DO) has become an accepted method to manage severe cases of micrognathia-induced airway obstruction in neonates.
- Standard imaging offers a limited role during pre-operative planning and throughout the operation.

Background

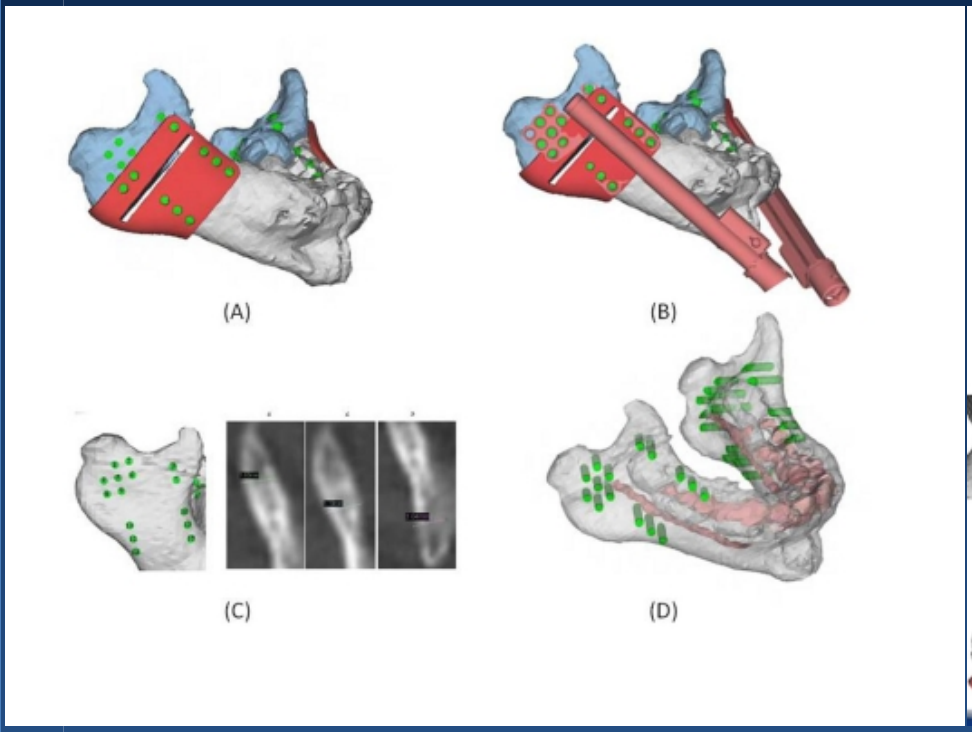
- To our knowledge, we offer the first description of virtual surgical planning (VSP) being used to guide DO in the mandible of a neonate.
- VSP can serve an important role in DO planning and can offer objective guidance in device selection, vector planning and operative guide positioning.

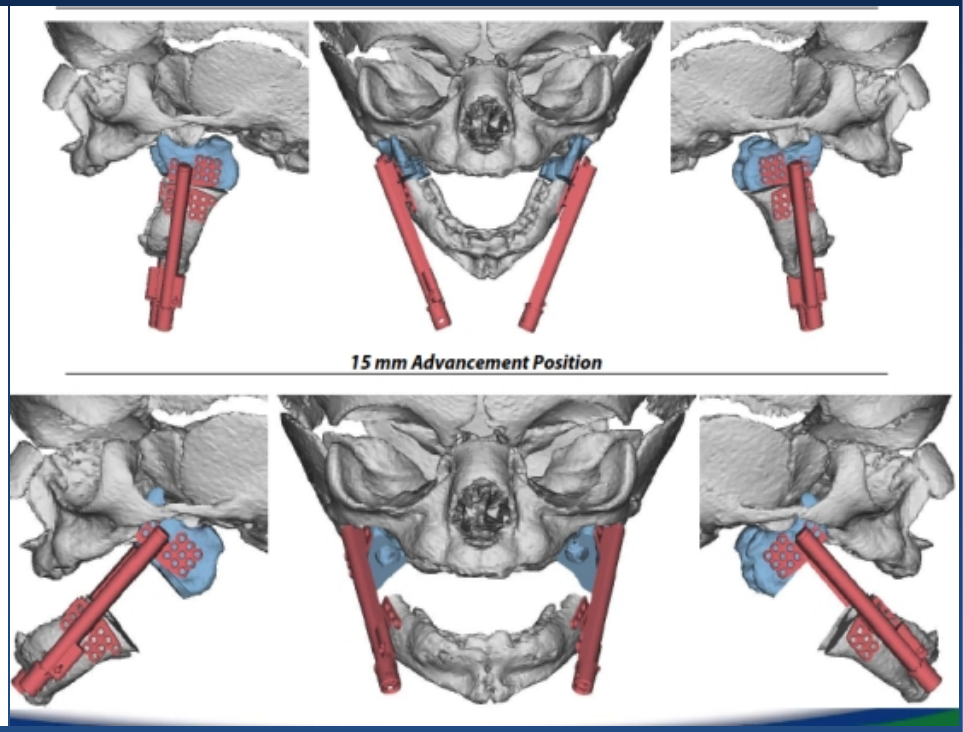
Pre-Operative VSP

- A virtual surgical plan was created using 3D reconstructions of the patients' CT scan.

- VSP was then used to create custom osteotomy guides that snapped onto the patients' mandible in the operating room.

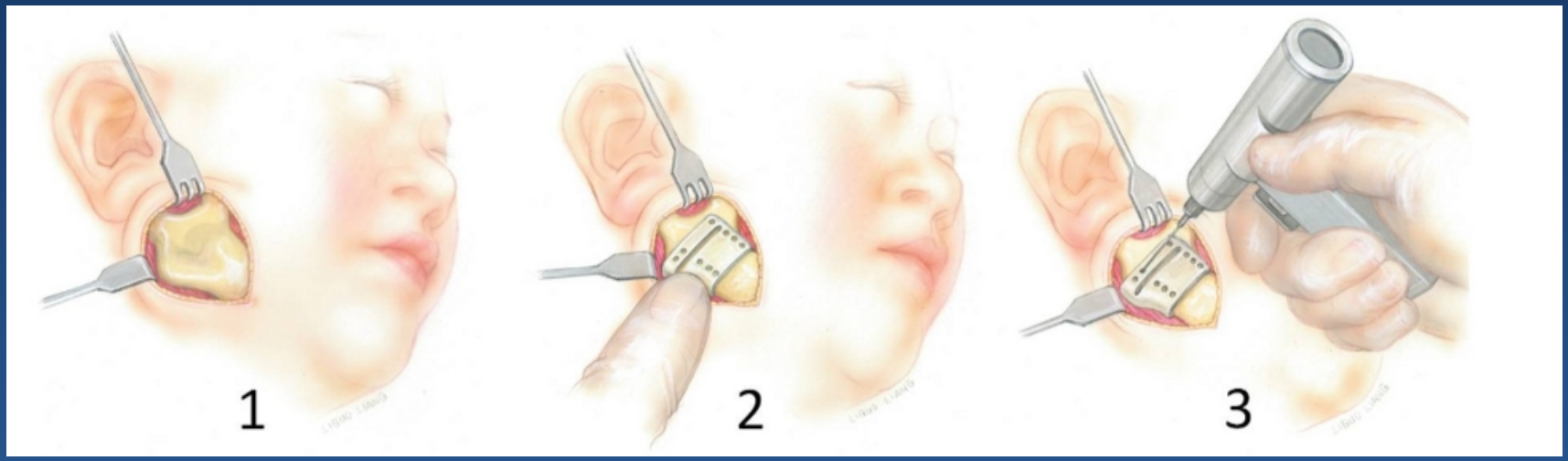
Pre-Operative VSP





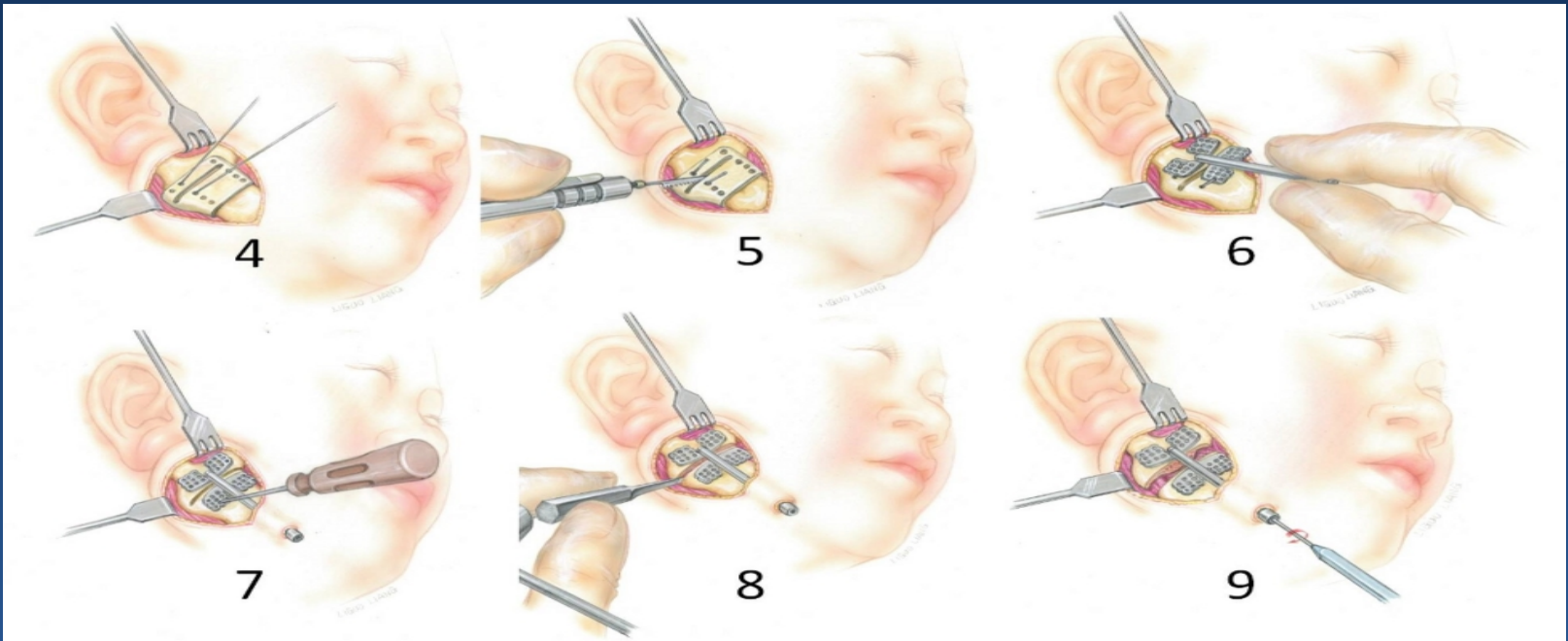
Intra-Operative VSP

- As predicted, given the uniqueness of each mandible, the custom guide would only snap on if placed in the VSP designed position



Intra-Operative VSP

- The VSP guide was then exchanged out for the distraction devices using K wires placed over pre-planned holes.

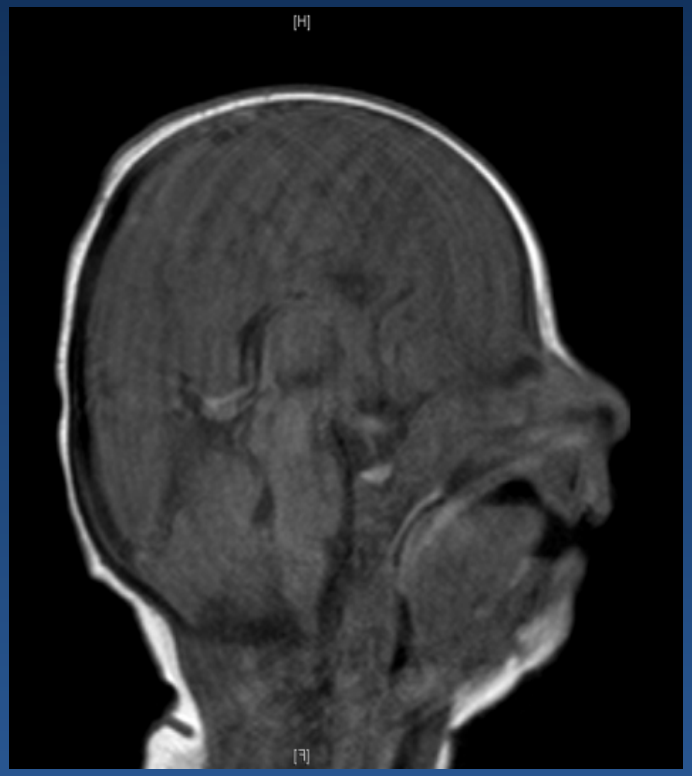


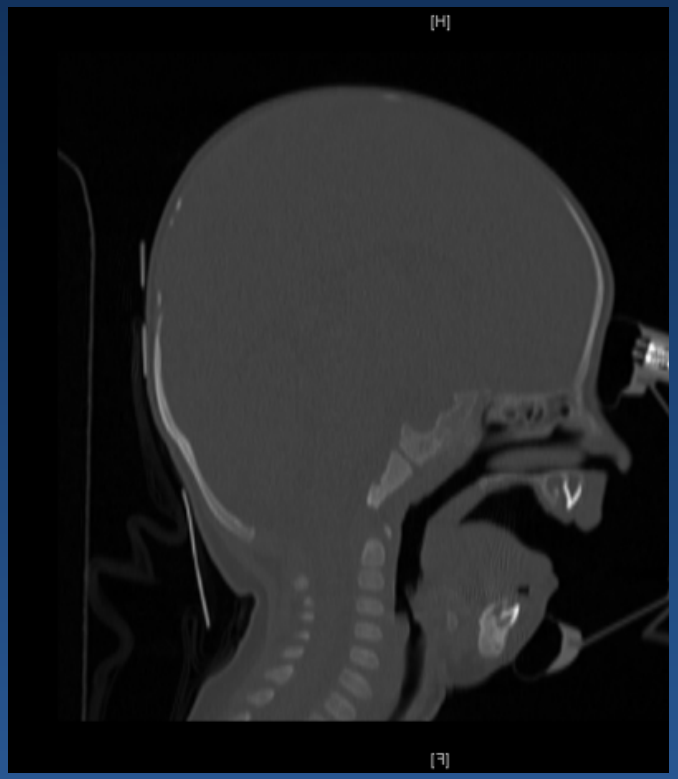
Results

- VSP was used for DO in 3 neonates (n = 6 mandibles)
- A total advancement of 20mm was performed bilaterally in each child
- At follow up, the children have excellent cosmetic results and have avoided tracheotomy.

Improvement in airway after VSP-DO

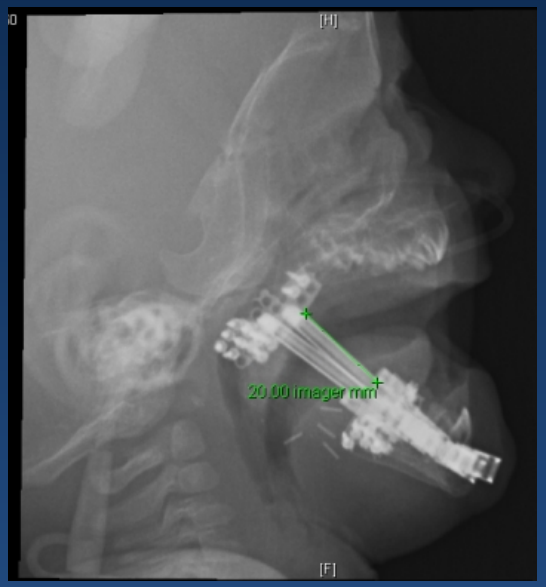
- Pre-operative MRI
- 3 month post-operative CT



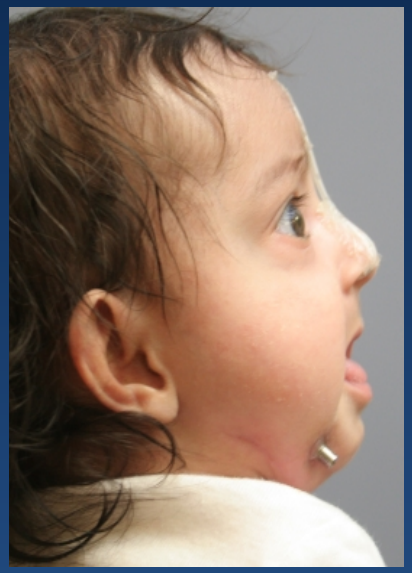


Progression of one patient with VSP-DO

POD 0



1 month post op



4 months post op

17 months post op

Conclusions: VSP-DO in the neonate

- Virtual Surgical Planning used in neonatal Distraction Osteogenesis transforms standard 2D imaging into an operative roadmap.
- The resultant model provides custom and precise guidance in device selection, vector planning and guide positioning that is easy to implement.