

Increasing Number of Cleft-Related Surgeries Results in Worsened Maxillary Hypoplasia: A Cephalometric Study

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INTRODUCTION

Maxillary hypoplasia is a common sequela in cleft lip and palate (CLP) patients that often requires orthognathic surgery for correction.¹ While intrinsic morphology plays a role, there is longstanding debate regarding the contribution of surgical intervention, particularly how **early surgery and scarring may result in growth restriction.**²⁻³

Our hypothesis was that a **greater number of cleft-related surgeries** early in life would be associated with more severe midface deficiency.

The **secondary aim** of this study was to examine whether **cleft morphology, surgical timing, and surgery type** also influenced maxillary hypoplasia.

METHODS

A retrospective review of patients with cleft lip or palate treated at Shriners Children's Hospital of Chicago was performed. Patients were included if they had a cone-beam CT scan at skeletal maturity as part of routine care. All CT scans were obtained prior to orthognathic surgery (OGS). Surgical history was collected, and surgeries were categorized by timing. Cephalometric analysis was performed using standardized landmarks to assess maxillary position and degree of hypoplasia (**Fig 1**).

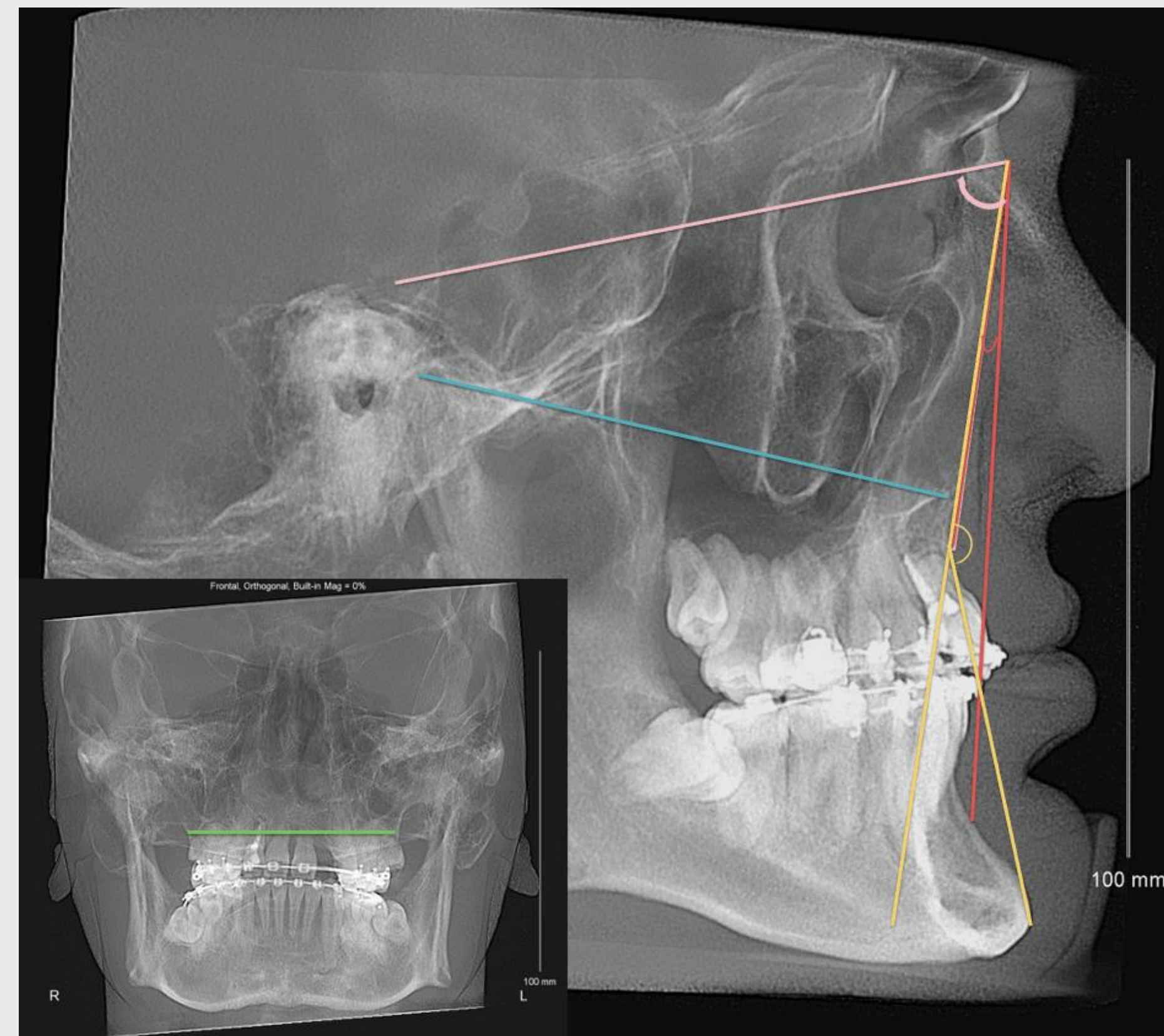


Figure 1 shows the key cephalometric measurements used to quantify maxillary growth. Refer to color code from methods.

Multivariable linear regression showed robust negative association with each additional surgery corresponding to **roughly a 1–2° reduction in measures of midfacial growth** (SNA, B= −2.15; ANB, B= −1.06; facial convexity angle, B= −1.51, p< .006).

Bilateral cleft morphology emerged as the only predictor of maxillary width, predicting a ~3mm narrower maxilla (B= −2.80, β= −0.30 p = .003).

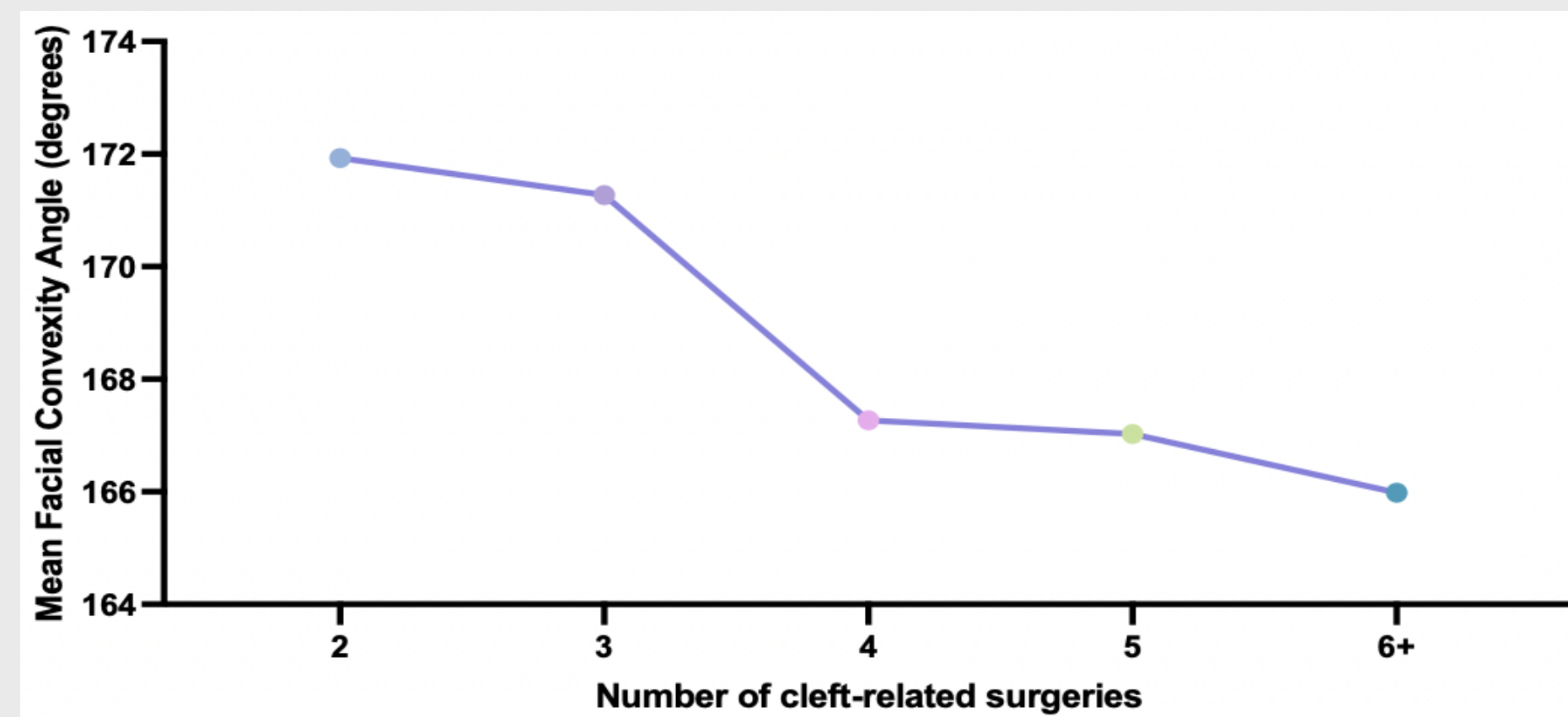


Figure 3 shows the inverse relationship between number of surgeries and facial convexity angle, significant on Spearman's correlation (p= -0.28, p=.004).

RESULTS

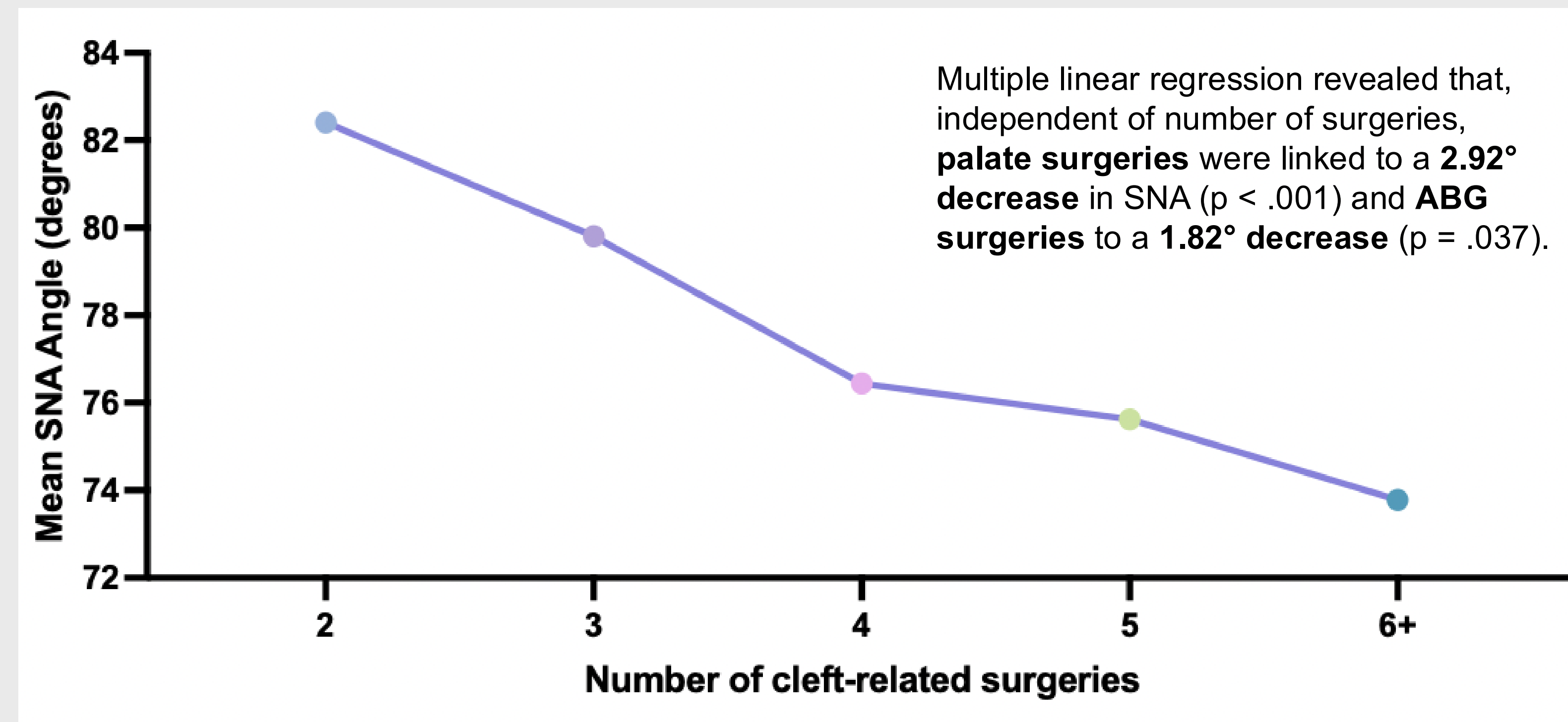


Figure 2 shows the inverse relationship between **number of surgeries** and **SNA angle** that was **significant on Spearman's correlation** (p= -.449, p<.001). A significant correlation was also found between number of surgeries and ANB (p= -0.28, p=.004).

Table 1. The impact of surgical burden on cephalometric measurements				
Total surgeries	<4 surgeries	≥4 surgeries	Mean difference	p-value
SNA Angle (°)	80.52	75.14	-5.38	<0.001
ANB Angle (°)	-0.22	-3.06	-2.84	<0.001
Facial Convexity Angle (°)	170.23	166.64	-3.59	<0.001
Maxillary width (mm)	64.82	63.34	-1.48	0.124
Co-ANS Left (mm)	95.49	93.46	-2.03	0.080
Co-ANS Right (mm)	95.57	93.67	-1.90	0.107

Table 1 shows the relationship between the mean cephalometric measurements and number of surgeries. Patients **with ≥4 total surgeries** had **significantly lower SNA, ANB, and facial convexity angles**.

Predictors	Multivariable linear regression assessed if surgical timing was a predictor of SNA angle. Notable all windows showed significance.
0-5 years	0–5 years (B= −1.92, p<0.001)
6-12 years	6–12 years (B= −1.81, p=0.003)
13-16 years	13–16 years (B= −1.93, p=0.006)
	Cleft morphology, gender, and palatal expansion did not reach statistical significance in this model. Standardized beta coefficients indicated that surgeries at 0–5 years had the strongest effect (β= −0.36).

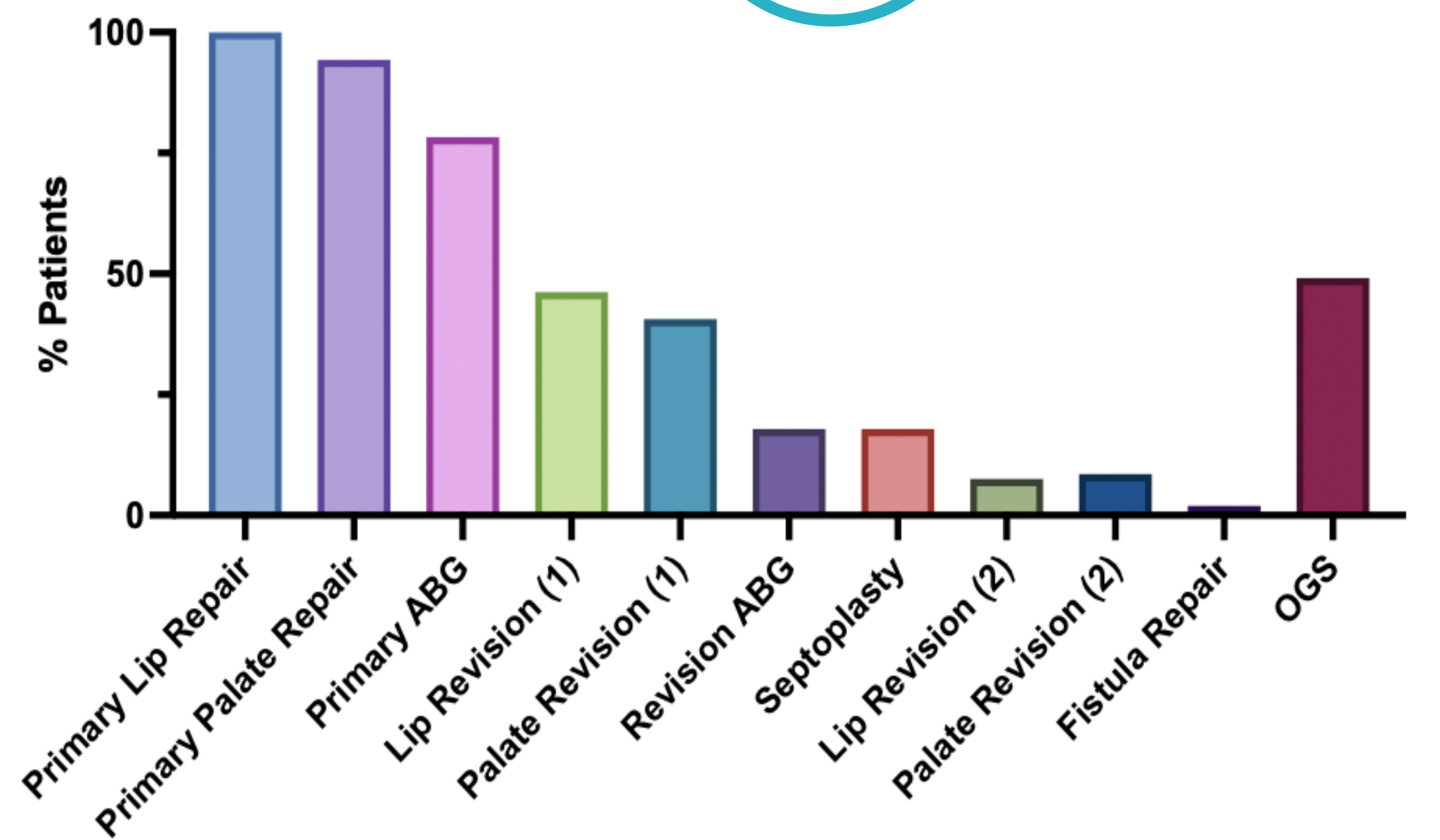


Figure 4 shows the % of patients who received each cleft-related surgery (N=106). Notably, **>95%** of patient had primary lip and palate repair, **80%** primary ABG, and **50%** ultimately underwent orthognathic surgery (OGS).

CONCLUSION

While previous studies have indicated a link between surgical scarring and midfacial hypoplasia, our study is the first to quantify this relationship using detailed cephalometric measurements in a large, skeletally mature cohort of cleft lip and palate patients.

Key findings:

- **Greater surgical burden:** A higher number of cleft-related surgeries is significantly linked to reduced midfacial growth.
- **Early surgical timing:** Procedures performed at a younger age show a stronger association with worsened midfacial growth.
- **Palate-related surgeries:** Increased frequency of palate surgeries is particularly detrimental, further contributing to growth restriction.
- **Bilateral cleft morphology:** Bilateral cleft morphology showed significantly restricted maxillary width as compared to unilateral clefts, regardless of their treatment history. This suggests that intrinsic anatomical factors, in addition to surgical interventions, play a critical role in maxillary development.

¹Velasques BD, Moura LB, Martins JR, Damian MF, Xavier CB. What is the relapse after Le Fort I maxillary advancement in cleft lip and palate patients? A systematic review. *Oral Maxillofac Surg.* 2021;25(2):139-148. doi:10.1007/s10006-020-00906-y
²Wolford LM, Stevao ELL. Correction of Jaw Deformities in Patients with Cleft Lip and Palate. *Bayl Univ Med Cent Proc.* 2002;15(3):250-254. doi:10.1080/08998280.2002.11927848
³Herber SC, Lehman JA. Orthognathic Surgery In The Cleft Lip And Palate Patient. *Clin Plast Surg.* 1993;20(4):755-768. doi:10.1016/S0094-1298(20)32382-8