

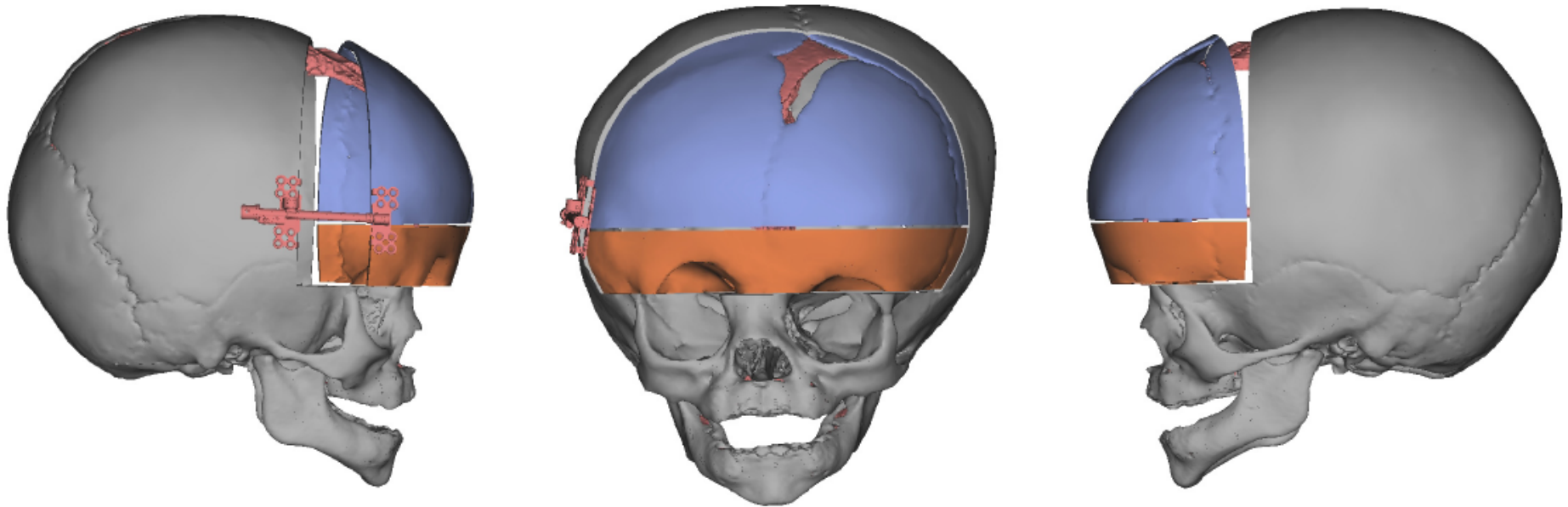
A Novel Method for Quantifying Intracranial Volume Change by Distraction Osteogenesis for Craniosynostosis

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Background

Distraction Osteogenesis can be an effective tool for anterior and posterior cranial vault expansion

Final Position Distracted 20mm



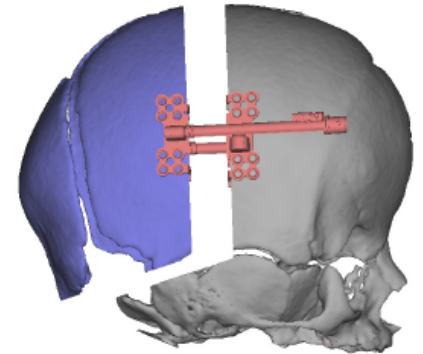
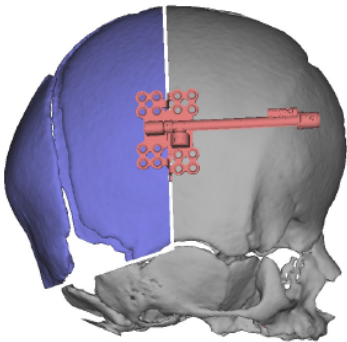
Methods:

- Retrospective Chart Review 2013-2016
- Open anterior and posterior cranial vault reconstruction combined with internal distraction
- **METRIC CALCULATION:**

% Intracranial Volume Change



Total Distraction Length



Results: Unilateral Distraction for Unicoronal Craniosynostosis

Patient	Age at Surgery (mo)	Advancement (mm)	% Volume Change	% Volume Change per mm Distraction
1	6.48	19	51.60	2.72
2	7.92	14	19.61	1.40
3	11.90	14	13.99	1.00
4	6.31	16	45.67	2.85
5	9.20	16	24.99	1.56
6	9.86	28	27.77	0.99
7	9.07	25	18.17	0.73
8	9.89	45	27.41	0.61
9	8.61	46	38.92	0.85
10	9.01	39	22.77	0.58
11	8.42	30	65.18	2.17

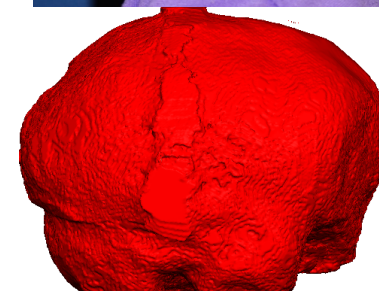
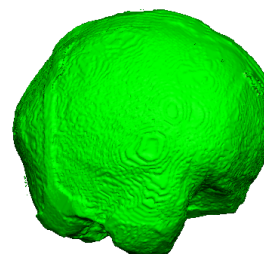
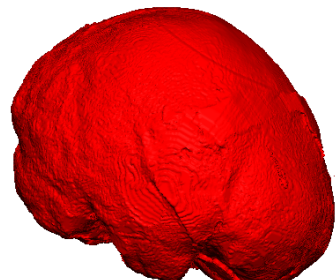
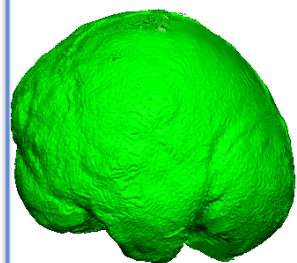
Mean: 8.79	Mean: 26.55	Mean: 32.37	Mean: 1.41
Median: 9.01	Median: 25	Median: 27.41	Median: 1

***Calculated Metric:
1% of intracranial volume change per millimeter of distraction***

Results: Unilateral Anterior vs. Bilateral Posterior Distraction

Group	n	Age (mo)	Advancement (mm)	% Volume Change	% Volume Change per mm Distraction
1° Anterior	11	8.79	26.55	32.37	1.00
1° Posterior	4	5.92	29.33	124.78	4.28

p<0.001



831.5 cc

1,155 cc

300 cc

789 cc

Anterior

Posterior

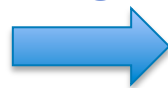
Results: Anterior vs. Posterior Distraction in the same patient

Group	n	Age (mo)	Advancement (mm)	% Volume Change	% Volume Change per mm Distraction
1° Posterior	3	5.93	30.44	143.5	5.16
2° Anterior	3	11.83	33	19.34	0.62

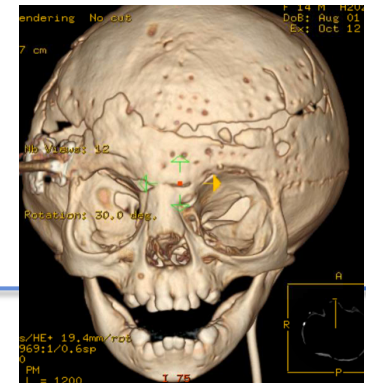
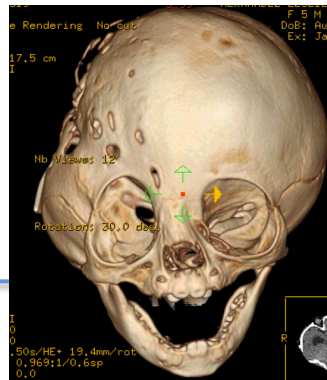
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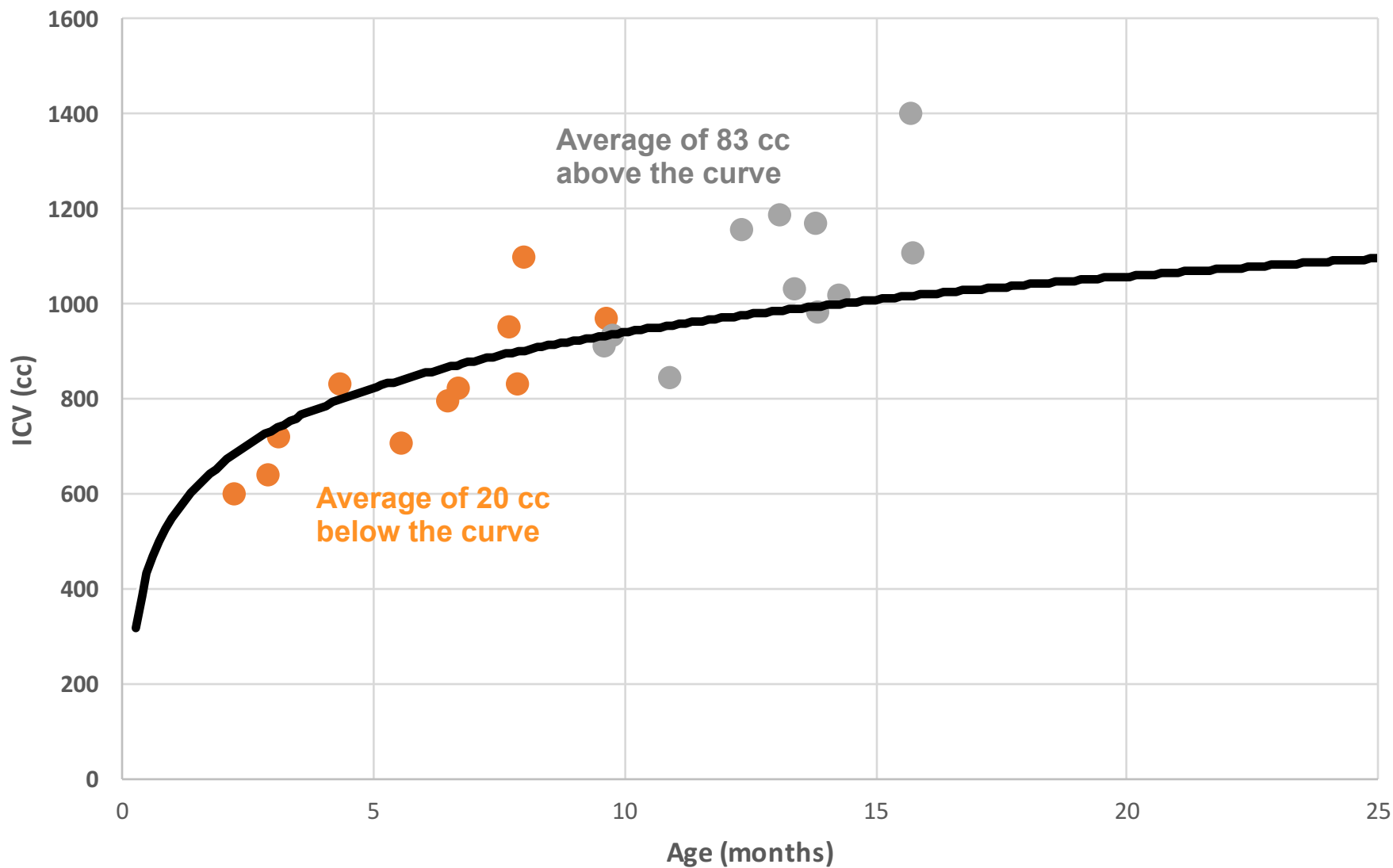
Posterior
DO



Anterior
DO



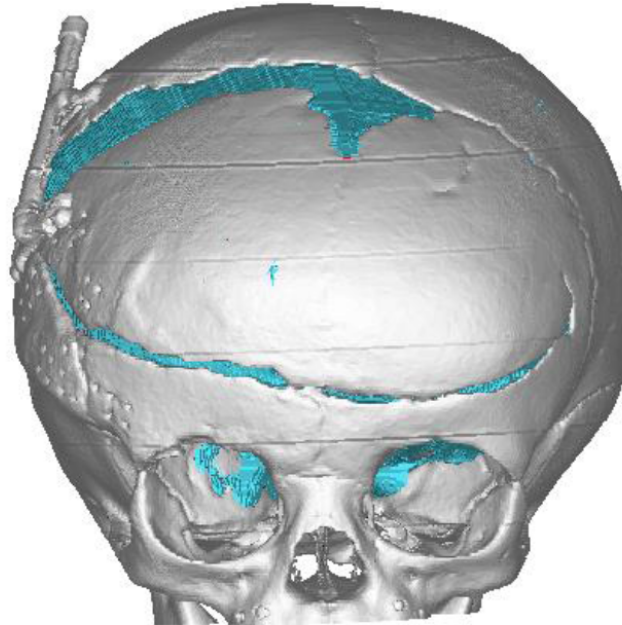
Unicoronal Patient Volumes Plotted on the Kamdar et al. Best-fit Logarithmic Curve



● Preop Vol ● Postop Vol

Results: Adjusting the Metric for the Normal ICV Growth Curve Unilateral Anterior Cranial Distraction

Metric (% Volume Change per mm Distraction)	Volume Change	Predicted Vol Change	Adjusted Volume Change	Adjusted Metric
1.00	251.07	148.10	102.97	0.39



Conclusions

- We describe a Metric for analyzing the efficiency of ICV change achieved by DO
- Reproducible
- Can be used to compare:
 - Across populations
 - Across diagnoses
 - Across surgical techniques
 - To the literature
- Correct for normal ICV growth
- Predict volumetric outcomes

- More robust normative data is required to facilitate normal growth corrections in young patients

% Intracranial Volume Change

Total Distraction Length

